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A Qualitative Study of Interdisciplinary Care Team Communication in an Open Surgical Intensive Care Unit

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ABSTRACT

Objective: Poor interdisciplinary care team communication is associated with increased mortality. The aim of this study was to define conditions for effective interdisciplinary care team communication.

Design: This was a qualitative study.

Setting: A Surgical Intensive Care Unit (SICUs) at an urban, academic medical center.

Participants: We performed 6 interviews and 10 focus groups from February to June 2021 (N=33). Interdisciplinary clinicians who care for critically ill patients were interviewed and included intensivists and surgical faculty surgeon physicians (transplant, colorectal, vascular, surgical oncology, trauma) faculty surgeons (n=10), (emergency medicine, surgery, gynecology, radiology) physician in training (n=6), nurse practitioners (n=5), nurses (n=7), fellows (n=1) and specialist clinicians such as respiratory therapists, pharmacists, and dieticians (n=4). Audio-recorded content of interviews and focus groups were transcribed verbatim, and de-identified. The study team iteratively generated the codebook and all transcripts were independently coded by two team members.

Primary Outcome: Transcripts were analyzed thematically to identify conditions for effective interdisciplinary care team communication.

Results: We identified five themes for effective interdisciplinary care team communication in our SICU setting: role definition, formal processes, informal communication pathways, hierarchical influences, and psychological safety. Participants reported that clear role definition and standardized formal communication processes empowered clinicians to engage in discussions that mitigated hierarchy and facilitated psychological safety.

Conclusions: Standardizing communication and creating defined roles in formal processes can promote effective interdisciplinary care team communication by fostering psychological safety.

Keywords: intensive care unit**;** interprofessional relations; organizational management

Strengths and Limitations of this Study: Participants included broad range of interprofessional clinician caring for critically ill patients about conditions required for effective communication. In order to be able to gain depth of understanding from many different types of clinicians, the study was limited to a single urban, academic, intensive care unit which may limit transferability.

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Competing Interests Statement: The authors declare no competing interests with regards to these data or this work.

BACKGROUND

Critically ill patients in Intensive Care Units (ICUs) depend on decision making about care that is diffused amongst a rotating, diverse cast of faculty surgeons from different specialties, physicians in training, nurses, dieticians, pharmacists, respiratory therapists, and other supporting staff. Often, these "expanding and contracting" [1] teams assemble as needed to address the intricacies of a patient's case yet there are team members who have never worked together. In this complex context, patient safety depends on the ability of the team to create situational awareness and execute teamwork skills, such as communication, coordination, and cooperation.[2] Notably, communication has been found to be the highest cited contributor to medical error.[3] Ineffective team communication results from relational and social factors intrinsic to medical teams, such as the status, power, vertical hierarchy, and role ambiguity.[3]

Effective interdisciplinary care team communication is the clear, brief, timely delivery of complete information amongst engaged key decision-makers, to create shared mental models of the problem and make treatment decisions.[4] However, there is a literature gap as to conditions influencing effective interdisciplinary care team communication, especially in surgical intensive care units (SICU) where surgical teams co-manage patient care.[5]

The overarching goal of this study was to identify conditions for effective interdisciplinary communication amongst interdisciplinary teams caring for patients in a large, urban, academic SICU. We sought first to engage interdisciplinary clinicians at all professional levels who care for critically ill and injured surgical patients. Second, we sought to understand how interdisciplinary care team communication occurred. Third, we sought to define barriers and facilitators to effective interdisciplinary care team communication to understand the conditions that promote effective interdisciplinary care team communication.

METHODS

Setting

This was an observational, cross-sectional study conducted at a single, open SICU at an urban academic medical center in the Midwest United States from February to June 2021. Based on an open ICU model, the SICU critical care team and the patient's surgical team co-manage the patient during their stay in the SICU. The surgical team is also referred to as the "primary" team. The SICU team conducts daily morning rounds and collaborates with the primary team on patient care decisions. In addition to the SICU and primary teams, there are often other consulting teams that support specialized patient care decisions. The SICU has approximately 20 consulting service lines that passe through their unit on a regular basis. These service lines, such as respiratory therapy, are another integral part of a patient's care plan. The Patient and Public were not involved in the design, conduct, reporting or dissemination of our research.

Semi-structured interviews

Cohort Description

We examined effective interdisciplinary care team communication, exploring relationships and patterns as they were identified in the data.[6] We purposefully enrolled a representative group of interdisciplinary roles (intensivists, colorectal surgeons, vascular surgeons, transplant surgeons, surgical oncologist, ethicists) and professional levels [faculty surgeon physicians, physicians in training, advanced practice providers (APPs) such as physician assistants, nurse practitioners] and specialist providers (dieticians, respiratory therapists, pharmacists) that work in the SICU to glean richer insight into our study population.

Recruitment

Participants were eligible for recruitment if they frequently cared for critically ill and injured patients. Participants were recruited via email by a study member to share their experiences around interdisciplinary communication in the SICU. We invited 33 participants. No participants refused to participate, dropped out of the study, or provided a repeat interview. Interviews and focus groups were conducted over Zoom. Only the participants and interviewers were present for the interviews. No patients or family members were involved in this study because although they may experience the consequences of poor interdisciplinary communication in the intensive care unit, they are rarely privy to interdisciplinary communication exchanges.

Interview guide development

Interview and focus group guides were designed to explore conditions for effective interdisciplinary care team communication of all professional levels caring for critically ill and injured surgical patients. The study team co-created an interview guide with non-participant clinicians. The interview guide elicited narratives about the participant's interdisciplinary communication in the care of critically ill and injured patients, specifically experiences sharing important information during patient care plan discussions, and how patient care plan disagreements were approached.

A female PhD health services researcher (JJ), a male MD surgical research fellow (EA), and a female management PhD candidate (CD), all with extensive experience in qualitative interviewing in a medical setting, conducted the interviews. One study member (JJ) had a prior relationship with a few of the participants from previous research studies. The three study team members did not work in the SICU and thus had no professional authority over participants. Participants were told that the study team was interested in understanding and improving

interdisciplinary communication in the care of critically ill and injured surgical patients. The interviews were audio recorded, transcribed verbatim, and de-identified. Field notes taken during the interviews were discussed at weekly team meetings. Interviews lasted approximately 60 minutes.

Analysis

Following each interview, study team members identified emergent themes on conditions of effective interdisciplinary communication. Eight people from the study team participated in the coding. The codebook was created by each study team member independently reviewing two transcripts to identify preliminary codes. After individual coding, the study team convened to reach consensus about the codes. An experienced physician-researcher (AS) with expertise in interdisciplinary care team communication also introduced deductive codes from the literature around teamwork climate,[7] physical and psychological accessibility,[8] and distribution of shared responsibility.[9] CD selected an additional transcript for the team to code to test and refine the codebook. Once the codebook was finalized, the transcripts were coded by dyads and coding conflicts were resolved by consensus (Appendix). MAXQDA software was used to support coding and analysis. Participants were later able to provide feedback on the main themes through a priority matrix survey.

RESULTS

We conducted 6 interviews and 10 focus groups. The sample of interdisciplinary participants included 10 physicians (intensivist, surgical oncologist, vascular, colorectal and transplant surgeons), intensive care nurses (n=7), and specialists such as respiratory therapists, pharmacists, and dieticians (n=4). (Table 1) Our sample included all professional levels including faculty surgeons, physicians in training (n=6), fellows (n=1) and advanced practice providers (n=5). We identified five themes.

Table 1. Qualitative Participants

Role	**Number of Participants**
Intensivist	3
Surgical Oncologist	1
Vascular Surgeon	2
Colorectal Surgeon	2
Transplant Surgeon	2
Critical Care Fellow	1
Physicians in training	6
ICU Nurse	7
Advanced Practice Providers	5
Respiratory Therapist	2
Pharmacist	1
Dietician	1

Abbreviations: ICU – Intensive Care Unit

Unclear Role Definitions Amplified During Patient Care Decision-Making

The open model structure of the SICU fostered a culture of shared responsibility between the interdisciplinary care teams that co-manage patient care. Unclear, diffuse responsibility blurred boundaries between the critical care team and consulting services. As one faculty surgeon physician noted, the complex patient care problems can overlap, making critical care management "…a lot greyer about, 'what am I handling and what are [the consultants] handling?'" The diffusion of responsibility was met with tension over who was responsible for different aspects of patients' care and who should be contacted.

"The ICU is...a juggernaut with lots of people that work in it...because of the nebulous reporting structure there, it could be a little challenging sometimes to figure out who is the decision maker, or who do I speak to about this or that?" *Faculty surgeon Physician*

Participants noted that ambiguity around roles and responsibilities inhibited care team members from making care decisions and escalating communication. Participants shared that this fragmented communication sometimes led to delays in care. Without shared knowledge of who to contact, non-physician team members spent extra time seeking advice from colleagues and searching through patient charts to find who was on call and might be overseeing a patient. Even when there was a call number in the patient notes, it would sometimes be an incorrectly listed clinician or non-physician team members would be verbally reprimanded for calling it. As one nurse said:

"In the [Epic] summary page, there is a section that shows you who is 'primary'…but that doesn't necessarily mean that's who you're supposed to page." *Bedside ICU Nurse*

Participants indicated that designating responsibility for specific aspects of patient care to each interdisciplinary care team, creating shared mental models around team boundaries, and establishing points of contact (and appropriate back-up contacts) could clarify communication and aid in more efficient patient care.

Underutilized Formal Processes for Interdisciplinary Care Team Communication

The main formal mechanisms around interdisciplinary care team communication include daily team meetings, multidisciplinary rounds, and patient admissions and handoffs. Implementing multidisciplinary rounds received positive feedback from interdisciplinary clinicians for providing a platform for different roles to converge on patient care. Since many

surgical teams were unable to round with the critical care team during the morning multidisciplinary rounding time, they sent representative team members, such as advanced practice providers (APPs), to the rounds or invited the SICU team to their team's morning rounds.

Participants reported that the effectiveness of communication during these formal processes varied by the lead faculty surgeon and their team culture. Without reinforced standardization, rounds were enacted differently depending on the faculty surgeon's preferences and priorities. As one nurse stated:

> "…regarding rounds, I think it's very much faculty surgeon-specific and driven. So, there's some faculty surgeons that value the interdisciplinary…and they take the time to make sure everyone's included and everyone understands what's going on. And then there's other faculty surgeons who that's not a priority for them... So I think that can delay care, and that's when communication breaks happen." *Bedside ICU Nurse*

Participants indicated that more standardized communication during formal processes could promote knowledge sharing during formal processes. One nurse how current handoff procedures can lead to sharing "half the story."

> "They give you sign out, but they're wanting to either go home or they have another patient to see. It's kind of lack luster and you get half the story. Then there you are, the primary nurse with the ICU physician in training overnight, trying to figure out the plan of care for this patient until the day team comes to see them." *Bedside ICU Nurse*

Informal Communication Pathways Between Teams

Participants noted that when formal processes, such as rounds and handoffs, were not standardized, team members often relied on informal communication pathways. Informal communication pathways included texting or paging questions or updates, unplanned visits to the OR for questions or updates, unplanned visits to the ICU team offices for questions or updates, and hallway conversations. This type of communication pathway allowed for rapid updating and information exchange outside of formal processes. Informal communication pathways seemed important for a setting like the SICU, with emergent issues arising that often necessitated quick decision-making. When formal processes felt too infrequent or insufficient to physician team members, informal communication pathways allowed care teams to respond to issues as they arose.

> "[Faculty surgeon] and I will use a lot of cell phone or texting and [Faculty surgeon] will even come down to the OR. Or he'll know I'm actually stuck in the OR for six hours. They'll need to get some message to us, and text just isn't good enough, so he'll walk down to the operating room." *Faculty surgeon*

While there are benefits to informal communication pathways (such as getting immediate, relevant patient updates outside of designated meeting times), participants reported that having an abundance of informal communication led to an "overcommunication" problem. Participants explained that constant communication between multiple types and levels of providers in the SICU does not always equate to an efficient sharing of knowledge across and within teams. Furthermore, different individuals in the same team occasionally had differing opinions creating confusion about what a specific team wanted. Additionally, the informal communication mechanisms were not structured to ensure that the information was followed-up with in a timely manner.

"So, I guess it varies from month to month, and it depends on the day and what's going on. But I have witnessed a lot of delays in patient care, and a lot of delays in patient throughput, because there hasn't been follow-up, or those 'checking back in with each other' type communication." *Nurse clinical coordinator*

Informal communication pathways were influenced by physical proximity (accessibility) and relationships with clinicians.[8] If an answer was needed quickly, clinicians would consult the SICU team members nearby on the floor and/or clinicians with whom they had established trust and respect. Participants underscored how face-to-face communication[10] and physical accessibility[8] were valued for more efficient interdisciplinary care team communication. The availability of certain clinicians on the floor, such as APPs, made their role in care decisions even more clinically relevant.

"I think the ICU team sometimes is more in communication with the nurses because they are literally on our unit so that we are able to voice our concerns immediately because they sit right there and we're right there, too." *Bedside ICU Nurse*

In workarounds for approval on patient care decisions, participants stated that seeking permission or advice from people they know they can get a quick, or potentially more favorable, response. While informal communication pathways can be an effective tool,[10] communication issues can arise when team members use them to circumvent appropriate approval. Participants reported that this often occurs when navigating disagreements between the SICU and primary teams. Often, team members rely on informal communication pathways when trying to place orders from a higher-level clinician.

"It can sometimes have that, "if Mom says no, go to Dad," and that's kind of what they'll do...you know how little kids do that, they go to dad. Sometimes people in the ICU will do that if they hear "no" from one person, they'll go to a different person and then they'll go to a different person and they'll just persist." *Physician in training*

Authority Bias and Hierarchy-Influenced Physician in training Communication Practices

Our data showed that both formal processes and informal communication pathways were subject to cognitive biases that influenced intergroup communication behaviors. Particularly, participants reported that the negative expressions of cognitive biases, such as overvaluing voices of authority in hierarchical systems, could diminish feelings of empowerment and trust especially in non-physician team members.

As the main figures of authority, faculty surgeons were reported to have the strongest influence over physician in training behavior and were felt to be responsible for teaching physicians in training "how to work with others." Participants, including physicians in training, noted that as part of the physician in training learning process, physicians in training adopt faculty surgeons' styles during their rotation. Physicians in training tended to model behaviors more from their team's faculty surgeons than from faculty surgeons on other teams or from non-faculty surgeon team members, including SICU nurses who provide educational trainings and orientation to the unit. However, participants were uncertain whether fellows and faculty surgeons were fully aware of their influence on interdisciplinary care team communication.

"I think it was just that it was not paid attention to...I think in the past, depending on who the faculty surgeon is in the ICU, it can be run very differently. As is on our service,

depending which faculty surgeon is currently on for that week, it can be run very differently." *APP*

Ultimately, participants felt that interdisciplinary communication reflected the culture that was developed and perpetuated by faculty surgeons. Thus, the behavior of faculty surgeons influenced the cognitive development of all individuals rapidly learning in the unit. Participants reported that when communicating with non-physicians, physicians in training would mirror their faculty surgeon's practices for creating (or reducing) psychological safety and minimizing (or increasing) the presence of hierarchy. As nurses noted:

> "Some physicians in training are great with it, some have no desire to speak with nurses. They're going to speak only to the doctor and the nurse can figure it out later. Anyways, my point is that I think it also comes from the faculty surgeons. There's some faculty surgeons that have no desire to communicate with the nurse…well, of course that behavior then is demonstrated to the physicians in training who follow the same behavior." *Nurse clinical coordinator*

Team cultures and practices that inhibit the non-physician voice block an optimal exchange of information, weakening effective interdisciplinary care team communication. At the same time when hierarchy was flatter, trusting relationships between physicians in training and nurses could greatly facilitate interdisciplinary communication. Physicians in training and nurses (both within and across teams) built trusting relationships through patterns of interactions where they saw each other work with patients, take feedback, and achieve consensus. The relationship between nurses and each individual physician in training had to be established anew every month because SICU physicians in training changed monthly. Physicians in training earned the trust of bedside SICU nurse when they made informal visits before and after morning rounds to check on

the patient and get updates from the nurse. This demonstrated respect for the nurse and valuing their perspective thereby flattening the interdisciplinary hierarchy.

> "During rounds, [the physician in training] had an excellent presentation, they asked us what we thought was going on…and then they'll circle back, talk to families, and just stuff like that… it's like okay, this person wants to be here. And then the trust comes in too. If I come to someone and I'm like, "this patient, this is what happened and I'm concerned." And they are like, "okay," and then they come with me and they assess the patient too… Those conversations, and just seeing that stuff from physicians in training helps build trust." *Bedside ICU Nurse*

Conversely, nurses earned the trust of the physicians in training when they would speak up to educate the physician in training, providing rationale to guide care based on their critical care experience and knowledge.

> "I think too, it's a lot of their first times putting in orders…it's a matter of us being like, 'hey, you put this in and that's not safe,' or, 'you have to change it to this because,' for X, Y, Z reasons. And I think that helps them trust us because we're not going to do things that will harm the patient, and we're going to help them figure out what needs to be done instead." *Bedside ICU Nurse*

Psychological Safety & Interdisciplinary Team Engagement

A high level of psychological safety sets the stage for participants to engage meaningfully and earn trust. Participants expressed desire to feel a higher level of psychological safety and active engagement in their patients' care decisions during team interactions - particularly, non-physician team members who were in a lower relative status in the

interdisciplinary hierarchy, such as APPs and nurses. Non-physician team members sought more consistent validation and respect by their colleagues during both formal and informal communication. These participants stated that they were more likely to speak up and share their perspective in team discussions when they felt they were supported by high-status team members (i.e., faculty surgeon physicians) to provide input on the care plan. Support from high-status team members was demonstrated by direct invitation (e.g., asking team members to attend the meeting or to speak during rounds), mindful presence (e.g., allowing team members to finish speaking, not interrupting or walking away), and validation (e.g., acknowledging and acting on what team members communicate).

Many faculty surgeons welcomed non-physician team members to attend and participate in their multidisciplinary rounds. Some faculty surgeons even waited to round on a patient until the patient's SICU nurse or the APP was available to join. In effective rounding conversations, faculty surgeons elicited feedback from non-physician team members by asking questions such as: "what are your thoughts?"; "is there anything else you need?"; and "what do you think we should do?" By engaging non-physician team members in formal conversations around patient care, it set the precedent that the team members' opinions and roles in a patient's care was valued. By inviting non-physician team members' input into the conversation, it allows for a more complete sharing of information.

> "It's just a nice invitation to bring up additional issues. Sometimes there's nothing additional…it's just nice to be offered that opportunity." *Clinical provider*

However, routines supporting psychological safety varied by faculty surgeon. While many faculty surgeons welcomed the input of non-physician team members, some either rejected non-physician team input or bypassed them during rounds completely. One non-physician

participant pointed out the physical cues that faculty surgeons can send to physicians in training and other team members, mentioning that "you feel you have to interject or catch if the team starts to walk away while you're mid-sentence." Participants reported that communication practices that support psychological safety and engagement in clinical decision making extend beyond rounds; how faculty surgeons and higher-level team members demonstrate respect and trust to non-physician team members throughout the shift impacted team communication.

> "...the faculty surgeon [physician] made a comment to their team about not listening to the non-physician and making sure that they take things to a more higher-level and I couldn't have helped feeling just a little bit insulted….I understand that I am definitely a lower-level staff member, but at the same time this is coming from a higher-level person who's telling me to carry out these plans." *APP*

DISCUSSION

The goal of the study was to better understand the conditions that are necessary for effective interdisciplinary communication in clinicians caring for critically ill and injured patients. This study found the conditions necessary for effective interdisciplinary team communication were clear role definition, standardization of formal processes, which supported psychological safety.

Others have found similarly that many conditions, such as physical accessibility,[8] can influence the effectiveness of a team's communication. Interdisciplinary care team communication can also serve different purposes depending on whether it is patterned as formal (scheduled) or informal (ad hoc).[11] Formal communication can help reduce complexity of the exchange,[12] yet informal communication can yield greater, more timely insights.[13] Team

members might resort to informal communication when systematic issues, like workflow and scheduling,[13] or lack of psychological safety[14] prohibit them from participating in formal communication events.

As Cumin et al. found, "information was five times more likely to be effectively communicated if it was mentioned during a formal team communication."[16] Our findings contribute to the argument that effective interdisciplinary care team communication would benefit from being more formalized, especially between high-level individuals in teams.[17] Studies have shown that standardized communication tools in formal processes, such as goal sheets, improve the perception of communication among team members,[18] reduce variations in how teams communicate,[7] foster clearer discussions around patient goals,[19] and improve overall transfer of knowledge.[20]

There was limitations to this study. First, this was a single-unit study in an urban academic hospital which limits transferability to rural or non-academic hospitals. Yet, by speaking to a wide variety of interdisciplinary clinicians we gained rich insight into the complexity of interdisciplinary communication both within and between teams. Our rich findings were validated with participant checking of clinicians that have worked in other intensive care units thus we believe likely reflects communication issues across other ICUs in other academic hospitals. Second, data collection via interviews and focus groups relied on the perception of communication as articulated by participants, instead of observed by study team members in situ. However, a concordant observational study of five units in the same hospital validated and reinforced the critical impact of leadership on team psychological safety during formal communication processes.[21] Third, these data were collected during the COVID pandemic when there were objectively greater stress and burden placed on interdisciplinary clinicians. The

backdrop of pandemic stress may have impacted the nature and intensity of participant responses.

CONCLUSION

Patient care areas, in particular intensive care units which care for critically ill and injured patients, depend on effective interdisciplinary team communication. Standardizing communication patterns and clearly defining roles have the effect of minimizing reliance on informal communication, which in turn creates the foundation for psychological safety.

Competing Interests None of the authors have any conflicts of interest to disclose.

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Code	Memo
Psychological safety	
Social norms	
Relationships	
Attendings not used to pushback	
Excluded in discussions	
Chance to ask questions	
Valued opinions	
Status	
Hierarchy	
Cognitive bias	
Respect	
Ownership	
Deferring decisions	
Delegation	
Responsiveness	
Attending preferences	
Primary team gives approval	
Anticipatory thinking	
Communication	
Agreement on care plan	
Changing plans	
Inter/intrapersonal	
Formality	
Mode	
Assignment of a calling consultant	
Fast decision-making	
Handoffs	
Shift to shift handoffs	
Floor to SICU handoffs	
Speaking up	
Going directly to top of hierarchy	
Rounds	
Rounding at different times	
Pre-rounding	
Post-rounding	
Work organization	
Morning rounds	
Communication with family	
More consultants, more mixed messages to family	
Need to smooth over confusion with family	
Conflicting messages between teams	
Tone	
Updates	
Variability in mechanism of communication	
Regular interactions	
Communication tools	
Notes	
WhatsApp	
Texting group chats	
Roles and responsibilities	
Role definition	

Role of APP	
Point person	
Mediating person	
Constant in ICU	
Advocate for attending	
Role of 2nd year	
Team manager	
Psychological accessibility	
Physical accessibility	
Cognitive load	
SICU - NIGHT	
SICU - DAY	
Managing expectations	
Rotations	
Staffing	

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	1/5-6
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	1/1-24
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	3/51-60
Purpose or research question - Purpose of the study and specific objectives or questions	3/66-72
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	6/126-129
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	5/111-120
Context - Setting/site and salient contextual factors; rationale**	4/75-83
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	5/94-102
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	5/99-102
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	5/114-133

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	5/104-133
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	7/139-149
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	6/130-133
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	6/122-129
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	6/129-133

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	7/139-343
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8/159-161 ; 8/170-171 ; 9/189-193 ; 9/197-200 ; 10/212-215 ; 11/225-228 ; 11/237-239 ; 12/247-250 ; 12/265-267 ; 13/274-278 ; 14/290-296 ; 14/300-304 ; 15/328-329 ; 16/339-343

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	16/345-376
Limitations - Trustworthiness and limitations of findings	17/377-391

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	19/397

Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	19/399

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
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A Qualitative Study of Interdisciplinary Care Team Communication in an Open Surgical Intensive Care Unit

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ABSTRACT

Objective: Poor interdisciplinary care team communication has been associated with increased mortality. The study aim was to define conditions for effective interdisciplinary care team communication.

Design: An observational cross-sectional qualitative study.

Setting: A Surgical Intensive Care Unit in a large, urban, academic referral medical center.

Participants: A total 6 interviews and 10 focus groups from February to June 2021 (N=33) were performed. Interdisciplinary clinicians who cared for critically ill patients were interviewed. Participants included intensivist, transplant, colorectal, vascular, surgical oncology, trauma faculty surgeons (n=10); emergency medicine, surgery, gynecology, radiology physicians-in-training (n=6), advanced practice providers (n=5), nurses (n=7), fellows (n=1) and sub-specialist clinicians such as respiratory therapists, pharmacists, and dieticians (n=4). Audio-recorded content of interviews and focus groups were de-identified and transcribed verbatim. The study team iteratively generated the codebook. All transcripts were independently coded by two team members.

Primary Outcome: Conditions for effective interdisciplinary care team communication.

Results: We identified five themes relating to conditions for effective interdisciplinary care team communication in our Surgical Intensive Care Unit setting: role definition, formal processes, informal communication pathways, hierarchical influences, and psychological safety. Participants reported that clear role definition and standardized formal communication processes empowered clinicians to engage in discussions that mitigated hierarchy and facilitated psychological safety.

Conclusions: Standardizing communication and creating defined roles in formal processes can promote effective interdisciplinary care team communication by fostering psychological safety.

Keywords: intensive care unit; interprofessional relations; organizational management

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Competing Interests Statement: The authors declare no competing interests with regards to these data or this work.

Strengths and Limitations of this Study

- The study interviewed a broad range of interdisciplinary clinicians caring for critically ill patients to capture the full range of conditions for effective interdisciplinary communication from all perspectives.
- The study was conducted in a large, urban, academic Surgical Intensive Care Unit in a referral hospital to gain a deeper understanding of communication dynamics across different disciplines of sub-specialist clinicians composed of ad-hoc teams who have never worked together and many learners with monthly turn-over caring to complex critically ill and injured patients.
- The study was limited to a single center may limit transferability of findings.

BACKGROUND

Critically ill patients in Intensive Care Units depend on decision making diffused amongst a rotating, diverse cast of faculty physicians from different specialties, physicians in training, nurses, dieticians, pharmacists, respiratory therapists, and other supporting staff. Often, these "expanding and contracting"(1) teams assemble ad-hoc to address the intricacies of individual patients' cases. Frequently, their team members have never worked together. This complex context depends on the ability of the care teams to create situational awareness and execute teamwork skills, such as communication, coordination, and cooperation.(2) Notably, communication has been found to be the highest cited contributor to medical error.(3) Ineffective communication results from relational and social factors intrinsic to medical teams, such as the status, power, vertical hierarchy, and role ambiguity.

Effective interdisciplinary care team communication has been defined as the clear, brief, timely delivery of complete information amongst engaged key decision-makers, to create shared mental models of the problem and make treatment decisions with situational awareness if those treatments fail.(4) However, there is a literature gap as to conditions influencing effective interdisciplinary care team communication, especially in surgical intensive care units (SICU) where surgical teams co-manage patient care.(5)

The overarching goal of this study was to identify conditions for effective communication amongst interdisciplinary teams caring for patients in a large, urban, academic SICU in a referral hospital. Qualitative study of interdisciplinary clinicians at all professional levels who cared for critically ill and injured surgical patients was performed identify the conditions for effective communication. We hypothesized that the complex structure of the setting would elucidate the most important conditions for effective communication amongst interdisciplinary care teams.

METHODS

Setting

This was an observational, cross-sectional study conducted at a single, open SICU at an urban academic medical center in the Midwest United States from February to June 2021. This study was conducted in a large, urban, academic Surgical Intensive Care Unit in a referral hospital. Each patient was co-managed by at least two physician teams, intensivists and surgeons, with high degree of sub-specialization in ad-hoc teams that had often never worked together and many learners with little institutional memory. This environment's complex structure was ideal to understand conditions for effective interdisciplinary communication.(6) The study sought to obtain data excepts that contributed to the result's trustworthiness by providing a "thick description"[6] of data in context.

An open ICU model has been defined as the critical care team and the patient's surgical team co-manage the patient during their stay in the SICU. The surgical team in this setting was commonly referred to as the "primary" team. The critical care team conducted daily morning rounds and collaborated with the primary team on patient care decisions. There were often other consulting teams that support specialized patient care decisions in addition to the critical care and primary surgical teams. The SICU had approximately 20 consulting service lines that passed through their unit on a regular basis. These service lines, such as respiratory therapy, are another integral part of a patient's care plan.

Patient and Public Involvement

The Patient and Public were not involved in the design, conduct, reporting or dissemination of the research.

Conceptual Model

To explore factors relating to effective interdisciplinary communication, we referenced Mulvale et al.'s (2016)(7) interprofessional collaboration gears model (**Figure 1**). This model (the "Gears Model") provided a framework for conceptualizing how interdisciplinary collaboration factors connected from macro to individual-levels. It presented collaboration as the outcome of four types of factors: macro (governance), meso (information systems and organizational culture), micro (team structure, team attitudes, social processes, and formal processes), and individual (belief in interprofessional care and flexibility). This study team interpreted collaboration to be similar to communication such that they share interrelated determinants. This study focused mostly on the micro-level factors emerging from data in the Gears Model to this context: team structure, team attitudes, social processes, and formal processes.

Semi-Structured Interviews

Cohort Description

The study examined effective interdisciplinary care team communication, exploring relationships and patterns as they were identified in these data.(8) A representative group of interdisciplinary roles (intensivists, colorectal surgeons, vascular surgeons, transplant surgeons, surgical oncologist, ethicists) and professional levels [faculty surgeon physicians, physicians in training, advanced practice providers (APPs) such as physician assistants, nurse practitioners] and specialist providers (dieticians, respiratory therapists, pharmacists) that work in the SICU were purposefully enrolled to glean richer insight into the problem.

Recruitment

Participants were eligible for recruitment if they frequently cared for critically ill and injured patients. Participants were recruited via email by a study member to share their

experiences around interdisciplinary communication in the SICU. A total of 33 participants were invited. No participants refused to participate, dropped out of the study, or provided a repeat interview. Interviews and focus groups were conducted over Zoom. Only the participants and interviewers were present for the interviews. No patients or family members were involved in this study because they are rarely privy to interdisciplinary communication exchanges. This study was approved by the University Institutional Review Board Number STU00218401. All participants gave informed consent before taking part.

Interview Guide Development

Interview and focus group guides were designed to explore conditions for effective interdisciplinary care team communication of all professional levels caring for critically ill and injured surgical patients (**Supplementary Material File 1**). The study team co-created an interview guide with non-participant clinicians. The interview guide elicited narratives about the participant's interdisciplinary communication in the care of critically ill and injured patients, specifically experiences sharing important information during patient care plan discussions, and how patient care plan disagreements were approached.

A female PhD health services researcher (JJ), a male MD surgical research fellow (EA), and a female management PhD candidate (CD), all with extensive experience in qualitative interviewing in a medical setting, conducted the interviews and focus groups. One study member (JJ) had a prior relationship with a few of the participants from previous research studies. The three study team members did not work in the SICU and thus had no professional authority over participants. Participants were told that the study team was interested in understanding and improving interdisciplinary communication in the care of critically ill and injured patients. The interviews were audio recorded, transcribed verbatim, and de-identified. Field notes taken during

the interviews then were discussed at weekly team meetings. Interviews lasted approximately 60 minutes and were conducted until data saturation, or the point where the study team was not seeing new data introduced, was reached.

Analysis

Each week, study team members debriefed the raw data from recent interviews and identified emergent themes on conditions for effective interdisciplinary communication. When it was time to begin coding, eight people from the study team participated in an (initially) inductive thematic analysis(9). The codebook was created by each of the eight study team members independently reviewing the same two transcripts to ascertain preliminary codes. After individual coding, the study team convened to discuss and reach consensus about the codes using a virtual whiteboard. Preliminary codes were added, clustered, and consolidated in an iterative process with feedback from the study team. An experienced physician-researcher (AS) with expertise in interdisciplinary care team communication and a PhD qualitative researcher specializing in microsystems (JJ) also introduced deductive codes from the literature around teamwork climate,(10) physical and psychological accessibility,(11) and distribution of shared responsibility.(12) CD selected an additional transcript for the team to code to test and refine the codebook. The team reconvened to reach agreement over the codes. Once the codebook (**Supplementary Material File 2**) was finalized, the transcripts were coded by dyads, each of whom resolved coding conflicts were by partnered consensus. MAXQDA software was used to support coding and analysis. We later invited participants to provide feedback on the main themes through a workshop and a priority matrix survey as a form of member checking.(13)

RESULTS

A total of 6 interviews and 10 focus groups were conducted. The sample of interdisciplinary participants included 10 physicians (intensivist, surgical oncologist, vascular, colorectal and transplant surgeons), intensive care nurses (n=7), and sub-specialists such as respiratory therapists, pharmacists, and dieticians (n=4). (**Table 1**) The sample included all professional levels including faculty surgeons, physicians in training (n=6), fellows (n=1) and advanced practice providers (n=5). Five themes were identified as conditions for effective communication amongst interdisciplinary teams caring for patients in a large, urban, academic SICU (**Figure 2**).

Unclear Role Definitions were Amplified During Patient Care Decision-Making

The open model structure of the SICU fostered a culture of shared responsibility between the interdisciplinary care teams that co-manage patient care. Unclear, diffuse responsibility blurred boundaries between the critical care team and consulting services. As one faculty surgeon noted, the complex patient care problems can overlap, making critical care management "…a lot greyer about, 'what am I handling and what are [the consultants] handling?'" The diffusion of responsibility was met with tension over who was responsible for different aspects of patients' care.

> "The ICU is...a juggernaut with lots of people that work in it...because of the nebulous reporting structure there, it could be a little challenging sometimes to figure out who is the decision maker, or who do I speak to about this or that?" *Faculty Surgeon*

Participants noted that ambiguity around roles and responsibilities inhibited care team members from making care decisions and escalating communication. Participants shared that this led to delays in care. Non-physician team members spent extra time seeking advice from

colleagues and searching through patient charts to who might be overseeing a patient. Even when there was a call number in the patient notes, it would sometimes be an incorrectly listed. As one nurse said:

> "In the [Epic] summary page, there is a section that shows you who is 'primary'…but that doesn't necessarily mean that's who you're supposed to page." *Bedside ICU Nurse*

Participants indicated that designating responsibility for specific aspects of patient care to each interdisciplinary care team, creating shared mental models around team boundaries, and establishing points of contact (and appropriate back-up contacts) could aid efficient patient care.

Formal Processes for Interdisciplinary Care Team Communication were Underutilized

The formal mechanisms around interdisciplinary care team communication included daily team meetings, multidisciplinary rounds, and patient admissions and handoffs. Implementing multidisciplinary rounds received positive feedback from interdisciplinary clinicians for providing a platform for different roles to converge on patient care. Since many surgical teams sent representative team members, such as advanced practice providers (APPs) to the critical care team morning multidisciplinary rounds or invited the critical care team to their team's morning rounds.

Participants reported that the effectiveness of communication during these formal processes varied by the lead faculty surgeon and their team culture. Rounds were enacted differently depending on the faculty surgeon's preferences and priorities. As one nurse stated:

> "…regarding rounds, I think it's very much faculty surgeon-specific and driven. So, there's some faculty surgeons that value the interdisciplinary…and they take the time to make sure everyone's included and everyone understands what's going on. And then

there's other faculty surgeons who that's not a priority for them... So I think that can delay care, and that's when communication breaks happen." *Bedside ICU Nurse*

Participants indicated that more standardized communication during formal processes could promote knowledge sharing. One nurse reported how a lack of standardized handoff procedures can lead to unintentionally sharing "half the story."

"They give you sign out, but… and you get half the story. Then there you are, the primary nurse with the ICU physician in training overnight, trying to figure out the plan of care for this patient until the day team comes to see them." *Bedside ICU Nurse*

Current Organizational Dynamics Promote Informal Communication Pathways

Participants noted that team members often relied on informal communication pathways because formal processes were lacking. Informal communication pathways included texting, paging, unplanned visits to the OR, unplanned visits to the critical care offices and hallway conversations. This type of communication pathway allowed for rapid updating and information exchange outside of formal processes. Informal communication pathways seemed important given emergent issues arising that necessitated quick decision-making.

"[Faculty surgeon] and I will use a lot of cell phone or texting and [Faculty surgeon] will even come down to the OR. Or he'll know I'm actually stuck in the OR for six hours. They'll need to get some message to us, and text just isn't good enough, so he'll walk down to the operating room." *Faculty surgeon*

While there are benefits to informal communication pathways (such as getting immediate, relevant patient updates outside of designated meeting times), participants reported that having an abundance of informal communication led to an "overcommunication" problem.

Participants explained that constant communication between multiple types and levels of providers in the SICU did not always equate to an efficient sharing of knowledge across and within teams. Additionally, the informal communication mechanisms in the complex context were not structured to ensure that the information was followed-up.

> "It varies from month to month, and it depends on the day and what's going on. But I have witnessed a lot of delays in patient care, and a lot of delays in patient throughput, because there hasn't been follow-up, or those 'checking back in with each other' type communication." *Nurse clinical coordinator*

Informal communication pathways were influenced by physical proximity (accessibility) and relationships with clinicians. If an answer was needed quickly, clinicians would consult the critical care team members nearby on the floor and/or clinicians with whom they had established rapport. Participants underscored how face-to-face communication and physical accessibility were valued. The availability of clinicians on the floor, such as APPs, made their role in care decisions more clinically relevant.

> "I think the ICU team sometimes is more in communication with the nurses because they are literally on our unit so that we are able to voice our concerns immediately because they sit right there and we're right there, too." *Bedside ICU Nurse*

In workarounds for approval on patient care decisions, participants stated that seeking permission or advice from people they know they can get a quick, or potentially more favorable, response. While informal communication pathways was an effective tool, communication issues arose when team members used them to circumvent appropriate approval. Participants reported that this often occurs when navigating disagreements between the SICU and primary teams.

"'If Mom says no, go to Dad', and that's what they'll do...you know how little kids do that. Sometimes people in the ICU will do that if they hear "no" from one person, they'll go to a different person." *Physician in training*

Hierarchy Bias the Communication Practices of Physicians in Training

Both formal processes and informal communication pathways were subject to cognitive biases that influenced communication behaviors. Particularly, participants reported that the negative expressions of cognitive biases, such as overvaluing voices of authority in hierarchical systems, could diminish empowerment especially in non-physician team members.

As the main figures of authority, faculty surgeons were reported to have the strongest influence and were felt to be responsible for teaching physicians in training "how to work with others." Participants, including physicians in training, noted that as part of the physician in training learning process, physicians in training adopted faculty surgeons' styles during their rotation. Physicians in training tended to model behaviors more from their team's faculty surgeons than from faculty surgeons on other teams or from non-faculty team members. However, participants were uncertain whether faculty surgeons were fully aware of their influence on interdisciplinary care team communication.

"It was just that it was not paid attention to...depending on who the faculty surgeon is in the ICU, it can be run very differently. As is on our service, depending which faculty surgeon is currently on for that week, it can be run very differently." *APP*

Participants reported that when communicating with non-physicians, physicians in training would mirror their faculty surgeon's practices for creating (or reducing) psychological safety and minimizing (or increasing) the presence of hierarchy. As nurses noted:

"Some physicians in training are great with it, some have no desire to speak with nurses. They're going to speak only to the doctor and the nurse can figure it out later. My point is that it also comes from the faculty surgeons. There's some faculty surgeons that have no desire to communicate with the nurse…well, of course that behavior then is demonstrated to the physicians in training who follow the same behavior." *Nurse clinical coordinator*

Team cultures and practices that inhibit the non-physician voice block an optimal exchange of information, weakening effective interdisciplinary care team communication. At the same time when the hierarchy was flatter, trusting relationships between physicians in training and nurses could greatly facilitate interdisciplinary communication. Physicians in training and nurses (both within and across teams) built trusting relationships through patterns of interactions where they saw each other work with patients, took feedback, and achieved consensus. The relationship between nurses and each individual physician in training had to be established anew every month because SICU physicians in training changed monthly. Physicians in training earned the trust of bedside SICU nurse when they made informal visits before and after morning rounds to check on the patient and get updates from the nurse. This demonstrated respect for the nurse and valuing their perspective thereby flattening the interdisciplinary hierarchy.

"During rounds, [the physician in training] had an excellent presentation, they asked us what we thought was going on…and then they'll circle back, talk to families, and just stuff like that… this person wants to be here. Then the trust comes in too. If I come to someone and I'm like, "this patient, this is what happened and I'm concerned." And they are like, "okay," and then they come with me and they assess the patient too… seeing that stuff from physicians in training helps build trust." *Bedside ICU Nurse*

Conversely, nurses earned the trust of the physicians in training when they would speak up to educate the physician in training, providing rationale to guide care based on their critical care experience and knowledge.

"It's their first time putting in orders…it's a matter of us being like 'hey, you put this in and that's not safe,' or, 'you have to change it to this because,' for X, Y, Z reasons. That helps them trust us because we're not going to do things that will harm the patient, and we're going to help them figure out what needs to be done." *Bedside ICU Nurse*

Standardized Practices Support the Development of Psychological Safety & Interdisciplinary Team Engagement

A high level of psychological safety sets the stage for participants to engage meaningfully and earn trust. Participants expressed desire to feel a higher level of psychological safety and active engagement in their patients' care decisions during team interactions - particularly, non-physician team members who were in a lower relative status in the interdisciplinary hierarchy, such as APPs and nurses. These participants stated that they were more likely to speak up and share their perspective in team discussions when they felt they were supported by high-status team members (i.e., faculty surgeons) to provide input on the care plan. Support from high-status team members was demonstrated by direct invitation (e.g., asking team members to attend the meeting or to speak during rounds), mindful presence (e.g., allowing team members to finish speaking, not interrupting or walking away), and validation (e.g., acknowledging and acting on what team members communicate).

"It's just a nice invitation to bring up additional issues. Sometimes there's nothing additional…it's just nice to be offered that opportunity." *Clinical provider*

However, routines supporting psychological safety varied by faculty surgeon. While many faculty surgeons welcomed the input of non-physician team members, some either rejected non-physician team input or bypassed them during rounds completely. One non-physician participant pointed out the physical cues that faculty surgeons can send to physicians in training and other team members, mentioning that "you feel you have to interject or catch if the team starts to walk away while you're mid-sentence." Participants reported that communication practices that support psychological safety and engagement in clinical decision making extend beyond rounds; how faculty surgeons and higher-level team members demonstrate respect and trust to non-physician team members throughout the shift impacted team communication.

> "...the faculty surgeon [physician] made a comment to their team about not listening to the non-physician and making sure that they take things to a more higher-level and I couldn't have helped feeling insulted….I understand that I am definitely a lower-level staff member, but at the same time this is coming from a higher-level person who's telling me to carry out these plans." *APP*

DISCUSSION

The overarching goal of this study was to identify conditions for effective communication amongst interdisciplinary teams caring for patients in a large, urban, academic SICU. This study identified the conditions for effective interdisciplinary team communication were clear role definition and standardization of formal processes, which supported psychological safety. In the absence of formal communication processes, clinicians expressed a tendency to engage in informal communication, which could be subject to bias.

Others have found that many conditions, such as physical accessibility,(11) can also influence the effectiveness of a team's communication.(14) Interdisciplinary care team communication can also serve different purposes depending on whether it is patterned as formal (scheduled) or informal (ad hoc).(15) Formal communication can help reduce complexity of the exchange,(16) yet informal communication can yield greater, more timely insights.(17) Team members might resort to informal communication when systematic issues, like workflow and scheduling, or lack of psychological safety prohibit them from participating in formal communication events.(18)

As Cumin et al. found, "information was five times more likely to be effectively communicated if it was mentioned during a formal team communication."(19) Our findings contribute to the argument that effective interdisciplinary care team communication would benefit from being more formalized, especially between high-level individuals in teams.(20) Studies have shown that standardized communication tools in formal processes, such as goal sheets, improve the perception of communication among team members,(21) reduce variations in how teams communicate,(10) foster clearer discussions around patient goals,(22) and improve overall transfer of knowledge.(23)

There were limitations to this study. First, this was a single-unit study in an urban academic hospital which limits transferability to rural or non-academic hospitals. Yet, by speaking to a wide variety of interdisciplinary clinicians we gained rich insight into the complexity of interdisciplinary communication both within and between teams. Our rich findings were validated with participant checking of clinicians that have worked in other intensive care units thus we believe likely reflects communication issues across other ICUs in other academic hospitals. Second, data collection via interviews and focus groups relied on the perception of

communication as articulated by participants, instead of observed by study team members in situ. However, a concordant observational study of five units in the same hospital validated and reinforced the critical impact of leadership on team psychological safety during formal communication processes.(24) Third, these data were collected during the COVID pandemic when there were objectively greater stress and burden placed on interdisciplinary clinicians. The backdrop of pandemic stress may have impacted the nature and intensity of participant responses.

Future Work

Clinicians reported that previous attempts had been made to standardize formal processes. Unless standardized routines are co-created with and championed by physicians and leadership, they are further challenged by the high turnover and need for frequent learner education in the ICU. A future direction is to engage physician and leadership as we scope a communication intervention that addresses these factors.

CONCLUSION

Intensive care units which care for critically ill and injured patients, depend on effective interdisciplinary team communication. Standardizing communication patterns and clearly defining roles have the effect of minimizing reliance on informal communication, which in turn creates the foundation for psychological safety.

Competing Interests: None of the authors have any conflicts of interest to disclose.

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Contributions Statement: Carmen Diaz, (Data Collection, Formal Analysis, writing and editing); Egide Abahuje (Data Collection, Formal Analysis, writing and editing); Andrew Berry (Conceptualization, methodology, writing and editing); Miriam Rafferty, (Conceptualization, methodology, writing and editing); Ali Amro, MD (Data Collection, Formal Analysis, writing and editing); Kaithlyn Tesorero, (Data Collection, Formal Analysis, writing and editing); Michael Shapiro, MD (Conceptualization, methodology, writing and editing); Bona Ko, MD (Data Collection, Formal Analysis, writing and editing); Whitney Jones, MD (Data Collection, Formal Analysis, writing and editing); John D. Slocum, MPH (Data Collection, Formal Analysis, writing and editing); Julie Johnson, PhD (Conceptualization, methodology, writing and editing); Anne M Stey, (Conceptualization, methodology, formal analysis, writing, reviewing, editing and supervision)

Data Availability Statement: De-identified Redacted Transcript Data can be made available by the corresponding author upon reasonable request.

Ethical Approval Statement: The study obtained ethics approval via institutional review board, the number was STU00218401. All participants gave informed consent before taking part.

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Tables & Figures Legends

Figure 1: Conceptual Model for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit Based on Mulvale et al. Interprofessional Collaboration Gears Model (2016

Macro Factors: Governance;
Meso Factors: Information Systems, Organizational Culture;
Micro Factors:
Team Structure: Champion/Facilitator, Team Size;
Social Processes: Levels of Conflict, Open Communication, Supportive Colleagues;
Formal Processes: Team Vision/Goals, Quality Audit/Process, Recognition, Group Problem-Solving, Team Meetings, Decision-Making Processes;
Team Attitudes: Feeling Part of Team, Support for Innovation;
Individual Factors: Belief in Interprofessional Care, Flexibility

Figure 2: Adapted Mulvale Interprofessional Collaboration Gears Model for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit

Figure 2 Legend: **Marco factors:** Open surgical ICU
Meso factors: Organizational culture of hierarchy
Micro factors: Structure Variability in role definition, lack of formal communication Processes giving rise to informal communication pathways
Individual factors: value psychological safety

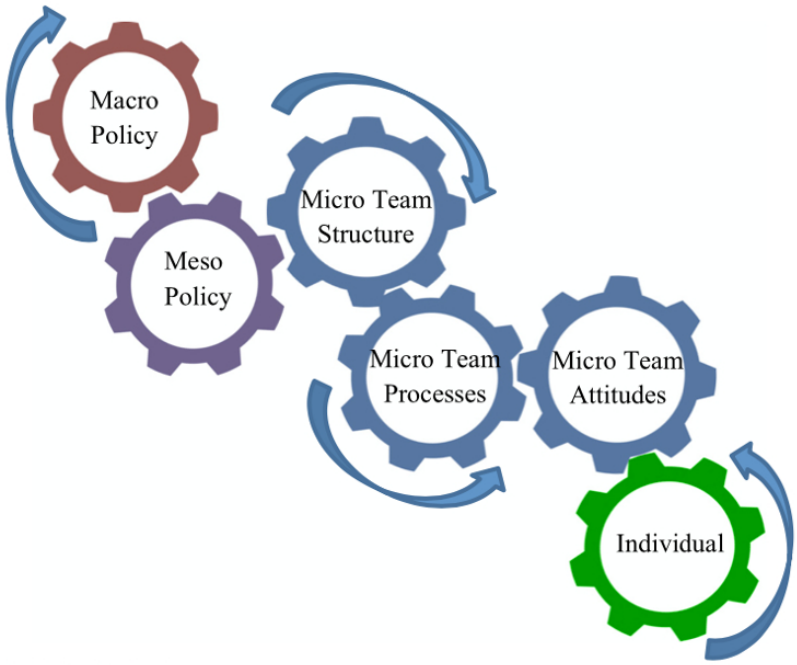
Table 1:Participant Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit

Role	Number of Participants
Intensivist	3
Surgical Oncologist	1
Vascular Surgeon	2
Colorectal Surgeon	2
Transplant Surgeon	2
Critical Care Fellow	1
Physicians in training	6
Intensive Care Unit Nurse	7
Advanced Practice Providers	5
Respiratory Therapist	2
Pharmacist	1
Dietician	1

Supplementary Files Legends

Supplementary File 1: Qualitative Interview Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

Supplementary Material File 2: Codebook for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units



MACRO FACTORS: Governance

MESO FACTORS: Information Systems, Organizational Culture

MICRO FACTORS:

Team Structure: Champion/Facilitator, Team Size
Social Processes: Levels of Conflict, Open Communication, Supportive Colleagues
Formal Processes: Team Vision/Goals, Quality Audit/Process, Recognition, Group Problem-Solving, Team Meetings, Decision-making Processes
Team Attitudes: Feeling part of Team, Support for Innovation

INDIVIDUAL FACTORS: Belief in Interprofessional Care, Flexibility

Fig. 1: "Mulvale et al. Factors Identified as Being Associated with Collaboration in IPCTs (2016)"

161x170mm (144 x 144 DPI)

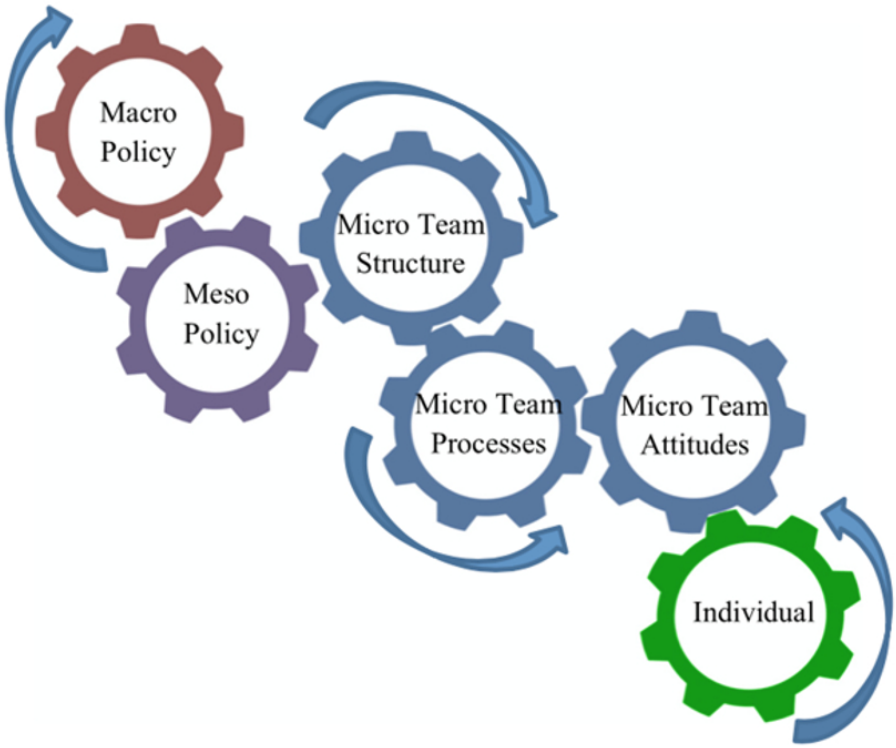


Fig. 2: "Adapted Model of Interprofessional Communication." We adapted the legend of Mulvale et al.'s "Figure 3. Factors Identified as Being Associated with Collaboration in IPCTs" to highlight our study's communication-based results across macro, meso, micro, and individual factors. (Creative Commons License: https://creativecommons.org/licenses/by/4.0/).

159x179mm (144 x 144 DPI)

Supplementary File 1: Qualitative Interview Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

1. Interviewee starts off with personal story about team-team communication.

2. Could you please describe your role in the ICU?

3. Could you please tell me about a time you communicated something you felt was important about a patient plan? How did that go?

4. Could you please tell me about a time you had something you felt was important to communicate about a patient plan, but decided not to share?

5. What happens if there's a disagreement with the patient plan?

Supplementary Material File 2: Codebook for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

Code
Psychological safety
Social norms
Relationships
Attendings not used to pushback
Excluded in discussions
Chance to ask questions
Valued opinions
Status
Hierarchy
Cognitive bias
Respect
Ownership
Deferring decisions
Delegation
Responsiveness
Attending preferences
Primary team gives approval
Anticipatory thinking
Communication
Agreement on care plan
Changing plans
Inter/intrapersonal
Formality
Mode
Assignment of a calling consultant
Fast decision-making
Handoffs
Shift to shift handoffs
Floor to SICU handoffs
Speaking up
Going directly to top of hierarchy
Rounds
Rounding at different times
Pre-rounding
Post-rounding
Work organization
Morning rounds
Communication with family

More consultants, more mixed messages to family
Need to smooth over confusion with family
Conflicting messages between teams
Tone
Updates
Variability in mechanism of communication
Regular interactions
Communication tools
Notes
WhatsApp
Texting group chats
Roles and responsibilities
Role definition
Role of APP
Point person
Mediating person
Constant in ICU
Advocate for attending
Role of 2nd year
Team manager
Psychological accessibility
Physical accessibility
Cognitive load
SICU - NIGHT
SICU - DAY
Managing expectations
Rotations
Staffing

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	1/5-6
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	1/1-24
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	3/51-60
Purpose or research question - Purpose of the study and specific objectives or questions	3/66-72
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	6/126-129
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	5/111-120
Context - Setting/site and salient contextual factors; rationale**	4/75-83
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	5/94-102
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	5/99-102
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	5/114-133

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	5/104-133
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	7/139-149
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	6/130-133
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	6/122-129
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	6/129-133

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	7/139-343
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8/159-161 ; 8/170-171 ; 9/189-193 ; 9/197-200 ; 10/212-215 ; 11/225-228 ; 11/237-239 ; 12/247-250 ; 12/265-267 ; 13/274-278 ; 14/290-296 ; 14/300-304 ; 15/328-329 ; 16/339-343

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	16/345-376
Limitations - Trustworthiness and limitations of findings	17/377-391

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	19/397

Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	19/399

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388

BMJ Open

Defining Conditions for Effective Interdisciplinary Care Team Communication in an Open Surgical Intensive Care Unit: A Qualitative Study

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Primary Subject Heading:	Intensive care
Secondary Subject Heading:	Qualitative research
Keywords:	Interprofessional Relations, Clinical Reasoning, Emotional Intelligence, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisational development < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Adult intensive & critical care < INTENSIVE & CRITICAL CARE

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Defining Conditions for Effective Interdisciplinary Care Team Communication in an Open Surgical Intensive Care Unit: A Qualitative Study

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Running Head: Understanding Interdisciplinary Communication

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Keywords: intensive care unit**;** interprofessional relations; organizational management

ABSTRACT

Objective: Poor interdisciplinary care team communication has been associated with increased mortality. The study aim was to define conditions for effective interdisciplinary care team communication.

Design: An observational cross-sectional qualitative study.

Setting: A Surgical Intensive Care Unit in a large, urban, academic referral medical center.

Participants: A total 6 interviews and 10 focus groups from February to June 2021 (N=33) were performed. Interdisciplinary clinicians who cared for critically ill patients were interviewed. Participants included intensivist, transplant, colorectal, vascular, surgical oncology, trauma faculty surgeons (n=10); emergency medicine, surgery, gynecology, radiology physicians-in-training (n=6), advanced practice providers (n=5), nurses (n=7), fellows (n=1) and sub-specialist clinicians such as respiratory therapists, pharmacists, and dieticians (n=4). Audio-recorded content of interviews and focus groups were de-identified and transcribed verbatim. The study team iteratively generated the codebook. All transcripts were independently coded by two team members.

Primary Outcome: Conditions for effective interdisciplinary care team communication.

Results: We identified five themes relating to conditions for effective interdisciplinary care team communication in our Surgical Intensive Care Unit setting: role definition, formal processes, informal communication pathways, hierarchical influences, and psychological safety. Participants reported that clear role definition and standardized formal communication processes empowered clinicians to engage in discussions that mitigated hierarchy and facilitated psychological safety.

Conclusions: Standardizing communication and creating defined roles in formal processes can promote effective interdisciplinary care team communication by fostering psychological safety.

Keywords: intensive care unit; interprofessional relations; organizational management

Funding Statement: This work was supported by the Northwestern Medicine Insurance Company.

Competing Interests Statement: The authors declare no competing interests with regards to these data or this work.

Strengths and Limitations of this Study

- The study interviewed a broad range of interdisciplinary clinicians caring for critically ill patients to capture the full range of conditions for effective interdisciplinary communication from all perspectives.
- The study was conducted in a large, urban, academic Surgical Intensive Care Unit in a referral hospital to gain a deeper understanding of communication dynamics across different disciplines of sub-specialist clinicians composed of ad-hoc teams who have never worked together and many learners with monthly turn-over caring to complex critically ill and injured patients.
- The study was limited to a single center may limit transferability of findings.

BACKGROUND

Critically ill patients in Intensive Care Units (ICU) depend on decision-making diffused amongst a rotating, diverse cast of faculty physicians from different specialties, physicians-in-training, nurses, dieticians, pharmacists, respiratory therapists, and other supporting staff. Often, these "expanding and contracting"(1) teams assemble ad-hoc to address the intricacies of individual patients' cases. Frequently, their team members have never worked together. This complex context depends on the ability of the care teams to create situational awareness and execute teamwork skills, such as communication, coordination, and cooperation.(2) Notably, communication has been found to be the highest cited contributor to medical error.(3) Ineffective communication results from relational and social factors intrinsic to medical teams, such as the status, power, vertical hierarchy, and role ambiguity.(3)

Effective interdisciplinary care team communication has been defined as the clear, brief, and timely delivery of complete information amongst engaged key decision-makers. It allows team members to create shared mental models of the problem and make treatment decisions with situational awareness if those treatments fail.(4) However, promoting effective interdisciplinary care team communication across hierarchical and role-based boundaries is shown to be challenging,(5, 6) especially considering the different impacts of formal and informal communication patterns.(7) While research finds that ineffective communication contributes to adverse patient outcomes, conditions for effective interdisciplinary care team communication, especially in surgical intensive care units (SICU) where surgical teams co-manage patient care, are not well defined.(8, 9)

The overarching goal of this study was to address this gap in the literature by identifying conditions for effective communication amongst interdisciplinary teams caring for patients in a

large, urban, academic SICU in a referral hospital. A qualitative study of interdisciplinary clinicians at all professional levels who cared for critically ill and injured surgical patients was performed to identify the conditions for effective communication. We hypothesized that the complex structure of the setting would elucidate the most important conditions for effective communication amongst interdisciplinary care teams.

METHODS

Setting

This was an observational, cross-sectional study conducted at a single, open SICU at a large, urban, academic medical center in the Midwestern United States from February to June 2021. Each patient was co-managed by at least two physician teams (intensivists and surgeons), ad-hoc teams that had often never worked together, and many learners with little institutional memory. This environment's complex structure was ideal to understand conditions for effective interdisciplinary communication. The study sought to obtain data excepts that contributed to the result's trustworthiness by providing a "thick description" of data in context.(10)

An open ICU model has been defined as the critical care team and the patient's surgical team co-managing the patient during their stay in the SICU. The surgical team in this setting was commonly referred to as the "primary" team. The critical care team conducted daily morning rounds and collaborated with the primary team on patient care decisions. There were often other consulting teams that supported specialized patient care decisions in addition to the critical care and primary surgical teams. The SICU had approximately 20 consulting service lines that passed through their unit on a regular basis. These service lines, such as respiratory therapy, were another integral part of a patient's care plan.

Patient and Public Involvement

The Patient and Public were not involved in the design, conducting, reporting or dissemination of the research.

Conceptual Model

To explore factors relating to effective interdisciplinary communication, we referenced Mulvale et al.'s (2016)(11) interprofessional collaboration gears model (**Figure 1**). This model (the "Gears Model") provided a framework for conceptualizing how interdisciplinary collaboration factors connected from macro to individual-levels. It presented collaboration as the outcome of four types of factors: macro (governance), meso (information systems and organizational culture), micro (team structure, team attitudes, social processes, and formal processes), and individual (belief in interprofessional care and flexibility). This study team interpreted collaboration to be similar to communication, such that they share interrelated determinants. This study focused mostly on the Gears Model micro-level factors emerging from data: team structure, team attitudes, social processes, and formal processes.

Semi-Structured Interviews

Cohort Description

The study examined effective interdisciplinary care team communication, exploring relationships and patterns as they were identified in these data.(12) A representative group of interdisciplinary roles (intensivists, colorectal surgeons, vascular surgeons, transplant surgeons, surgical oncologist, ethicists) and professional levels (faculty surgeon physicians, physicians-in-training, advanced practice providers (APPs) (e.g., physician assistants and nurse practitioners), and specialist providers (e.g., dieticians, respiratory therapists, pharmacists) that work in the SICU were purposefully enrolled to glean richer insight into the problem.

Recruitment

Participants were eligible for recruitment if they frequently cared for critically ill and injured patients. Participants were recruited via email by a study member to share their experiences around interdisciplinary communication in the SICU. A total of 33 participants were invited. No participants refused to participate, dropped out of the study, or provided a repeat interview. Interviews and focus groups were conducted over Zoom. Only the participants and interviewers were present for the interviews. No patients or family members were involved in the study because they are rarely privy to interdisciplinary communication exchanges. This study was approved by the University Institutional Review Board Number STU00218401. All participants gave informed consent before taking part.

Interview Guide Development

Interview and focus group guides were designed to explore conditions for effective interdisciplinary care team communication of all professional levels caring for critically ill and injured surgical patients (**Supplementary Material File 1**). The study team co-created an interview guide with non-participant clinicians. The interview guide elicited narratives about the participant's interdisciplinary communication in the care of critically ill and injured patients – specifically their experiences sharing important information during patient care plan discussions and how patient care plan disagreements were approached.

A female PhD health services researcher (JJ), a male MD surgical research fellow (EA), and a female management PhD candidate (CD), all with extensive experience in qualitative interviewing in a medical setting, conducted the interviews and focus groups. One study member (JJ) had a prior relationship with a few of the participants from previous research studies. The three study team members did not work in the SICU and thus had no professional authority over participants. Participants were told that the study team was interested in understanding and

improving interdisciplinary communication in the care of critically ill and injured patients. The interviews were audio recorded, transcribed verbatim, and de-identified. Field notes taken during the interviews were discussed at weekly team meetings. Interviews lasted approximately 60 minutes and were conducted until data saturation, or the point where the study team was not seeing new data introduced, was reached.

Analysis

Each week, study team members debriefed the raw data from recent interviews and identified emergent themes around conditions for effective interdisciplinary communication. When it was time to begin coding, eight people from the study team participated in an (initially) inductive thematic analysis. (13) The codebook was created by each of the eight study team members. They all independently reviewed the same two transcripts to ascertain preliminary codes. After individual coding, the study team convened to discuss and reach consensus about the codes using a virtual whiteboard. Preliminary codes were added, clustered, and consolidated in an iterative process with feedback from the study team. An experienced physician-researcher (AS) with expertise in interdisciplinary care team communication and a PhD qualitative researcher specializing in microsystems (JJ) also introduced deductive codes from the literature around teamwork climate,(14) physical and psychological accessibility,(15) and distribution of shared responsibility.(16) CD selected an additional transcript for the team to code to test and refine the codebook. The team reconvened to reach agreement over the codes. Once the codebook (**Supplementary Material File 2**) was finalized, the transcripts were coded by dyads, which resolved coding conflicts through partnered consensus. MAXQDA software was used to support coding and analysis. For member checking, we invited participants to provide feedback on the main themes through a workshop and a priority matrix survey.(17)

RESULTS

A total of 6 interviews and 10 focus groups were conducted. The sample of interdisciplinary participants included 10 physicians (intensivist, surgical oncologist, vascular, colorectal and transplant surgeons), intensive care nurses (n=7), and sub-specialists such as respiratory therapists, pharmacists, and dieticians (n=4). (**Table 1**) The sample included all professional levels including faculty surgeons, physicians-in-training (n=6), fellows (n=1) and advanced practice providers (n=5). Five themes were identified as conditions for effective communication amongst interdisciplinary teams caring for patients in a large, urban, academic SICU (**Figure 2**).

Unclear Role Definitions were Amplified During Patient Care Decision-Making

The open model structure of the SICU fostered a culture of shared responsibility between the interdisciplinary care teams that co-managed patient care. Unclear, diffuse responsibility blurred boundaries between the critical care team and consulting services. As one faculty surgeon noted, the complex patient care problems can overlap, making critical care management "…a lot greyer about, 'what am I handling and what are [the consultants] handling?'" The diffusion of responsibility was met with tension over who was responsible for different aspects of the patients' care.

> "The ICU is...a juggernaut with lots of people that work in it...because of the nebulous reporting structure there, it could be a little challenging sometimes to figure out who is the decision maker, or who do I speak to about this or that?" *Faculty Surgeon*

Participants noted that ambiguity around roles and responsibilities inhibited care team members from making care decisions and escalating communication. Participants shared that this

led to delays in care. Non-physician team members spent extra time seeking advice from colleagues and searching through patient charts to find who might be overseeing a patient. Even when there was a call number in the patient notes, it would sometimes be an incorrectly listed. As one nurse said:

> "In the [Epic] summary page, there is a section that shows you who is 'primary'…but that doesn't necessarily mean that's who you're supposed to page." *Bedside ICU Nurse*

Participants indicated that designating responsibility for specific aspects of patient care to each interdisciplinary care team, creating shared mental models around team boundaries, and establishing points of contact (and appropriate back-up contacts) could aid efficient team communication around patient care.

Formal Processes for Interdisciplinary Care Team Communication were Underutilized

The formal mechanisms around interdisciplinary care team communication included daily team meetings, multidisciplinary rounds, and patient admissions and handoffs. The implementation of multidisciplinary rounds received positive feedback from interdisciplinary clinicians for providing a platform for different roles to converge on patient care. Many surgical teams sent representative team members, such as advanced practice providers (APPs), to the critical care team morning multidisciplinary rounds or invited the critical care team to their own team's morning rounds.

Participants reported that the effectiveness of communication during these formal processes varied by the lead faculty surgeon and their team culture. Rounds were enacted differently depending on the faculty surgeon's preferences and priorities. As one nurse stated:

"…regarding rounds, I think it's very much faculty surgeon-specific and driven. So, there's some faculty surgeons that value the interdisciplinary…and they take the time to make sure everyone's included and everyone understands what's going on. And then there's other faculty surgeons who that's not a priority for them... So I think that can delay care, and that's when communication breaks happen." *Bedside ICU Nurse*

Participants indicated that more standardized communication during formal processes could promote knowledge sharing. One nurse reported how a lack of standardized handoff procedures can lead to unintentionally sharing "half the story."

"They give you sign out, but… and you get half the story. Then there you are, the primary nurse with the ICU physician-in-training overnight, trying to figure out the plan of care for this patient until the day team comes to see them." *Bedside ICU Nurse*

Current Organizational Dynamics Promoted Informal Communication Pathways

Participants noted that team members often relied on informal communication pathways because formal processes were lacking. Informal communication pathways included texting, paging, unplanned visits to the OR, unplanned visits to the critical care offices, and hallway conversations. They allowed for rapid updating and information exchange outside of formal processes. Informal communication pathways seemed important given the emergent issues that arise and necessitate quick decision-making.

"[Faculty surgeon] and I will use a lot of cell phone or texting and [Faculty surgeon] will even come down to the OR. Or he'll know I'm actually stuck in the OR for six hours. They'll need to get some message to us, and text just isn't good enough, so he'll walk down to the operating room." *Faculty surgeon*

While there are benefits to informal communication pathways (such as getting immediate, relevant patient updates outside of designated meeting times), participants reported that having an abundance of informal communication led to an "overcommunication" problem. Participants explained that constant communication between multiple types and levels of providers in the SICU did not always equate to an efficient sharing of knowledge. Additionally, informal communication pathways in the complex SICU environment were not always structured for following-up on information.

> "It varies from month to month, and it depends on the day and what's going on. But I have witnessed a lot of delays in patient care, and a lot of delays in patient throughput, because there hasn't been follow-up, or those 'checking back in with each other' type communication." *Nurse clinical coordinator*

Informal communication pathways were influenced by physical proximity (accessibility) and relationships with clinicians. If an answer was needed quickly, clinicians would consult the critical care team members nearby on the floor and/or clinicians with whom they had established rapport. Participants underscored how face-to-face communication and physical accessibility were valued. The availability of clinicians on the floor, such as APPs, made their role in care decisions more clinically relevant.

> "I think the ICU team sometimes is more in communication with the nurses because they are literally on our unit so that we are able to voice our concerns immediately because they sit right there and we're right there, too." *Bedside ICU Nurse*

As a workaround for approval on patient care decisions, participants stated that they can get a quick, or potentially more favorable, response by seeking permission or advice from people

they know. While informal communication pathways was an effective tool, communication issues arose when team members used the pathways to circumvent appropriate approval. Participants reported that this often occurs when team members are navigating disagreements between the SICU and primary teams.

> "'If Mom says no, go to Dad', and that's what they'll do...you know how little kids do that. Sometimes people in the ICU will do that if they hear "no" from one person, they'll go to a different person." *Physician-in-training*

Hierarchy Influenced the Communication Practices of Physicians-in-Training

Both formal processes and informal communication pathways were subject to cognitive biases that influenced communication behaviors. Participants reported that the negative expressions of cognitive biases, such as overvaluing voices of authority in hierarchical systems, could diminish team members empowerment, especially in non-physicians.

As the main figures of authority, faculty surgeons were reported to have the strongest influence and felt to be responsible for teaching physicians-in-training "how to work with others." Participants, including physicians-in-training, noted that as part of the physician-in-training learning process, physicians-in-training adopted faculty surgeons' styles during their rotation. Physicians-in-training tended to model behaviors more from their team's faculty surgeons than from faculty surgeons on other teams or from non-faculty surgeon team members. However, participants were uncertain whether faculty surgeons were fully aware of their influence on interdisciplinary care team communication.

"It was just that it was not paid attention to...depending on who the faculty surgeon is in the ICU, it can be run very differently. As is on our service, depending which faculty surgeon is currently on for that week, it can be run very differently." *APP*

Participants reported that when communicating with non-physicians, physicians-in-training would mirror their faculty surgeon's practices for creating (or reducing) psychological safety and minimizing (or increasing) the presence of hierarchy. As nurses noted:

"Some physicians-in-training are great with it, some have no desire to speak with nurses. They're going to speak only to the doctor and the nurse can figure it out later. My point is that it also comes from the faculty surgeons. There's some faculty surgeons that have no desire to communicate with the nurse…well, of course that behavior then is demonstrated to the physicians-in-training who follow the same behavior." *Nurse clinical coordinator*

Team cultures and practices that inhibit the non-physician voice block an optimal exchange of information, weakening effective interdisciplinary care team communication. When the hierarchy was flatter, trusting relationships between physicians-in-training and nurses could greatly facilitate interdisciplinary communication. Physicians-in-training and nurses (both within and across teams) built trusting relationships through patterns of interactions where they saw each other work with patients, took feedback, and achieved consensus. The relationship between nurses and each individual physician-in-training had to be established anew every month because SICU physicians-in-training changed monthly. Physicians-in-training earned the trust of bedside SICU nurses when they made informal visits before and after morning rounds to check on the patients and get updates from the nurses. This demonstrated respect for the nurses, valuing their perspective and flattening the interdisciplinary hierarchy.

"During rounds, [the physician-in-training] had an excellent presentation, they asked us what we thought was going on…and then they'll circle back, talk to families, and just stuff like that… this person wants to be here. Then the trust comes in too. If I come to someone and I'm like, "this patient, this is what happened and I'm concerned." And they are like, "okay," and then they come with me and they assess the patient too… seeing that stuff from physicians-in-training helps build trust." *Bedside ICU Nurse*

Conversely, nurses earned the trust of the physicians-in-training when they would speak up to educate the physician-in-training, providing rationale to guide care based on their critical care experience and knowledge.

"It's their first time putting in orders…it's a matter of us being like 'hey, you put this in and that's not safe,' or, 'you have to change it to this because,' for X, Y, Z reasons. That helps them trust us because we're not going to do things that will harm the patient, and we're going to help them figure out what needs to be done." *Bedside ICU Nurse*

Standardized Practices Supported the Development of Psychological Safety & Interdisciplinary Team Engagement

A high level of psychological safety sets the stage for participants to engage meaningfully and earn team members' trust. Participants, particularly non-physician team members such as APPs and nurses, expressed a desire to feel more engaged and psychologically safe in team-level patient decision-making. These participants stated that they were more likely to speak up and share their perspective in team discussions when they felt encouraged by high-status team members (i.e., faculty surgeons) to provide input on the care plan. Support from high-status team members was demonstrated by direct invitation (e.g., asking team members to

attend the meeting or to speak during rounds), mindful presence (e.g., allowing team members to finish speaking, not interrupting them or walking away), and validation (e.g., acknowledging and acting on what team members communicate).

> "It's just a nice invitation to bring up additional issues. Sometimes there's nothing additional…it's just nice to be offered that opportunity." *Clinical provider*

However, routines supporting psychological safety varied by faculty surgeons. While many faculty surgeons welcomed the input of non-physician team members, some either rejected non-physician team input or bypassed them during rounds completely. One non-physician participant pointed out that faculty surgeons can use physical cues to show physicians-in-training and other team members that the non-physician's input is valued. Otherwise, "you feel you have to interject or catch if the team starts to walk away while you're mid-sentence." Participants reported that can be impacted by how faculty surgeons and higher-level team members demonstrate respect and trust to non-physician team members outside rounds as well.

> "...the faculty surgeon [physician] made a comment to their team about not listening to the non-physician and making sure that they take things to a more higher-level and I couldn't have helped feeling insulted….I understand that I am definitely a lower-level staff member, but at the same time this is coming from a higher-level person who's telling me to carry out these plans." *APP*

DISCUSSION

The goal of this study was to identify conditions for effective communication among interdisciplinary teams caring for patients in a large, urban, academic SICU. Two key conditions, clear role definition and standardization of formal processes, were found to support

the creation of psychological safety. In the absence of formal communication processes, clinicians expressed a tendency to engage in informal communication, which could be subject to bias. Our findings uniquely address a gap in the literature in which conditions for effective interdisciplinary team communication are not clearly defined,(8) particularly in the complex SICU setting, and illustrate the relationship between micro-level factors driving communication outcomes.

Others have found that conditions, such as physical accessibility,(15) can also influence the effectiveness of a team's communication.(18) Interdisciplinary care team communication can also serve different purposes depending on whether it is patterned as formal (scheduled) or informal (ad hoc).(7) Formal communication can help reduce the complexity of the exchange,(19) yet informal communication can yield greater, more timely insights.(20) Team members might resort to informal communication when systematic issues, like workflow and scheduling, or lack of psychological safety prohibit them from participating in formal communication events.(21)

As Cumin et al. found, "information was five times more likely to be effectively communicated if it was mentioned during a formal team communication."(22) Our findings contribute to the argument that effective interdisciplinary care team communication would benefit from being more formalized, especially between high-level individuals in teams.(23) Studies have shown that standardized communication tools in formal processes, such as goal sheets, improve the perception of communication among team members,(24) reduce variations in how teams communicate,(14) foster clearer discussions around patient goals,(25) and improve the overall transfer of knowledge.(26)

There were limitations to this study. First, this was a single-unit study in an urban academic hospital which limits transferability to rural or non-academic hospitals. Yet, by speaking to a wide variety of interdisciplinary clinicians, we gained rich insight into the complexity of interdisciplinary communication both within and between teams. Our rich findings were validated with participant checking of clinicians that have worked in other intensive care units. Thus, we believe our findings likely reflect communication issues across other ICUs in other academic hospitals. Second, data collection via interviews and focus groups relied on the participants' perception of communication, instead of direct observations by study team members in situ. However, a concordant observational study of five units in the same hospital validated and reinforced the critical impact of leadership on team psychological safety during formal communication processes.(27) Third, these data were collected during the COVID pandemic when there were objectively greater stress and burden placed on interdisciplinary clinicians. The backdrop of pandemic stress may have impacted the nature and intensity of participant responses.

Future Work

Clinicians reported that previous attempts had been made to standardize formal processes in the ICU. The implementation of standardized routines is challenged by the ICU's high turnover and need for frequent learner education. A future direction is to engage physicians and leadership in co-creating and championing new standardized processes. Together, we plan to scope a communication intervention that addresses the findings of this study.

CONCLUSION

Intensive care units, which care for critically ill and injured patients, depend on effective interdisciplinary team communication. Standardizing communication patterns and clearly defining roles could minimize reliance on informal communication and create the foundation for psychological safety.

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Data Availability Statement: De-identified Redacted Transcript Data can be made available by the corresponding author upon reasonable request.

Ethical Approval Statement: The study obtained ethics approval via institutional review board, the number was STU00218401. All participants gave informed consent before taking part.

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Tables & Figures Legends

Figure 1: Conceptual Model for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit Based on Mulvale et al. Interprofessional Collaboration Gears Model (2016)

Macro Factors: Governance;
Meso Factors: Information Systems, Organizational Culture;
Micro Factors:
Team Structure: Champion/Facilitator, Team Size;
Social Processes: Levels of Conflict, Open Communication, Supportive Colleagues;
Formal Processes: Team Vision/Goals, Quality Audit/Process, Recognition, Group Problem-Solving, Team Meetings, Decision-Making Processes;
Team Attitudes: Feeling Part of Team, Support for Innovation;
Individual Factors: Belief in Interprofessional Care, Flexibility

Figure 2: Adapted Mulvale Interprofessional Collaboration Gears Model for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit

Figure 2 Legend: **Marco factors:** Open surgical ICU
Meso factors: Organizational culture of hierarchy
Micro factors: Variability in role definition, lack of formal communication processes giving rise to informal communication pathways
Individual factors: Value psychological safety

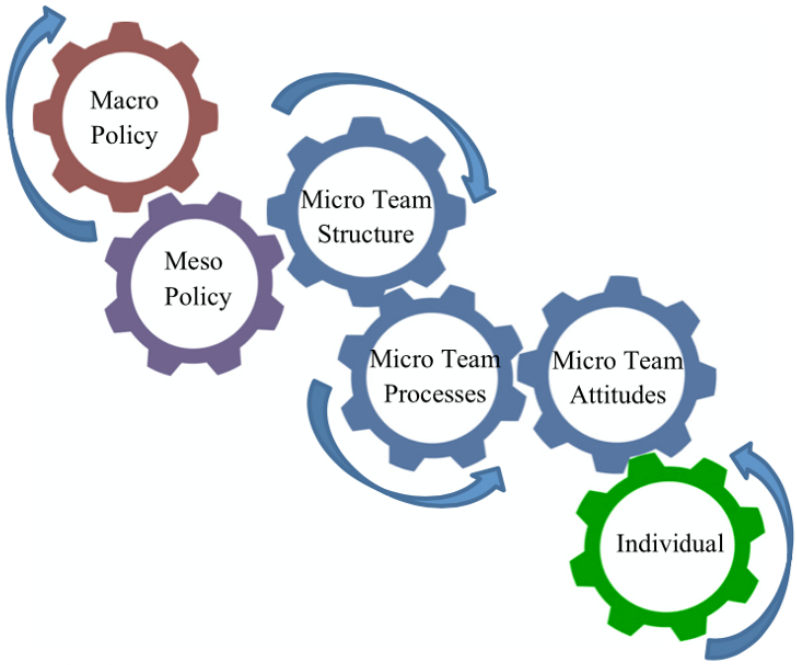
Table 1:Participant Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Unit

Role	Number of Participants
Intensivist	3
Surgical Oncologist	1
Vascular Surgeon	2
Colorectal Surgeon	2
Transplant Surgeon	2
Critical Care Fellow	1
Physicians-in-training	6
Intensive Care Unit Nurse	7
Advanced Practice Providers	5
Respiratory Therapist	2
Pharmacist	1
Dietician	1

Supplementary Files Legends

Supplementary File 1: Qualitative Interview Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

Supplementary Material File 2: Codebook for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units



MACRO FACTORS: Governance

MESO FACTORS: Information Systems, Organizational Culture

MICRO FACTORS:

Team Structure: Champion/Facilitator, Team Size
Social Processes: Levels of Conflict, Open Communication, Supportive Colleagues
Formal Processes: Team Vision/Goals, Quality Audit/Process, Recognition, Group Problem-Solving, Team Meetings, Decision-making Processes
Team Attitudes: Feeling part of Team, Support for Innovation

INDIVIDUAL FACTORS: Belief in Interprofessional Care, Flexibility

Fig. 1: "Mulvale et al. Factors Identified as Being Associated with Collaboration in IPCTs (2016)"

161x170mm (144 x 144 DPI)

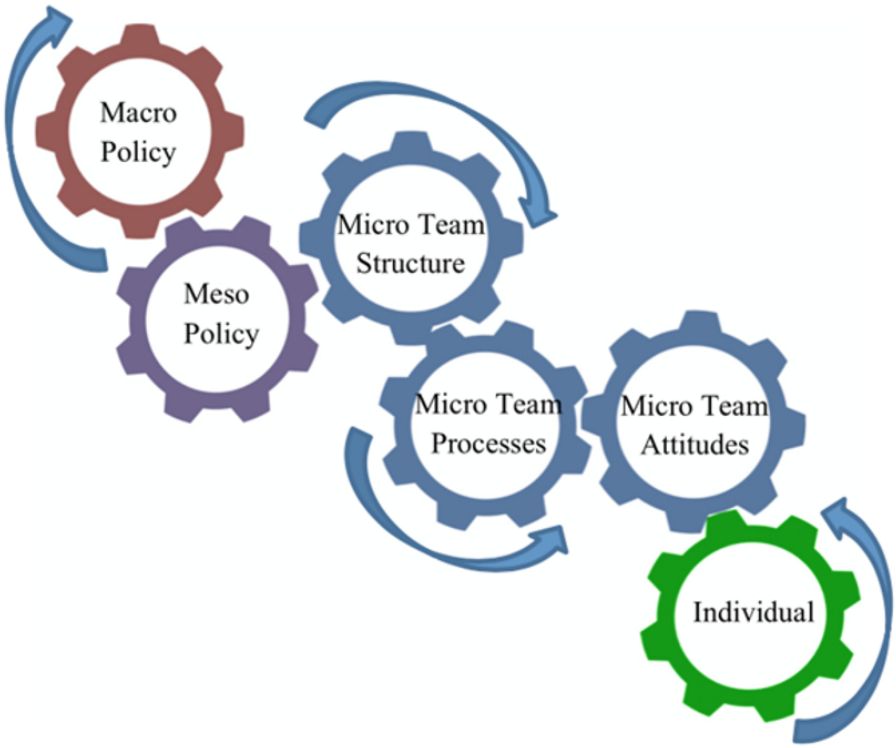


Fig. 2: "Adapted Model of Interprofessional Communication." We adapted the legend of Mulvale et al.'s "Figure 3. Factors Identified as Being Associated with Collaboration in IPCTs" to highlight our study's communication-based results across macro, meso, micro, and individual factors. (Creative Commons License: https://creativecommons.org/licenses/by/4.0/).

159x179mm (144 x 144 DPI)

Supplementary File 1: Qualitative Interview Guide for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

1. Interviewee starts off with personal story about team-team communication.

2. Could you please describe your role in the ICU?

3. Could you please tell me about a time you communicated something you felt was important about a patient plan? How did that go?

4. Could you please tell me about a time you had something you felt was important to communicate about a patient plan, but decided not to share?

5. What happens if there's a disagreement with the patient plan?

Supplementary Material File 2: Codebook for Assessing Conditions for Effective Communication Amongst Interdisciplinary Teams in Surgical Intensive Care Units

Code
Psychological safety
Social norms
Relationships
Attendings not used to pushback
Excluded in discussions
Chance to ask questions
Valued opinions
Status
Hierarchy
Cognitive bias
Respect
Ownership
Deferring decisions
Delegation
Responsiveness
Attending preferences
Primary team gives approval
Anticipatory thinking
Communication
Agreement on care plan
Changing plans
Inter/intrapersonal
Formality
Mode
Assignment of a calling consultant
Fast decision-making
Handoffs
Shift to shift handoffs
Floor to SICU handoffs
Speaking up
Going directly to top of hierarchy
Rounds
Rounding at different times
Pre-rounding
Post-rounding
Work organization
Morning rounds
Communication with family

More consultants, more mixed messages to family
Need to smooth over confusion with family
Conflicting messages between teams
Tone
Updates
Variability in mechanism of communication
Regular interactions
Communication tools
Notes
WhatsApp
Texting group chats
Roles and responsibilities
Role definition
Role of APP
Point person
Mediating person
Constant in ICU
Advocate for attending
Role of 2nd year
Team manager
Psychological accessibility
Physical accessibility
Cognitive load
SICU - NIGHT
SICU - DAY
Managing expectations
Rotations
Staffing

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	1/5-6
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	1/1-24
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	3/51-60
Purpose or research question - Purpose of the study and specific objectives or questions	3/66-72
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	6/126-129
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	5/111-120
Context - Setting/site and salient contextual factors; rationale**	4/75-83
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	5/94-102
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	5/99-102
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	5/114-133

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	5/104-133
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	7/139-149
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	6/130-133
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	6/122-129
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	6/129-133

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	7/139-343
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	8/159-161 ; 8/170-171 ; 9/189-193 ; 9/197-200 ; 10/212-215 ; 11/225-228 ; 11/237-239 ; 12/247-250 ; 12/265-267 ; 13/274-278 ; 14/290-296 ; 14/300-304 ; 15/328-329 ; 16/339-343

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	16/345-376
Limitations - Trustworthiness and limitations of findings	17/377-391

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	19/397

Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	19/399

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388