

Military Surgical Team Communication: Implications for Safety

LTC Christopher Stucky, PhD, RN, CNOR, CSSM, RN-BC, NEA-BC
Nurse Scientist | Center for Nursing Science and Clinical Inquiry
Womack Army Medical Center, Fort Bragg, NC





LTC Christopher Stucky, PhD



- Lieutenant Colonel Christopher Stucky is a Nurse Scientist at the Center for Nursing Science and Clinical Inquiry (CNSCI), Womack Army Medical Center, Fort Bragg, NC. LTC Stucky entered active duty in the U.S. Army in 1992 and is board certified in perioperative nursing (CNOR), as a Certified Surgical Services Manager (CSSM), nursing informatics (RN-BC), and as a nurse executive (NEA-BC).
- He completed his PhD in Nursing at Uniformed Services University of the Health Sciences (USUHS) and his undergraduate studies at the University of Colorado. LTC Stucky deployed twice to Iraq as a perioperative nurse in support of Operation Iraqi Freedom (2004 to 2005) and Operation New Dawn (2010-2011).
- He is the current Army Director of the TriService Nursing Research Program (TSNRP) Biobehavioral Research Interest Group (BHRIG). LTC Stucky serves on the Alumni Advisory Council for the Jonas Center for Nursing and Veterans Healthcare. He serves on DHA Tri-Service Nursing workgroups for Research and Innovation and Readiness. The TSNRP, Army Nurse Corps Association (ANCA), and Jonas Philanthropies funded his previous research with grant awards. He has been recognized for superior military service by being awarded the Meritorious Service Medal (MSM) and induction into the Order of Military Medical Merit (O2M3).
- His long-term goal is to develop a comprehensive research program to identify perioperative communication weaknesses, with the aim of increasing healthcare quality and safety. LTC Stucky's research interests concern network analysis, informatics, systems science, communication, and team performance.
- Currently funded for two studies **"An Analysis of Perioperative Communication in a Large Military Medical Center"** and **"A Retrospective Analysis of the factors that Impact Surgical Team Performance in a Military Medical Center."**



Disclosures

- LTC Christopher Stucky has no relevant financial or non-financial relationships to disclose relating to the content of this activity. The TSNRP, Army Nurse Corps Association, and Jonas Philanthropies provided grant funding for the research discussed in this presentation.
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the U.S. Army, the Department of Defense, or the U.S. Government.
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- Commercial support was not received for this activity.



Learning Objectives

At the conclusion of this activity, the learner will:

1. Identify at least three factors that make the operating room particularly susceptible to adverse events and patient harm.
2. Discuss three reasons why building a culture of safety and progressing towards high-reliability benefits the Defense Health Agency.
3. Explain at least three safety improvements discussed in this presentation to optimize surgical team communication, improve healthcare quality, and decrease risk.



Presentation Agenda

- 2020 year of the Nurse
- Why Surgical Team Communication?
- Background
- Military relevance
- Gaps in the knowledge
- Theoretical frameworks / Social Network Analysis
- Study Design
- Results
- Implications
- Key Takeaways
- How to obtain CE



2020 Year of the Nurse

- The World Health Organization designated 2020 as the year of the nurse and the Midwife (World Health Organization, 2020)
- Nurses play a critical role in redesigning healthcare
- Nurses are the most trusted profession (Smiley et al., 2018)
- Nurses pioneer new ideas, create knowledge, advance policy, and work in every level of the healthcare system from Surgeon General to ward nurse
- Nursing has its own philosophers, scientists, and theorists
- Nursing has an independent and vast body of scientific knowledge



Why Surgical Team Communication?



Figure 1: Surgical Team Communication; Credit: LTC Christopher Stucky



Research Overview

- Discuss the results from two studies
 - A Network Analysis of Perioperative Communication Patterns in a Military Medical Setting (TSNRP Grant # N16-P13)
 - A Retrospective Analysis of the Factors that Impact Surgical Team Performance in a Military Medical Center (ANCA Grant-06182019)
- Provide an overview of four manuscripts on this topic:
 - Stucky, CH, et al. (2019). "Military surgical team communication: implications for safety." *Military Medicine* [Advance online publication, published Oct 29, 2019].
 - Stucky CH, et al. (2020). "A Network Analysis of Perioperative Communication Patterns." *AORN J.* 2020; June 2020.
 - Stucky CH, De Jong MJ. "Surgical Team Familiarity: An Integrative Review." *AORN J.* 2020; Under review
 - Stucky CH, et al., "The Paradox of Network Inequality: Differential Impacts of Status and Influence on Surgical Team Communication." *Military Medicine* 2020; Under review



Background

- *To Err is Human: Building a Safer Health System*
- Medical error is the third leading cause of death (Makary & Daniel, 2016)
- Between 200,000 to 400,000 people die annually from preventable medical errors (James, 2013)
- Adverse events occur in up to 13% of admitted hospital patients (Van Den Bos et al., 2011)
- The direct annual cost of medical errors in the US is \$17.1 billion (Levinson, 2010)
- 51.4 million surgeries are performed annually (Hall, 2017)
- Surgical adverse events represent 65% of all adverse events (Zegers et al., 2011)



Background

- The OR has the highest prevalence of adverse events (41.0%), as compared to the ICU (3.1%) and the ED(3.0%) (De Vries et al., 2008)
- Surgical adverse events occur in 14.4% of patients (Anderson et al., 2013)
- Errors in communication are:
 - The most frequent root cause of adverse events (Lee et al., 2014)
 - Responsible for 30% of medical malpractice claims and 32% of all malpractice claims involving nurses (CRICO Strategies, 2015)
 - Most common behavioral factor in a “Never Event” (Thiels et al., 2015)
 - Cause 70% of sentinel events (TJC, 2019)
- Quality of care is predicated on information flow
- Frequently missing or inaccurate information (Lingard et al., 2004)
- Information loss and communication breakdown at every phase of the perioperative period (Nagpal et al., 2010)
- Miscommunication among clinicians during transitions in care cause 80% of medical error (Galatzan, et al., 2018)



Background - Factors

- The operating room (OR) is a fast-paced, dynamic environment and one of the most complex work settings in healthcare (Stawicki et al., 2013)
- The social and cultural environment causes errors
- Authority gradients and hierarchical power disparities (Green et al., 2017)
- Hierarchy prevents some clinicians from speaking up (Gillespie et al., 2013)
- Physicians typically hold greater hierarchical power (Nelson, et al., 2008)
- Many report difficulty voicing safety concerns (Minehart et al., 2020)
- Nurses frequently lack the space or confidence to offer suggestions (Raica, 2009)



Military Relevance

- Scrutiny of the quality and safety of military healthcare (Stars and Stripes, 2014)
- Comprehensive review of the Military Health System (Department of Defense, 2014)
- High-reliability science enables hospitals to achieve quality and safety
- Military Transformation into a high-reliability organization (HRO)
- The cornerstone of patient safety is effective clinician communication
- Optimizing communication is a crucial step to becoming an HRO
- Military surgical teams are particularly susceptible to communication error



Gaps in the Knowledge

- Improved understanding of communication is key to reducing error
- Inadequate research attention to discover the characteristics of successful military interprofessional healthcare teams (Varpio et al., 2018)
- Communication studies use linear theory and focus on the behavior of the individual
- Little is known about how the relationships among interprofessional clinicians influence their communication patterns and effectiveness



Theoretical Framework

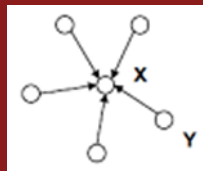
Social Network Analysis

- Emerged from discoveries in different fields
- Investigates social structures by focusing on relationships
- Describes relationships between people and between people and things
- Social Networks are comprised of participants and their interactions are represented as ties.
- Patterns of relationships influence behaviors, attitudes, beliefs, and actions
- Network structure provides participants with opportunities or constraints
- Networks are ubiquitous and varied
- Very versatile. Every health topic can be viewed through the network perspective (e.g., spread of obesity, pandemic flu)

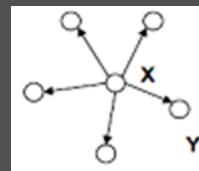


Theoretical Framework

- Centrality
 - Centrality is a broad set of concepts that gauge the extent to which a person occupies a prestigious or critical network position
 - Degree Centrality: The number of ties a participant has to other network members
 - Directed networks have an *indegree* and *outdegree* measure
- Participants with more ties (high degree centrality) have multiple alternative ways and resources to reach goals, more influence, high network involvement, and are a major channel for information



High *indegree* centrality (summation of incoming ties) signifies popularity or prestige



High *Outdegree* centrality (summation of outgoing ties) signifies influence and ability to share knowledge

Figure 2: Degree Centrality



Theoretical Framework

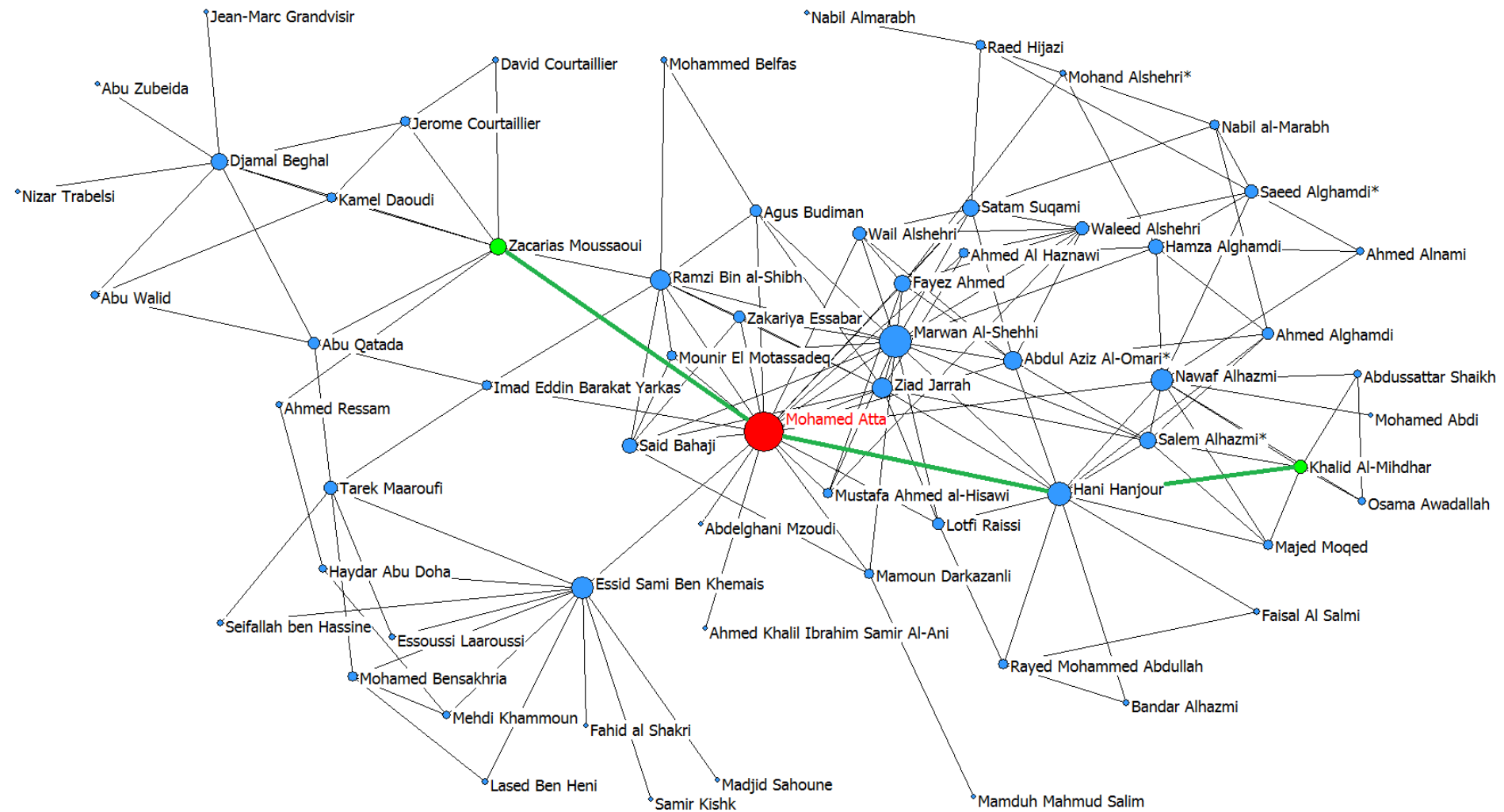
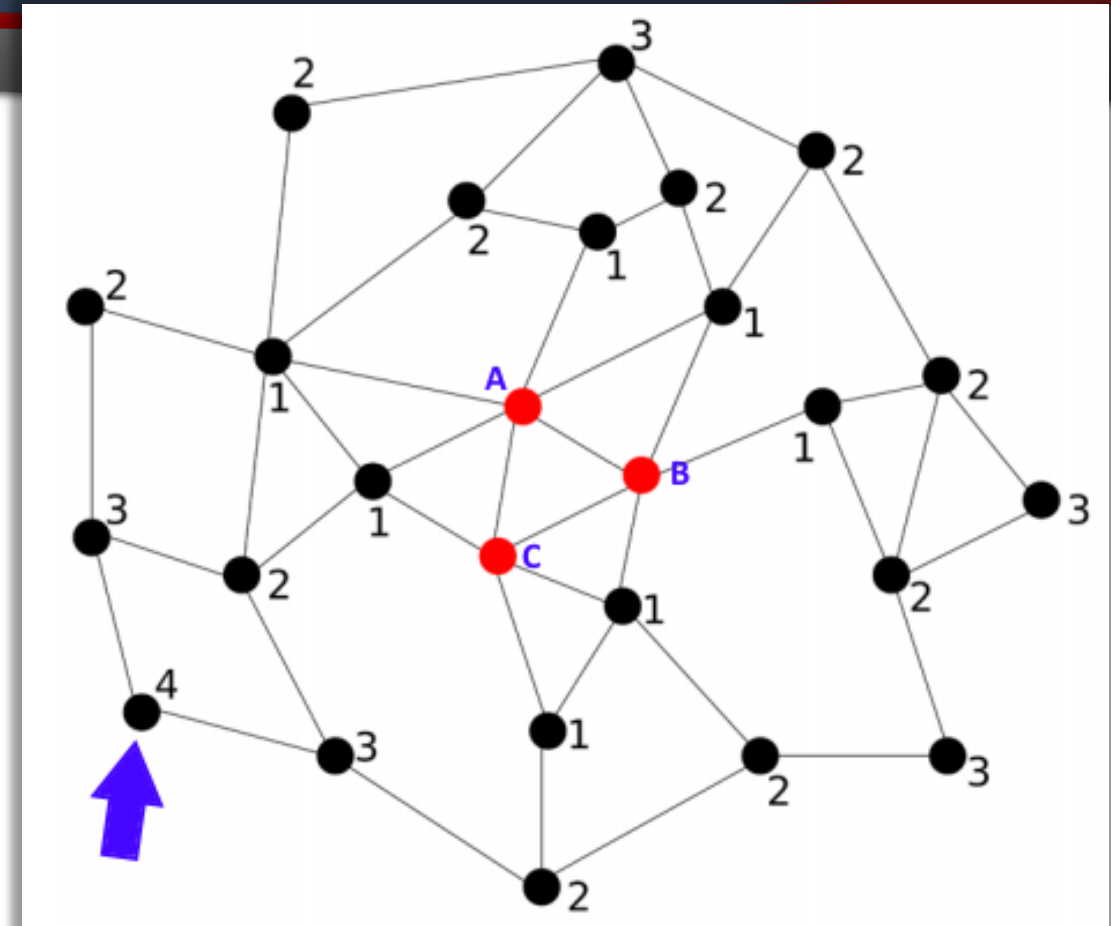


Figure 3: Example Social Network



Theoretical Framework

- *Geodesic* Distance: Relational tie quantity in the shortest path between participants
- An indicator of the efficiency of information flow in the network
- **Participants A, B, and C, are connected with a *geodesic* distance of 1. They are a cohesive team.**
- Long distances between network participants denote information that does not transverse the network quickly
- Participants with short geodesic distances have stronger connections
- We should strive to create cohesive teams in which information and resources flow freely



Geodesic Distance

Figure 4: *Geodesic* Distance



Theoretical Framework

Density

- Degree of cohesion- how close-knit is the network?
- Ranges from 0 (no density) to 1 (maximally dense) or 0 to 100%

Centralization

- A depiction of the network distribution of power and influence
- Indicates the degree to which a single participant dominates the social network
- Ranges from 100%, where one participant is maximally central, and all other participants are minimal, to 0% where there is an even dispersal of relationships



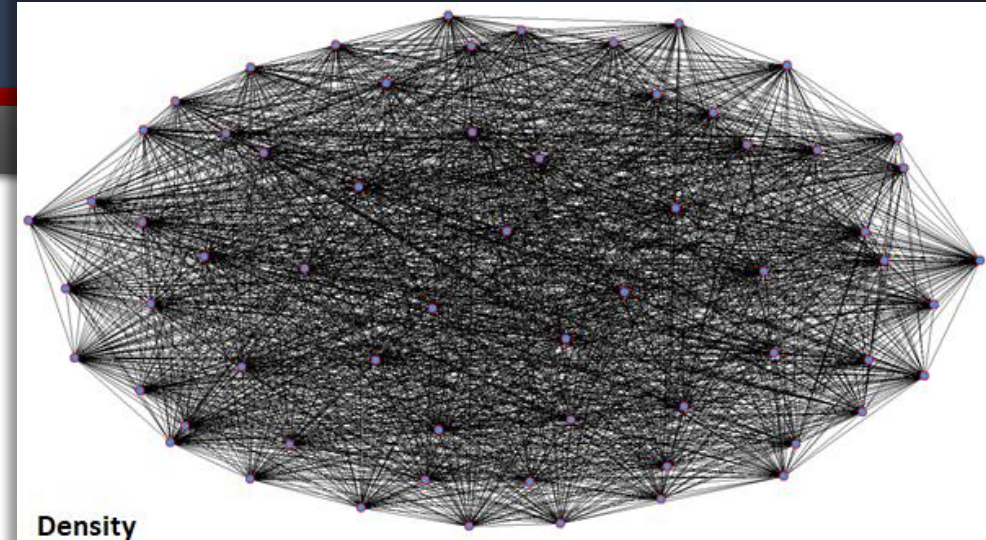
Theoretical Framework

Density

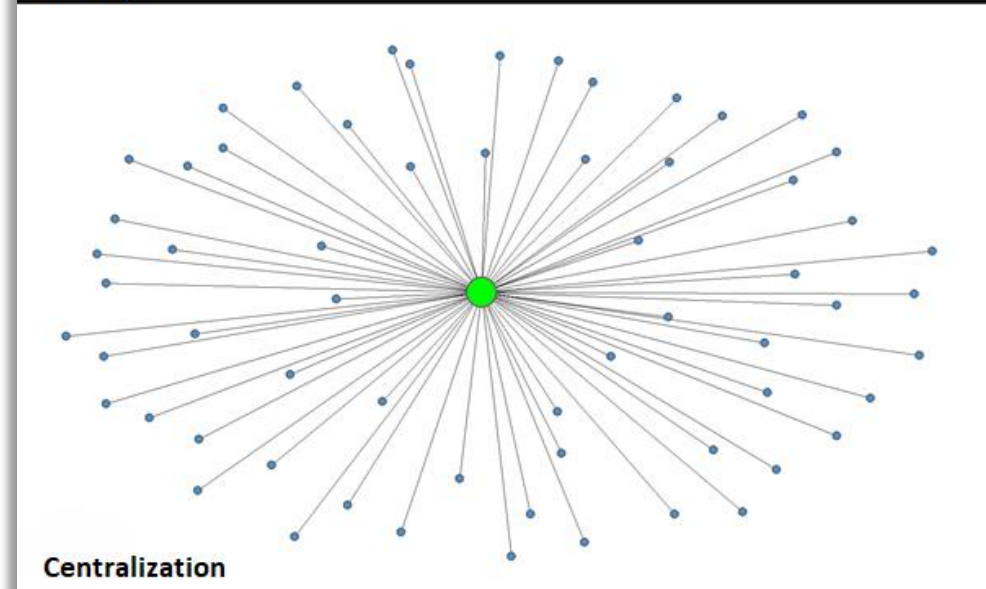
- Depiction of maximal density (100%)

Centralization

- Depiction of 100% network centralization



Density



Centralization

Figure 5: Density and Centralization



Research Purpose

Study: A Network Analysis of Perioperative Communication Patterns in a Military Medical Setting

- The purpose of this study was to characterize the typical OR communication patterns of clinicians at a small outpatient Military Treatment Facility (MTF) and to determine how the interdependent relationships affect individual and group behavior, using the methods of social network analysis



Study Design

- Design: Exploratory, prospective, cross-sectional, network-centric
- Sample: Total population sampling of all active duty or civilian nurses, surgeons, anesthesia providers, and surgical technologists assigned to the OR at a military MTF
- Reviewed and approved by the IRB as minimal risk
- Sample Size: 80% response rate targeted
- Developed a network survey
- Data Collection: We administered a network survey to surgical teams at the end of the last surgical case for 3 months



Study Design- Survey Development

Network Survey (Abbreviated)

Network/Model	Question	Scale
Interaction Network	How frequently do you interact in the OR with each of the people on the list below? *Monthly (1) to several times a day (5).	Scale (1-5)
Close Working Relationship	Would you say that you have a close working relationship with this person?	Yes/No
Socialization Network	Have you socialized with this person outside of work?	Yes/No
Task-specific communication model	During the surgical case, how well/clearly did the person below communicate requests/commands related to the case? *Ordinal: Very Low Quality Communication (1) to Very Good Communication (5)	Ordinal (1-5)
General communication model	How would you rate the communication quality of the people below? *Ordinal: Very Low Quality Communication (1) to Very Good Communication (5)	Ordinal (1-5)
Advice-seeking Network	Have you gone to this person for advice?	Yes/No
Advice-giving Network	Has this person come to you for advice?	Yes/No
Voice Network	Do you feel comfortable voicing safety concerns and speaking up to the below team member in this surgical case?	Yes/No



Study Design

Research Questions

- What are the associations between clinician relationships (e.g., interaction, close-working relationships, socialization, advice, and speaking-up/voice) and clinician communication effectiveness?
- Are the most influential members (highest degree centrality) in the setting rated as the most effective communicators?
- What relationships influence interpersonal communication effectiveness among military surgical team members?
- Do dense networks exhibit higher network communication effectiveness?
- What is the influence of high levels of status (*indegree* centralization) and influence (*outdegree* centralization) on surgical team communication?



Research Results

- Enrolled the entire population of clinicians $N = 47$, with 45 participants providing responses
- Overall response rate of 96%
- Surveyed 50 Surgical Teams.

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max
Age (Years)	47	35.04	9.06	19	55
Age by Group (Years)					
Surgical Technician	13	24	3.91	19	33
Perioperative Nurse	6	40.83	6.61	32	50
Surgeon	15	40	6.94	32	55
Anesthesia Provider	11	39.09	5.57	30	47
Resident Surgeon	2	30	2.82	28	32
Years of Experience					
Surgical Technician	13	2.85	2.13	0.4	6
Perioperative Nurse	6	9.08	4.00	2	13.5
Surgeon	15	8	5.7	1	17
Anesthesia Provider	11	5.8	3		12
Resident Surgeon	2	2.25	1.06	1.5	3
Years worked in the OR at MGMSC					
Surgical Technician	13	2.26	1.57	.33	5.5
Perioperative Nurse	6	1.19	1.53	0.25	4
Surgeon	15	2.65	1.72	5	6
Anesthesia Provider	11	1.68	1.35	0.167	4
Resident Surgeon	2	2.04	0	0.5	0.5



Research Results - Individual

- The task-specific communication and general communication models were very highly correlated ($r = 0.802, P < .001$)
- The demographic variables of age, race, gender, clinical experience, and OR work frequency were not significantly associated with communication effectiveness
- Voice network: All participants were comfortable voicing safety concerns
- Our findings did not uncover authority gradients that affect speaking-up patterns
- Military rank highly correlated with occupational group ($r = 0.888, P < .001$)
- The interaction, close working relationship, socialization network, and advice networks *outdegree* and *indegree centrality* were significantly associated with the communication effectiveness
- Communication effectiveness increased in networks in which clinicians reported interacting frequently, having close working relationships, socializing, and seeking and providing advice to others
- Clinicians with the most connections to other network members were typically rated as having higher communication effectiveness



Research Results

Occupational Group Findings

- Occupational group predicted communication effectiveness (e.g., Interaction ($F_{(4,44)} = 6.88, P < .001$)
- Anesthesia providers had the highest communication effectiveness rating, followed by perioperative registered nurses, surgeons, and surgical technologists.

Characteristics of Participants in Social Network Analysis of OR Communication Patterns		
	<i>n</i> (%)	Communication Effectiveness Average (<i>SD</i>)
Occupation		
All Groups	47 (100)	4.35 (0.53)
Surgeon	15 (33.3)	4.38 (0.67)
Surgical technologist	13 (26.7)	4.18 (0.53)
Anesthesia professional	11 (24.4)	4.53 (0.41)
Perioperative RN	6 (11.1)	4.41 (0.48)
Surgical resident	2 (4.4)	4.24 (0.55)
Military Status		
Officer	30 (63.8)	4.57 (0.54)
Enlisted	13 (27.7)	4.18 (0.48)
Civilian (federal employee)	4 (8.5)	4.35 (0.50)
Sex		
Male	28 (59.6)	4.36 (0.46)
Female	19 (40.4)	4.33 (0.57)
Race		
Caucasian	30 (63.83)	4.38 (0.54)
African American	6 (12.77)	4.11 (0.52)
Hispanic	5 (10.64)	4.43 (0.40)
Asian or Pacific Islander	4 (8.51)	4.51 (0.35)
Multiple answers	2 (4.26)	4.53 (0.39)
		Mean (<i>SD</i>)
Age, y		35.0 (9.1)
Clinical OR Experience, y		6.0 (4.6)
Time Worked at Institution, y		2.0 (1.6)

SD = standard deviation;

^aCommunication effectiveness is measured on a scale of 1 to 5 with 1 representing very low quality communication and 5 representing very good quality communication



Research Results Dyadic

- As the geodesic distance decreases between two individuals in the interaction, close working relationship, socialization, advice-seeking, and advice-giving networks, so does the dyadic differences in communication effectiveness
- Put simply, stronger connections in the aforementioned networks are associated with reduced dyadic communication effectiveness differences
- Socialization had the largest effect on communication effectiveness

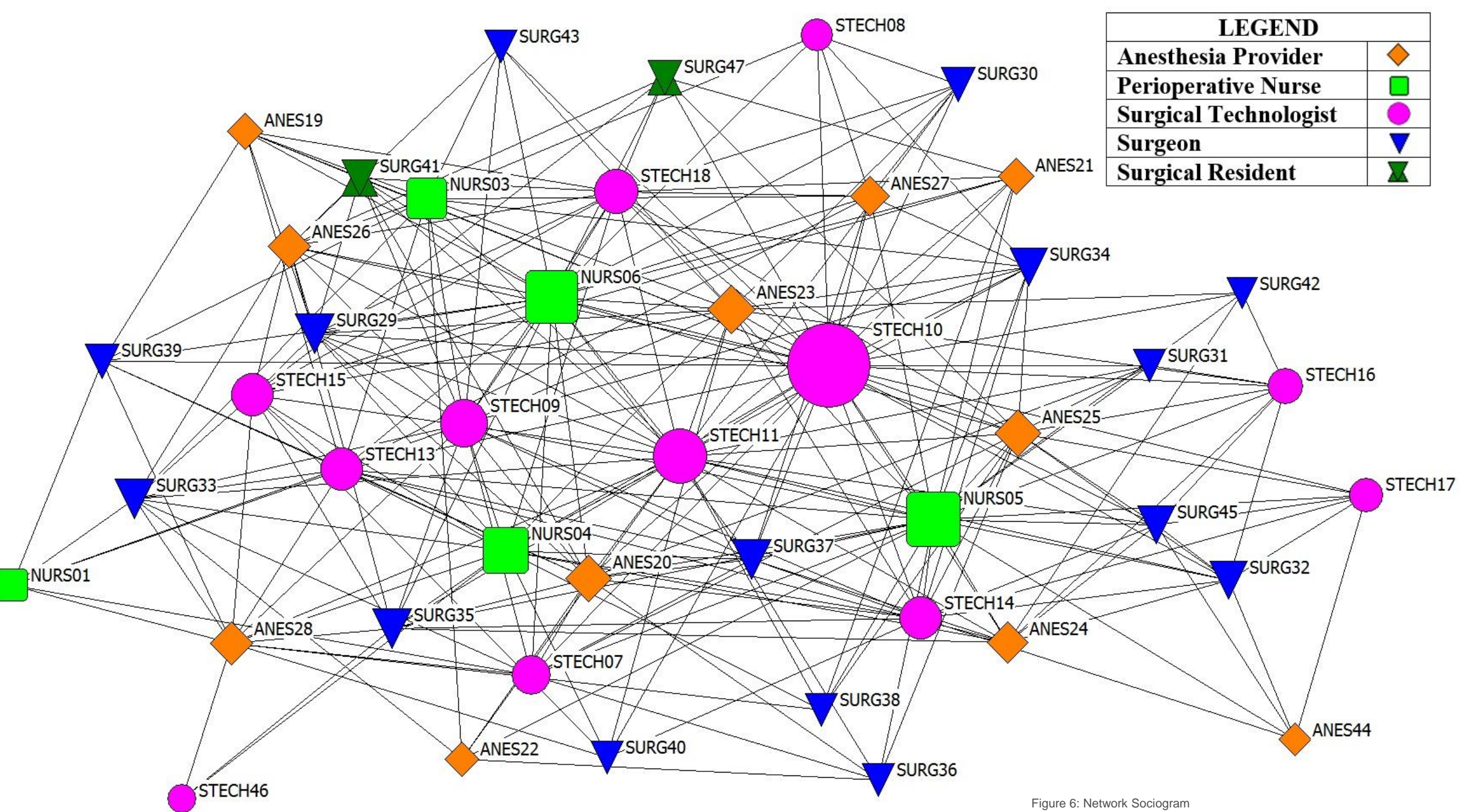


Figure 6: Network Sociogram



Research Results Group / Network Level

- Do dense networks exhibit higher network communication effectiveness?
- Increases in network communication effectiveness were associated with increases in network density for all five networks
- The results are analogous with the individual and dyadic findings
- Overall, the networks were not very dense

Network Density Summary Statistics				
Network	Mean	<i>SD</i>	Min	Max
Interaction	2.409	0.349	1.5	3.15
Close working Relationship	0.459	0.159	0.083	1
Socialization	0.039	0.069	0	0.333
Advice-seeking	0.434	0.190	0	0.75
Advice-giving	0.370	0.185	0	0.75



Research Results Group / Network Level

- What is the influence of high levels of status (*indegree centralization*) and influence (*outdegree centralization*) on surgical team communication?
- As the concentration in status decreases, communication effectiveness increases
- As the concentration in influence increases, communication effectiveness also increases
- Network indegree (i.e. status) ($\beta = -0.893, p = .019$) had a larger impact than outdegree (i.e. influence) ($\beta = 0.617, p = .015$)
- Communication improves when there is less inequality in the concentration of status among surgical team members, and influential members with an ability to spread ideas and behaviors increase communication effectiveness

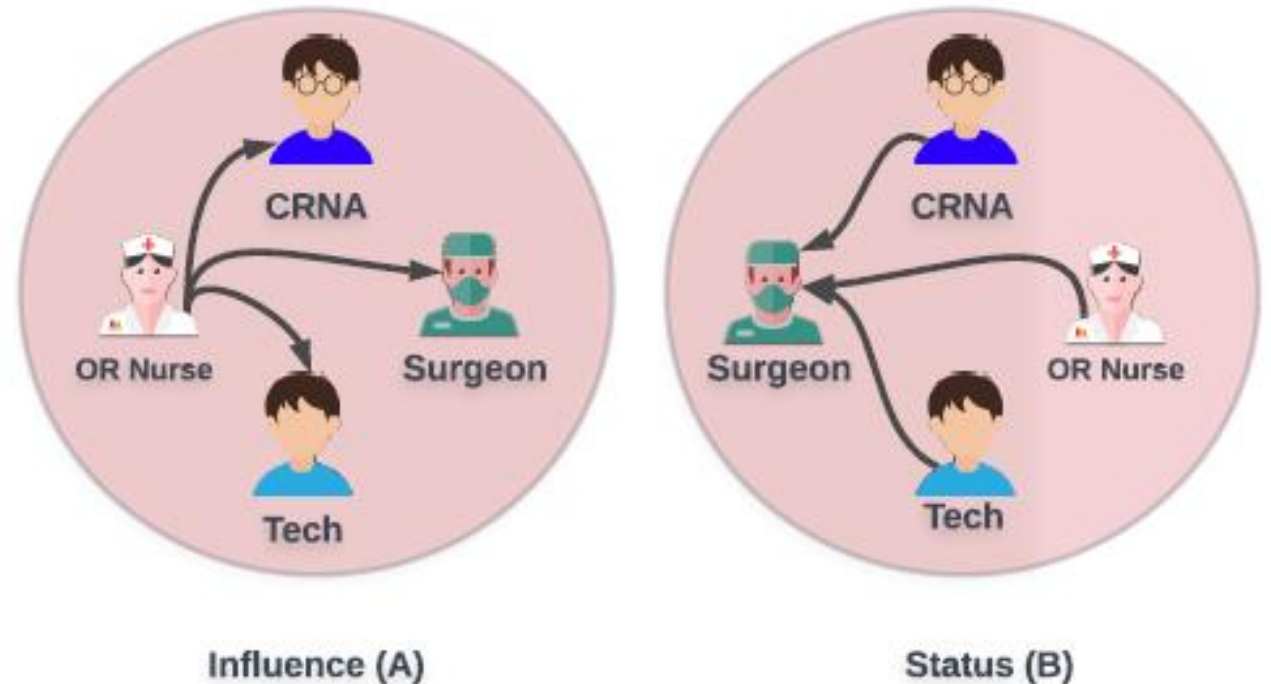


Figure 6: Influence and Status

For Figure 6A, the OR Nurse is an influential member with high outdegree and an ability to easily share knowledge with other network members. For Figure 6B, the Surgeon has high network status and high indegree because many others seek to direct ties to them



Surgical Team Familiarity

- Communication effectiveness increased with interaction frequency
- Problem: Surgical teams are frequently formed ad hoc with members who do not work consistently together
- Stucky CH, De Jong MJ. Surgical Team Familiarity: An Integrative Review. AORN J. 2020; Under review
- We comprehensively evaluated evidence regarding surgical team familiarity and its relationship to surgical team performance
- We searched PubMed, Web of Science, EMBASE, and PsychINFO for manuscripts with surgical team familiarity concepts



Surgical Team

- We identified 598 manuscripts, 16 of which met our inclusion criteria
- We used the AORN Evidence Rating Model to critically appraise the strength and quality of evidence
- 11 studies were low quality, 4 studies were good quality, and one study was high quality
- Familiar teams performed 19% to 73% of surgical cases

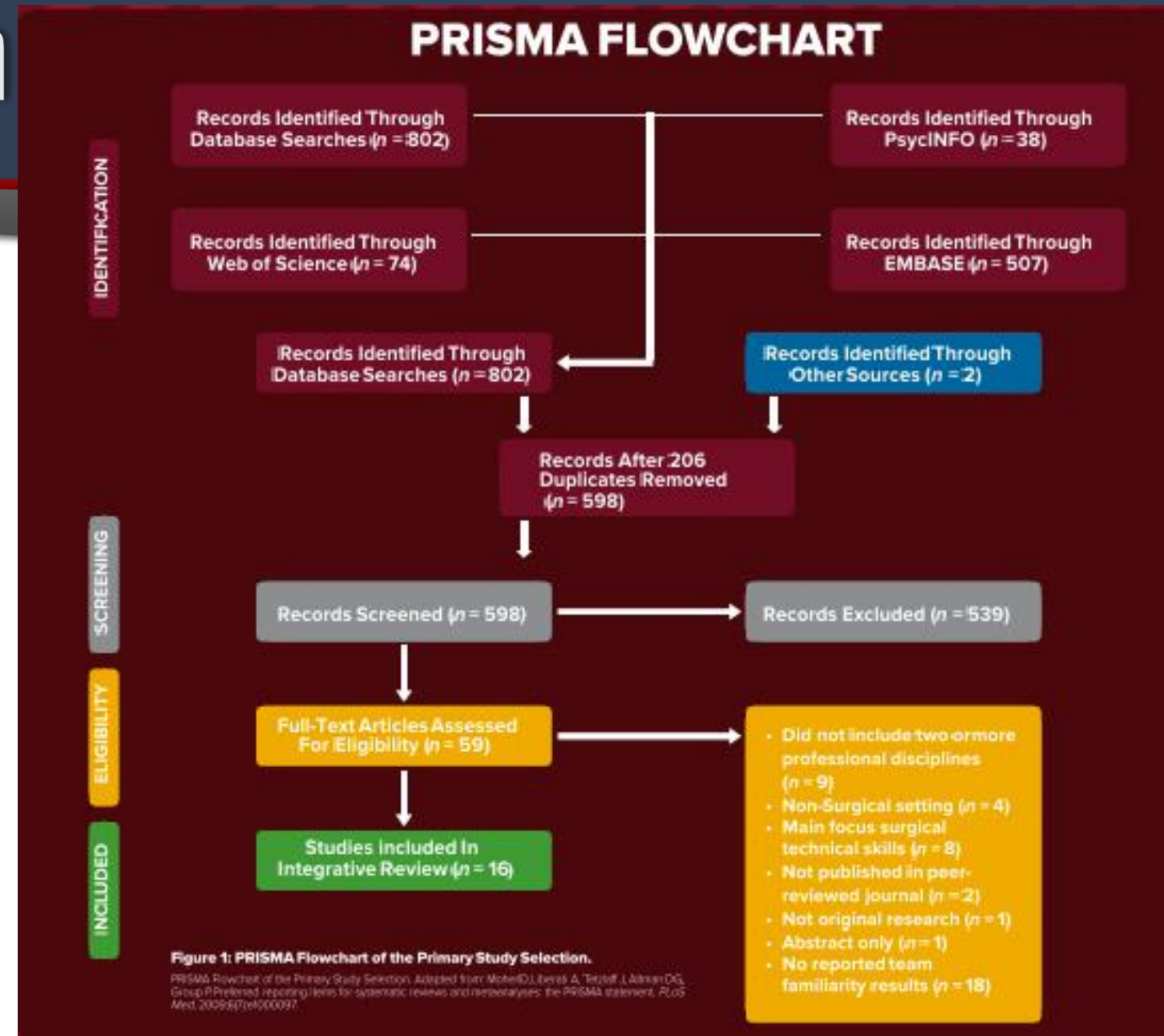


Figure 7 PRISMA Flowchart



Surgical Team Familiarity

- Surgical team familiarity is associated with better performance on many metrics, including:
 - Shorter total operative time (Xiao et al., 2015)
 - Team member safety (Myers et al., 2016)
 - Decreased surgical errors and disruptions (ElBardissi et al., 2008)
 - Reduced miscommunication (Gillespie et al., 2012)
 - Fewer patient readmissions (Xiao et al., 2015)
- Perioperative leaders should consider surgical team familiarity to reduce inefficiencies and optimize surgical care



Surgical Team Performance

- A Retrospective Analysis of the Factors that Impact Surgical Team Performance in a Military Medical Center (ANCA Grant-06182019)
- Retrospective analysis of 760 surgical cases
- Determined the association between surgical team consistency and the performance measures of turnover time, total surgical time, on-time surgical start, and difficulty of surgery
- Determined the relationship between surgical team size and turnover time, total surgical time, on-time surgical start, and difficulty of surgery
- Initial results: Surgical Team Consistency rate was very low



Discussion

- The results highlight the complexity of human interaction and the unique communication challenges inherent in surgical settings
- Communication effectiveness improved significantly in networks in which OR team members reported frequent interaction, close-working relationships, socialization with others outside of work, and giving advice to others
- Socialization was uncommon, but had the largest effect
- Surgeons and anesthesia providers seek advice half as often as perioperative nurses and surgical technologists, but are most often asked for advice
- No authority gradients uncovered
- Military rank and occupational group were highly correlated
- Anesthesia providers highest communication effectiveness
- Communication improves with a more even level of network status
- Captain of the Ship: Participants preferred a focal communicator
- Strong surgical leadership is important



Implications for Leaders

- Informal relationships influence communication, and interaction frequency and team familiarity are important factors that affect team performance
- Surgical teams are often assembled ad hoc
- Familiar teams with consistency in membership have better performance
- The military needs to reconsider its policies for building safe and efficient surgical teams
- Tools need to be developed to assist perioperative leaders
- Team consistency and team performance are measures administrators should consider when assigning surgical team members to cases



Implications

- Military now deploys small and highly mobile surgical teams such as the ERSTs and FRSTs
- The military should consider policies that reduce the rotation or relocation of medical personnel
- Our study found the mean years worked in the OR was 2.04 ($SD = 1.60$) as compared to civilian hospitals ($M 10.0, SD = 9.08$) (Makary et al., 2006)
- A perioperative culture change must occur
- Surgical team members are accustomed to being a “jack of all trades”
- Set familiarity and consistency of team membership expectations
- Set formal policies affirming the scheduling process
- Team training to enhance cohesion and improve socialization, advice and interaction
- The merit of socialization in healthcare teams is potentially undervalued by the military



Key Takeaways

- Perioperative nurses are vital to the delivery of safe and effective surgical care
- The ability of team members to communicate clinical information effectively is essential to building a safety culture
- Our work shows that critical communication is influenced by informal relationships
- Communication effectiveness in military teams will likely improve by maintaining team consistency, fostering team cohesion, and allowing for frequent interaction both inside and outside of the work environment
- The results from these studies provide guidance that may increase quality and safety, therefore assisting the Defense Health Agency transition into a HRO



Questions??

- **YOU MADE IT TO THE END!**
- For questions about this presentation or to discuss perioperative research, please contact LTC Christopher Stucky at christopher.h.stucky.mil@mail.mil or by phone 910-907-8888
- For further reading see Stucky, CH, et al. (2019). "Military surgical team communication: implications for safety." *Military Medicine* [Advance online publication, published Oct 29, 2019].
or
- Stucky CH, et al. (2020). "A Network Analysis of Perioperative Communication Patterns." *AORN J.* 2020; June 2020.

MILITARY MEDICINE, 00

Military Surgical Team Communication: Implications for Safety

LTC Christopher H. Stucky, PhD, AN USA*; Col Marla J. De Jong, PhD, USAF NC (Ret.)†; Felichism W. Kabo, PhD, M.Arch‡

ABSTRACT Introduction: Medical error is the third leading cause of death in the United States, contributing to suboptimal care, serious patient injury, and mortality among beneficiaries in the Military Health System. Recent media reports have scrutinized the safety and quality of military healthcare, including surgical complications, infection rates, clinician competence, and a reluctance of leaders to investigate operational processes. Military leaders have aggressively committed to a continuous cycle of process improvement and a culture of safety with the goal to transform the Military Health System into a high-reliability organization. The cornerstone of patient safety is effective clinician communication. Military surgical teams are particularly susceptible to communication error because of potential barriers created by military rank, clinical specialty, and military culture. With an operations tempo requiring the military to continually deploy small, agile surgical teams, effective interpersonal communication among these team members is vital to providing life-saving care on the battlefield. Methods: The purpose of our exploratory, prospective,

Figure 8: Military Medicine



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