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"Who wants me to do what?" varied expectations from key stakeholder groups in the surgical intensive care unit creates a challenging learning environment

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ABSTRACT

Background: Surgical intensive care units (SICU) require complex care from a multi-disciplinary team. Frequent changes in team members can lead to shifting expectations for junior general surgical trainees, which creates a challenging working and learning environment. We aim to identify expectations of junior surgery trainee's medical knowledge and technical/non-technical skills at the start of their SICU rotation. We hypothesize that expectations will not be consistent across SICU stakeholder groups.
Methods: Twenty-eight individual semi-structured interviews were conducted with six SICU stakeholder groups at a medium-sized academic hospital. Expectations were identified from interview transcripts. Frequency counts were analyzed.
Results: Forty-one expectations were identified. 4 expectations were identified by a majority of interviewees. Most expectations were identified by 7 or fewer interviewees. 23 (53%) expectations were shared by at least one stakeholder group. 2 (8%) expectations were shared by all groups.
Conclusions: SICU stakeholder groups identified ten medical knowledge, ten technical skill, and three non-technical skill expectations. Yet, few expectations were shared among the groups. Thus, SICU stakeholder groups have disparate expectations for surgery trainees in our SICU.

Introduction

Surgical patients, especially those critically ill in the surgical intensive care unit (SICU), require complex care from a dedicated, multi-disciplinary team. At academic hospitals, the SICU also functions as a classroom for students and trainees of many disciplines: medicine, nursing, and pharmacy, among others. The possibility of trainee mistakes creates a tension between the training function of academic SICUs and the need to provide the safest care possible.

Junior general surgery trainees starting their SICU rotation feel this tension.[1] While trainees are not expected to begin their rotation with the same knowledge and skills as SICU fellows or attending staff, they are expected to have a baseline of knowledge and skills to ensure the safe management of critically ill patients. A standardized set of expectations for what medical knowledge and which technical and non-technical skills junior general surgery trainees should possess prior to the start of their SICU rotation does not exist. Due to the lack of clear and standardized expectations, members of the multi-disciplinary SICU team form their own expectations of trainees. This can be problematic because expectations may change frequently as team members with different expectations rotate on and off service on a weekly, or even daily, basis. Also, in some cases, expectations can be based on an incorrect understanding of basic trainee attributes.[2]

Unclear and shifting expectations create a challenging working and learning environment for junior general surgery trainees. In response to mismatched or unclear expectations, surgical trainees may resort to fabricating information, remaining silent and/or avoiding calling for help to maintain their image of knowledge and confidence.[1,3] This has obvious negative implications for patient care such as delay in care and missed vital signs, lab(s) or imaging abnormalities.

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At our institution, categorical general surgery residents rotate in the SICU as a PG2. In 2017, we created a SICU boot camp for rising PG2 general surgery trainees to prepare them for their upcoming rotation. However, in recent years, members of the SICU team have voiced concerns about the lack of consistency in the knowledge and skills of the junior general surgery trainees at the start of their rotation despite the boot camp training. Thus, we sought to identify key SICU stakeholder expectations of junior general surgery trainee's medical knowledge and technical/non-technical skills at the start of their surgical intensive care unit (SICU) rotation to evaluate for gaps in our SICU boot camp curriculum. Based on anecdotal experience of differing expectations, we hypothesize that the medical knowledge and technical/non-technical skill expectations of junior general surgery trainees at the start of their SICU rotation will not be consistent across key SICU stakeholder groups.

Material and methods

We performed a needs assessment using semi-structured interviews to identify the expectations of SICU team members regarding the medical knowledge and technical/non-technical skills that they believe are important for junior general surgery trainees to possess at the start of their SICU rotation. This study was conducted in the SICU of a medium-sized, quaternary care, academic hospital. The SICU is a 16-bed, closed unit. It is managed by a team led by an intensivist who is boarded in critical care and either surgery or anesthesia. The rest of the SICU team includes a surgical critical care fellow, a PG2 general surgery trainee, 1–2 PG1 specialty surgery trainees, an advanced practice provider (APP), 1–3 fourth year medical students, and individual bedside nurses. The SICU team works closely together in the SICU workroom. The Fellow is present and available for the trainees all day during business hours. Additionally, faculty provide their pager and cell phone number to junior trainees to facilitate easy, quick communication. Our Institutional IRB determined that this study was not human research and therefore informed consent was not obtained from participants.

Group and interviewee selection

We identified six groups as relevant SICU stakeholders based on their consistent, daily interaction with trainees: bedside nurses, advanced practice providers, fellows, faculty, and general surgery trainees that had (PG2 trainees) and had not (PG1 trainees) completed a SICU rotation. Each group brings a unique perspective that, when considered collectively, provides a robust sense of the expectations of junior general surgery trainees at the start of their SICU rotation. Faculty and fellows were selected to offer the perspective of the teacher and supervisor. APPs were selected based on their increasingly role as one of the members on the provider team.[4] Bedside nurses were selected based on their position as primary caregiver for patients and their relationship with trainees. PG2 trainees were selected to gain the "lived experience" perspective and all had recently completed the SICU boot camp. PG1 trainees were selected to obtain the perspective of trainees that had not yet rotated in the SICU.

At least four individuals were interviewed from each of the six groups. At the time of the study, there were nine SICU faculty that were board certified in surgery, five SICU fellows, five APPs, over 40 bedside nurses, nine PG2 trainees, and nine PG1 trainees. All SICU faculty from the Department of Surgery were emailed and the five faculty that responded were chosen to be interviewed. At the time of this study, SICU faculty that were board certified in anesthesia were only beginning to staff the SICU service. For this reason, we elected to exclude them from this study, however it would be worthwhile to include them in future work. Of the five SICU fellows, only four had rotated in the SICU at our hospital during the time of the study. All four were emailed and all accepted our request for an interview. All five APP were emailed and four accepted our request for an interview. The SICU Nurse Manager sent the lead author (MCB) the names of bedside nurses that would be willing to participate in the study. From that list, five bedside nurses accepted our request for an interview. All five PG2 trainees that rotated in the SICU during the period of the study accepted our request for an interview. All nine PG1 trainees were emailed and the five that responded were chosen to be interviewed.

Semi-structured interviews

Questions were created based on the authors' experience with the SICU and the SICU boot camp. Questions were not validated, which is consistent with typical methodology in qualitative research. MCB conducted 28 one-on-one semi-structured interviews. MCB is a general surgery resident trainee. He completed the interviews during his first research year as a PG4 resident. During this time, he had no supervisorial role over younger residents. Interviews were conducted in the middle of the academic year so that participants were not biased in their responses. PG2 trainees were interviewed after at least one week of working in the SICU to gain the "lived experience" perspective. All other individuals from all other groups were interviewed at the time they agreed to participate in the study.

Interviewees were asked a set of ten to twelve open-ended questions. Additional follow-up and clarification questions were asked as needed. The questions that serve as the basis for this study focused on eliciting the interviewees' expectations for junior general surgery trainees as they start their SICU rotation. The interviews were audio recorded and lasted approximately 30 min. Recordings were transcribed by a transcription service, Tybee Types, and given a unique identifier to maintain anonymity.

Analysis

CFB, who has a PhD in Communication Studies and MCB independently read the transcripts to familiarize themselves with the data. They each combed through the data, collected all the responses to each question, and categorized them into groups by answer and team member status. Each expectation was given a shortened "code" for ease of reference. Expectations were separated into the categories of medical knowledge, technical skills, and non-technical skills. Some expectations represented general topics such as "cardiovascular physiology" or "identifying a failing patient," while others represented specific topics such as "sepsis," "arterial lines," or "vasopressors."

The authors met to compare expectations and reached consensus to create a codebook. MCB used the codebook to analyze the transcripts. He then completed a frequency count of expectations sorted first by individual interviewee and second by group. An expectation was deemed significant if it was identified in the majority of responses in a group (at least three members of a group). Responses were initially analyzed individually to obtain a global sense of the data. Then responses were sorted into the six groups to gain a sense of the expectations by group.

Results

The 28 stakeholder interviewees identified 41 unique expectations for junior general surgery trainees at the start of their SICU rotation. The expectations, along with the shortened "codes" and representative quotations, are listed in Table 1: Expectation

Table 1
Expectation definitions.

Expectation	Shortened "Code"	Representative Quotations
Medical Knowledge		
Knowledge of antibiotics	Antibiotics	"Have a good grasp on our antibiogram and our resistance patterns in this institution, to be able to make appropriate decisions" "It just breaks the whole path of treatment if you don't know anything about antibiotics"
Knowledge of ARDS	ARDS	"They should have basic understanding of ARDS, how to treat that" "They need to know the ARDSNet criteria"
Know when and how to call for help	Call for help	"They need to know how to get help"
Knowledge of cardiovascular physiology	Cardiovascular physiology	"They need to understand airway, breathing, circulation" "They need to understand some cardiac physiology, including beta and alpha effects of the heart, and the drugs and how they work. They need to understand the concept of oxygen delivery and oxygen consumption and how shock contributes to those, and how each of the different shocks contribute in different ways, and then how to affect the components of cardiac output to increase it"
Knowledge of appropriate fluid resuscitation	Fluid resuscitation	"Have some basic knowledge of fluid resuscitation" "Know what type of fluid you need to resuscitate with; know when you need to resuscitate fluid"
Be able to perform the initial management of a failing patient	Management of a failing patient	"The things that require emergent response and knowledge, there's not a zillion of them, right? The question is what can kill them in 5 min. If the answer is anything, they should have a knowledge of that."
Be able to manage general surgery diagnoses	Managing general surgery diagnosis	"I think you need to have the basic understanding of surgical pathology and disease"
Be able to identify a failing patient	Identifying a failing patient	"They need to learn how to recognize a sick patient" "I would say basically they especially need to understand life-threatening situations such as shortness of breath, hemodynamic compromise, strokes, heart attack, bleeding, shock states; be able to recognize early signs of infection, PE" "Understanding when a patient is, let's say, crashing, for lack of a better term, those unstable patients, because that happens a lot more in the ICU I think than on the floor, so being able to identify that early"
Knowledge of infectious disease	Infectious diseases	"Basic knowledge of infectious disease" "They need to know the ID guidelines, how long to treat certain infections." "They need to know about infectious diseases, particularly surgical infections, and mostly that's going to be pulmonary infections, intra-abdominal infections, urinary tract infections, and skin and soft tissue infections …. They need to know the distinction between hospital- and community-acquired infections"
Knowledge of common SICU drugs	Medications, generally	"Basic drugs that we use all the time" "A strong knowledge of medications"
Be able to identify respiratory distress	Respiratory distress	"Respiratory distress in general, not prolonging intubation when it needs to happen just because they want to see what happens" "Management of respiratory distress: I expect somebody to come to the bedside and make a decision about what can we do to get this person through an episode, is this somebody that's going to be okay on BiPAP versus should we just intubate."
Knowledge of sepsis and its treatment	Sepsis	"Some understanding of what the heck is sepsis" "Sepsis is a big thing that we see. Many times, I'll come across residents who haven't read the first sepsis guidelines"
Knowledge of respiratory physiology	Respiratory physiology	"Have basic knowledge of pulmonary and cardiovascular physiology" "Pulmonary is huge. Pulmonary and cardiac are obviously very big" "You have to have a good grasp of knowledge on the cardio-respiratory-renal systems"
Knowledge of shock and its treatment	Shock	"They need to know the types of shock, how to identify them and how to start basic treatment for each type"
Knowledge of SICU equipment	SICU equipment	"How equipment works and how it impacts the patient" "The equipment is a major challenge in that knowing the different kinds of tracheostomy tubes, the different kinds of central lines, the different lengths of central lines, and the different kinds of ECMO cannulas."
Knowledge of how to triage patients and work flow	Triage	"Basically, triaging what needs to happen early on versus not" "Triage sick and stably sick"
Knowledge of vasopressors	Vasopressors	"Pressers, how they work, why they work, when they work" "Different mechanisms for controlling blood pressures"
Knowledge of ventilators	Ventilators	"Basic understanding of ventilator management" "Different vent settings and how long they take to go into effect and when you should be seeing an improvement"
Technical Skills		
Able to place arterial lines	Arterial Line	"How to do an a-line"
Able to place a basic IV	Basic IV	"Basic IV start"
Able to perform a bronchoscopy	Bronchoscopy	"How to do a bronchoscopy"
Able to insert a chest tube	Chest Tube	"Chest tube insertion"
Able to perform a cricothyroidotomy	Cricothyroidotomy	"Emergency airway if anesthesia couldn't make it in time" "Cricothyrotomy"
Able to place a central line	CVC (Central Line)	"Central line placement"
Able to perform an ECHO	ECHO	"Maybe some degree of echo"
Basic understanding of EGD	EGD	"Basic understanding of EGD"
Able to assess fluid status	Fluid Assessment	"Some knowledge of fluid assessment and ways to figure out" "They need to know how to assess volume status in patients and the different options that are available, and the pros and cons of each option, and they also need to know how to interpret and use these devices"
Able to place a Foley catheter	Foley Placement	"Foley tube placement"
Able to intubate a patient	Intubation	"Understanding the technique behind intubation" "Good to know how to intubate a patient"
No technical skills are needed	None	"I don't think that any of these are necessary"

Table 1 (*continued*)

Expectation	Shortened "Code"	Representative Quotations
Medical Knowledge		
Able to perform a paracentesis	Paracentesis	"Paracentesis"
Able to perform a PEG tube placement	PEG	"PEG tube placement"
Able to perform a good physical exam	Physical Exam	"Do a basic physical exam, and can you listen to the lungs, can you listen to the heart" "Doing almost a full-body assessment on a patient"
Able to re-wire central lines	Re-wire line	"Rewire lines"
Able to perform a thoracentesis	Thoracentesis	"How to find a pocket of fluid in the chest"
Able to perform some or all of a tracheostomy	Tracheostomy	"Some perc trach things" "Assist in a trach" "In a crash situation you should know the basic steps of how to do an endotracheal intubation and even a crash tracheostomy"
Able to use the ultrasound	Ultrasound	"Basic knowledge of how to use an ultrasound unit" "Use the ultrasound"
Able to perform wound management	Wound Management	"Vac changes, we do those, but I think the ICU, you end up with patients who have a lot of ostomies or various other abdominal things going on. How should you best place an ostomy appliance at the same time that you have a wound vac?"
Non-Technical Skills		
Able to be humble	Humility	"Knowing what your limitations are" "Swallow your pride and ask the nurses, who likely have been through these situations more than you have" "Not wanting to ask for help, that ends up hurting everybody in the long run, so it's really a lot better if we talk through things as a team. And along those lines, remembering that we are all a member of the team"
Able to be organized	Organization	"Being able to organize your thought processes and plans because you can miss a lot of things if you don't diligently look through all of their data from the previous day" "Organization is probably one of the most important ones. You have a lot of patients with a lot of problems"
Able to communicate with team, patient and families	Communication	"They should know how to talk to families; practice talking about withdrawing care specifically, when an intervention isn't appropriate; how to talk to nurses appropriately and communicate with nurses" "I think a lot of times the intent is to communicate, but it may come across as demeaning to the nurses or whoever else is on service that may be providing for the patient." "I'm going to go with communication. I think you need to be really specific when you talk to other residents when they sign-out to each other, and when you're communicating within the team, to be more specific about what you're asking about what patient, who, when, so communication difficulties don't lead to errors"

Definitions. The vast majority of the expectations were either Medical Knowledge (n = 18) or Technical Skill (n = 20). There were 3 Non-Technical Skill expectations.

Twenty-seven (96%) interviewees identified at least one Medical Knowledge (MK) expectation, all interviewees identified at least one Technical Skill (TS) expectation, and 20 (71%) interviewees identified at least one Non-Technical Skill (NTS) expectation. No expectation was identified by all interviewees. There were 4 expectations (10%) that were identified by more than half of the interviewees: knowledge of ventilators (n = 16, 57%), being able to place a central line (n = 27, 96%), being able to place an arterial line (n = 23, 82%), and being able to communicate effectively (n = 18, 64%). The remaining 37 (90%) expectations were shared by between 1 and 13 people (Table 2: Interviewee Expectations Identified).

The expectations identified by at least one group are listed in Table 3: Expectation Frequency Counts by Group. To be included in this table, at least three interviewees from a single group (ex: RN or APP) had to identify the same expectation. In total, 23 (53%) expectations were identified by at least one group (MK n = 10, TS n = 10, NTS n = 3). 9 (22%) expectations were identified by more than one group (MK n = 5, TS n = 3, NTS n = 1) and only 2 (5%) expectations were identified by all groups (TS n = 2).

The frequency counts of expectations and the groups that identified those expectations are also listed in Table 3. The PG1 and Faculty identified the most expectations (n = 10). The Fellows and APPs identified the fewest expectations (n = 5). The Faculty identified the most MK expectations (n = 5), the PG1 identified the most TS expectations (n = 5), and the PG1 and RN identified the most NTS expectations (n = 2). The groups with the most overlapping expectations were PG1-Faculty and PG2-Faculty (n = 5).

Discussion

Our data demonstrate a lack of common, shared expectations of junior general surgery trainees at the start of their SICU rotation by SICU team members in our hospital. While trainees are provided a clear endpoint as outlined by the SICU Rotation Goals and Objectives created by our Surgical Education Office, there is no clear starting line. While all faculty on all rotations are encouraged to discuss expectations with trainees, it is unknown if this routinely occurs. Additionally, if it does occur, the effectiveness of this communication is not known. A lack of clear, shared expectations creates a void that trainees fill with perceived expectations, which can result in undesirable behaviors such as fabricating information, remaining silent and avoiding calling for help, which can result in poor patient care.[1]

One possible explanation for the disparate expectations is that each group's sphere of immediate interest does not always overlap. In other words, one group's needs of a trainee may differ from another group's needs, which could create discrete expectations from each group. Consider the following example. A patient in the SICU starts to decompensate due to sepsis. The bedside nurse expects the junior general surgery trainee – who is typically the first point of contact – to know which medication(s) they want to order and when to call for help. When the trainee calls their supervisor (SICU fellow or faculty), the supervisor expects the trainee to have an understanding of sepsis, its causes, its effects on cardiovascular and respiratory physiology, the need to further identify a source, and the initial treatment. Both groups have an expectation that the trainee can communicate clearly and appropriately throughout the event, but the expectations regarding the context of that

Table 2
Interviewee expectations identified.

Expectations		# of Interviewees (n = 28)
Medical Knowledge		27 (96%)
	Ventilators	16 (57%)
	Vasopressors	13 (46%)
	Sepsis	11 (39%)
	Respiratory physiology	10 (36%)
	Cardiovascular physiology	9 (32%)
	Identifying a failing patient	9 (32%)
	Management of a failing patient	9 (32%)
	Call for help	7 (25%)
	Infectious diseases	7 (25%)
	Shock	7 (25%)
	Fluid resuscitation	6 (21%)
	ARDS	5 (18%)
	Antibiotics	4 (14%)
	Medications, generally	4 (14%)
	Respiratory distress	4 (14%)
	Managing general surgery diagnosis	3 (11%)
	SICU equipment	2 (7%)
	Triage	2 (7%)
Technical Skills		28 (100%)
	CVC (Central Line)	27 (96%)
	Arterial Line	23 (82%)
	Intubation	11 (39%)
	Chest Tube	10 (36%)
	Tracheostomy	9 (32%)
	Ultrasound	7 (25%)
	Bronchoscopy	6 (21%)
	Cricothyroidotomy	5 (18%)
	PEG	5 (18%)
	Physical Exam	5 (18%)
	Re-wire line	5 (18%)
	Basic IV	3 (11%)
	Foley Placement	3 (11%)
	Paracentesis	3 (11%)
	Wound Management	3 (11%)
	ECHO	2 (7%)
	Fluid Assessment	2 (7%)
	None	2 (7%)
	Thoracentesis	2 (7%)
	EGD	1 (4%)
Non-Technical Skills		20 (71%)
	Communication	18 (64%)
	Organization	7 (25%)
	Humility	5 (18%)

Note: Each expectation is represented by its corresponding shortened “code” for ease of reading.

communication may differ. Ultimately, both groups’ goal is timely, safe, and appropriate patient care, but the role they play in achieving that goal can affect the expectations that they have.

Despite a paucity of shared expectations, there were two technical skills that were nearly universally identified as expectations: the ability to place arterial and central lines. These were the only two expectations shared among all six groups. It is not surprising that these two expectations had near unanimous endorsement; arterial and central lines are ubiquitous in the SICU. There are numerous studies that demonstrate that vascular access education and simulation leads to fewer infections associated with central venous catheters and improved trainee performance.[5–7] Fewer infections and improved technical performance ensures patient safety, which supports the notion that trainees should possess common baseline skills prior to their rotation in the SICU.

One way to ensure trainees have a baseline of knowledge and skills prior to a rotation is a boot camp. Boot camps offer trainees “just-in-time” education. Many medical schools have created courses for fourth-year students and residency programs administer similar courses during PG1 orientation.[8–12] These courses have been shown to improve a PG1 resident’s technical skills and medical knowledge more efficiently than standard training.[10] Noting the particular importance of these boot camps in surgery, the American Board of Surgery has developed a Resident Prep Curriculum in collaboration with the American College of Surgeons, Association of Program Directors in Surgery and the Association for Surgical Education.[13] Since their endorsement, at least 47 institutions have adopted that curriculum and many more have developed similar preparatory courses.[12]

Despite the increasing popularity of boot camps for senior medical students and newly minted PG1 residents, there has not been similar interest in instituting boot camps for older residents.[14] The reasons for this are unclear. Like the transition into residency, advancing from PG1 to PG2 comes with a new set of responsibilities and expectations. One of the most significant new responsibilities at some surgery programs is coverage of the surgical intensive care unit. Just as in medical school, PG1 general surgery trainees cycle through a set of clinical rotations, but their individual experiences vary. Some PG1 trainees may not care for any critically ill patients while their colleagues might care for many. Because of this

Table 3
Expectation frequency counts by group.

Expectation	Group	
	Count	Role
Medical Knowledge		
Ventilators	4	PG2, RN, APP, Fellow
Vasopressor	2	PG1, RN
Respiratory physiology	2	PG2, Faculty
Cardiovascular physiology	2	PG2, Faculty
Identifying a failing patient	2	PG1, Faculty
Management of a failing patient	1	PG1
Call for Help	1	RN
Medications, generally	1	RN
Infectious Diseases	1	Faculty
Sepsis	1	Faculty
Technical Skills		
Arterial line	6	All
CVC (Central line)	6	All
Intubation	2	PG1, Faculty
Chest tubes	1	PG1
Ultrasound	1	PG2
Bronchoscopy	1	APP
Cricothyroidotomy	1	PG1
Paracentesis	1	Faculty
PEG	1	Fellows
Tracheostomy	1	Fellows
Non-Technical Skills		
Communication	5	PG1, PG2, RN, APP, Faculty
Organization	1	PG1
Humility	1	RN

Note: Each expectation is represented by its corresponding shortened "code" for ease of reading.

discrepancy, it is essential to ensure that all PG1 residents are ready and appropriately prepared for the increased medical knowledge and skills (technical and non-technical) required to safely care for patients in the SICU. This is supported by a study from the pediatric literature, which found improved self-reported readiness and confidence for their neonatal ICU rotation after participating in a boot camp.[15]

Recognizing a need to ensure exposure to essential critical topics and procedures, we implemented a SICU boot camp in 2017 for rising PG2's. We modeled the course after the "Foundations of Critical Care" course at the University of Michigan.[16] The course topics included arterial lines, central lines, intubation/emergency airway, ventilators, cardiorespiratory physiology and pathophysiology. There were also simulated critical response scenarios such as atrial fibrillation with rapid ventricular response and intra-abdominal sepsis after an intestinal anastomosis.

Some of the most frequently identified expectations in our study are represented in the topics listed above with one major exception: non-technical skills. While this is unfortunate, it isn't surprising. Despite the growing body of evidence for the effect of non-technical skills on patient care, the importance of non-technical skills has only started to gain momentum in recent years.[17] A lack of non-technical skills has been demonstrated to lead to poor patient care[18–21] and to a phenomenon called "resident bypass," in which surgical and intensivist staff bypass their respective residents due to concerns for patient safety. In the study on "resident bypass," five factors were cited as reasons for bypass: "lack of trust, lack of specialized knowledge, poor system design, need for timely communication, and residents' inadequate contribution to decision-making."[22] Improving trainees' non-technical skills would address many of these factors, such as improving trust and ability to communicate, both of which may also increase a trainee's contribution to decision-making.

It is reassuring that more than 70% of interviewees and five of the six groups in our study identified at least one non-technical skill expectation. In this study, the most commonly identified non-technical skill was communication – yet the context in which it was identified was vast. As can be seen in the representative quotations in Table 1, interviewees identified and valued many different types of communication (ex: between teams, with patients/families, with nursing/hospital staff, etc.). Multiple methods are being developed to address how best to teach each individual type of communication.[23–26] At our institution, all trainees participate in family conference Objective Structured Clinical Exams (OSCE) throughout residency that focus on difficult conversations.[26–28] Based on this study, it appears that we may need to develop additional OSCE scenarios to address the types and contexts of communication identified as important by interviewees.

Moving forward, our study suggests that pre-rotation expectations could be beneficial for junior general surgery residents starting in the SICU based on disparate expectations from key SICU stakeholders. It may also be beneficial for other rotations in our residency program to evaluate whether shared expectations of residents exist among their team members. Our study should be reproduced at other surgery programs to assess whether disparate expectations are common across programs or unique to our institution. Additionally, our institution should incorporate non-technical skill training into our SICU boot camp. Based on existing literature, it may be beneficial to include other professions, such as nursing, respiratory therapy and pharmacy, among others, into these sessions too.[29,30]

One of the strengths of our study is its inclusivity. Interest in critical care education began two decades ago. Historically, SICU fellows and faculty have done the majority of the teaching in the ICU.[31] However, as SICU's become an increasingly multi-disciplined environment, APP's have started to act in a dual-role as educator and team-member.[4] Additionally, multiple studies have shown the benefit of interprofessional education and simulation specifically in the ICU.[23,29,30,32] For these reasons, we incorporated the perspectives of a variety of SICU team members to generate the most generalizable results.[33]

This study is not without its limitations. First, it was conducted at a single institution, which could limit its generalizability. Second, since MCB, a resident, conducted the interviews, it is possible that his prior relationships with any of the participants may have affected their responses. This bias could be avoided in the future by including an outside party to complete the interviews. Also, the participants in each group that are interested in education may have been more likely to participate than those not interested in education – which may have created a selection bias. There are other disciplines in the SICU that were not consulted as a part of this study, such as pharmacy, nutrition, social work, care coordinator, health unit coordinator, nursing aids, and physical and occupational therapists. Although junior general surgery trainees have a variable depth of interactions with the aforementioned groups, each may have their own set of expectations for the trainees. Future studies should consider whether other disciplines should also be consulted. Additionally, the SICU faculty who are boarded in anesthesia were not contacted to participate in this study. Moving forward, their input should be sought. Lastly, most of the SICU fellows are not from our institution and spend 1 rotation (roughly 2 months) in this hospital's SICU. For that reason, their expectations of trainees may be based on their previous experience in residency or what they observe in other SICUs where our trainees do not rotate. This may have contributed to the lack of common expectations among the groups.

Conclusion

This study demonstrates that while individuals from six SICU stakeholder groups have some common expectations for junior general surgery trainees at the start of their SICU rotation such as knowledge of ventilators, being able to place a central and arterial line, and being able to communicate effectively; they largely identified disparate expectations for trainees. Our study begs the question: should our SICU rotation – or even all rotations - provide start-of-rotation expectations similar to the current end-of-rotation expectations? Finally, as new SICU curricula and boot camps are developed, it is essential to include as many members of the multi-disciplinary SICU team as possible based on the benefits of utilizing multiple stakeholders when characterizing trainee competence.

Declaration of competing interest

The authors have no personal or financial conflicts of interest.

References

1. Patel P, Martimianakis MA, Zilbert NR, et al. Fake it 'til you make it: pressures to measure up in surgical training. *Acad Med*. 2018;93(5):769–774. https://doi.org/10.1097/ACM.0000000000002113.
2. Schlitzkus LL, Agle SC, McNally MM, Schenarts KD, Schenarts PJ. What do surgical nurses know about surgical residents? *J Surg Educ*. 2009;66(6):383–391. https://doi.org/10.1016/j.jsurg.2009.08.001.
3. Jin CJ, Martimianakis MA, Kitto S, Moulton CAE. Pressures to "measure up" in surgery: managing your image and managing your patient. *Ann Surg*. 2012;256(6):989–993. https://doi.org/10.1097/SLA.0b013e3182583135.
4. Kahn SA, Davis SA, Banes CT, Dennis BM, May AK, Gunter OD. Impact of advanced practice providers (nurse practitioners and physician assistants) on surgical residents' critical care experience. *J Surg Res*. 2015;199:7–12. https://doi.org/10.1016/j.jss.2015.05.036.
5. Sherertz RJ, Ely EW, Westbrook DM, et al. Education of physicians-in-training can decrease the risk for vascular catheter infection. *Ann Intern Med*. 2000;132(8):641–648. https://doi.org/10.7326/0003-4819-132-8-200004180-00007.
6. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevrolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. *Lancet*. 2000;355(9218):1864–1868. https://doi.org/10.1016/S0140-6736(00)02291-1.
7. Britt RC, Novosel TJ, Britt LD, Sullivan M. The impact of central line simulation before the ICU experience. *Am J Surg*. 2009;197(4):533–536. https://doi.org/10.1016/j.amjsurg.2008.11.016.
8. Minter RM, Amos KD, Bentz ML, et al. Transition to surgical residency: a multi-institutional study of perceived intern preparedness and the effect of a formal residency preparatory course in the fourth year of medical school. *Acad Med*. 2015;90(8):1116–1124. https://doi.org/10.1097/ACM.0000000000000680.
9. Heskin L, Mansour E, Lane B, et al. The impact of a surgical boot camp on early acquisition of technical and nontechnical skills by novice surgical trainees. *Am J Surg*. 2015;210(3):570–577. https://doi.org/10.1016/j.amjsurg.2014.12.046.
10. Antonoff MB, Swanson JA, Green CA, Mann BD, Maddaus MA, D'Cunha J. The significant impact of a competency-based preparatory course for senior medical students entering surgical residency. *Acad Med*. 2012;87(3):308–319. https://doi.org/10.1097/ACM.0b013e318244bc71.
11. Cohen ER, Barsuk JH, Moazed F, et al. Making july safer: simulation-based mastery learning during intern boot camp. *Acad Med*. 2013;88(2):233–239. https://doi.org/10.1097/ACM.0b013e31827bfc0a.
12. Neylan CJ, Nelson EF, Dumon KR, et al. Medical school surgical boot camps: a systematic review. *J Surg Educ*. 2017;74(3):384–389. https://doi.org/10.1016/j.jsurg.2016.10.014.
13. Cogbill TH. Statement on surgical preresidency preparatory courses. *Am Surg*. 2014;80(11):1085–1086. https://doi.org/10.1097/SLA.0000000000001030.
14. Cleland J, Patey R, Thomas I, Walker K, O'Connor P, Russ S. Supporting transitions in medical career pathways: the role of simulation-based education. *Adv Simul*. 2016;1(1):14. https://doi.org/10.1186/s41077-016-0015-0.
15. Surcouf JW, Mumphrey CG, Barkemeyer BM, et al. Neonatal intensive care unit boot camp: a preparatory curriculum for pediatric residents. *MedEdPORTAL J Teach Learn Resour*. 2018;14:10720. https://doi.org/10.15766/mep_2374-8265.10720.
16. Fawley J, Howard R, Napolitano L. Clinical impact of critical care summer school on junior resident confidence in the surgical intensive care unit. : Association for Surgical Education - Surgical Education Week. Chicago https://www.surgicaleducation.com/annual-meeting-2019-presentations/?prognum=PS1-03; 2019.
17. Ounounou E, Aydin A, Brunckhorst O, Khan MS, Dasgupta P, Ahmed K. Nontechnical skills in surgery: a systematic review of current training modalities. *J Surg Educ*. 2018;76(1):14–24. https://doi.org/10.1016/j.jsurg.2018.05.017.
18. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Health Care*. 2004;13(SUPPL. 1):85–90. https://doi.org/10.1136/qshc.2004.010033.
19. Williams M, Hevelone N, Alban RF, et al. Measuring communication in the surgical ICU: better communication equals better care. *J Am Coll Surg*. 2010;210(1):17–22. https://doi.org/10.1016/j.jamcollsurg.2009.09.025.
20. Makary MA, Daniel M. Medical error-the third leading cause of death in the US. *BMJ*. 2016;353. https://doi.org/10.1136/bmj.i2139.
21. Anderson O, Davis R, Hanna GB, Vincent CA. Surgical adverse events: a systematic review. *Am J Surg*. 2013;206(2):253–262. https://doi.org/10.1016/j.amjsurg.2012.11.009.
22. Gotlib Conn L, Haas B, Rubenfeld GD, et al. Exclusion of residents from surgery-intensive care team communication: a qualitative study. *J Surg Educ*. 2016;73(4):639–647. https://doi.org/10.1016/j.jsurg.2016.02.002.
23. Joyce MF, Berg S, Bittner EA. Practical strategies for increasing efficiency and effectiveness in critical care education. *World J Crit Care Med*. 2017;6(1):1. https://doi.org/10.5492/wjccm.v6.i1.1.
24. Klaas S, Kara M, Nikki M, Rhona F, Simon PB. A ward-round non-technical skills for surgery (WANTSS) taxonomy. *J Surg Educ*. 2019. https://doi.org/10.1016/j.jsurg.2019.09.011.
25. Spence H, Somasundram K, Biyani CS, Jain S. Training nontechnical skills in ward rounds to improve team performance. *J Surg Educ*. 2020:1–10. https://doi.org/10.1016/j.jsurg.2020.02.012.
26. Chipman JG, Beilman GJ, Schmitz CC, Seatter SC. Development and pilot testing of an OSCE for difficult conversations in surgical intensive care. *J Surg Educ*. 2007;64(2):79–87. https://doi.org/10.1016/j.jsurg.2006.11.001.
27. Chipman JG, Beilman GJ, Schmitz CC, Seatter SC. Development and pilot testing of an OSCE for difficult conversations in surgical intensive care. *J Surg Educ*. 2007;64(2):79–87. https://doi.org/10.1016/j.jsurg.2006.11.001.
28. Branson CF, Houseworth J, Chipman JG. Communication deficits among surgical residents during difficult patient family conversations. *J Surg Educ*. 2018;76(1):158–164. https://doi.org/10.1016/j.jsurg.2018.05.014.
29. Nicksa GA, Anderson C, Fidler R, Stewart L. Innovative approach using interprofessional simulation to educate surgical residents in technical and nontechnical skills in high-risk clinical scenarios. *JAMA Surg*. 2015;150(3):201–207. https://doi.org/10.1001/jamasurg.2014.2235.
30. George KL, Quatrara B. Interprofessional simulations promote knowledge retention and enhance perceptions of teamwork skills in a surgical-trauma-burn intensive care unit setting. *Dimens Crit Care Nurs*. 2018;37(3):144–155. https://doi.org/10.1097/DCC.0000000000000301.
31. Horst HM, Tisherman S a, Ivy ME, Bonnell B. Critical care education of surgical residents: a survey of general surgery residency programs. *Curr Surg*. 1999;56(4-5):263–266. https://doi.org/10.1016/S0149-7944(99)00066-5.
32. Zhu J, Stadeli KM, Pandit K, et al. Standardizing nightly huddles with surgical residents and nurses to improve interdisciplinary communication and teamwork. *Am J Surg*. 2020. https://doi.org/10.1016/j.amjsurg.2020.03.002.
33. Lundsgaard KS, Tolsgaard MG, Mortensen OS, Mylopoulos M, Østergaard D. Embracing multiple stakeholder perspectives in defining trainee competence. *Acad Med*. 2019;94(6):838–846. https://doi.org/10.1097/ACM.0000000000002642.