Military Surgical Team Communication: Implications for Safety

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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, cross-sectional study was to examine the association between social distance and interpersonal communication in a military surgical setting. Using social network analysis to map the relationships and structure of interpersonal relations, we developed six networks (interaction frequency, close working relationship, socialization, advice-seeking, advice-giving, and speaking-up/voice) and two models that represented communication effectiveness ratings for each participant. We used the geodesic or network distance as a predictor of team member network position and assessed the relationship of distance to pairwise communication effectiveness with permutation-based quadratic assignment procedures. We hypothesized that the shorter the network geodesic distance between two individuals, the smaller the difference between their communication effectiveness. Results: We administered a network survey to 50 surgical teams comprised of 45 multidisciplinary clinicians with 522 dyadic relationships. There were significant and positive correlations between differences in communication effectiveness and geodesic distances across all five networks for both general ($r = 0.819$–0.894, $P < 0.001$ for all correlations) and task-specific ($r = 0.729$–0.834, $P < 0.001$ for all correlations) communication. This suggests that a closer network ties between individuals is associated with smaller differences in communication effectiveness. In the quadratic assignment procedures regression model, geodesic distance predicted task-specific communication ($\beta = 0.056$–0.163, $P < 0.001$ for all networks). Interaction frequency, socialization, and advice-giving had the largest effect on task-specific communication difference. We did not uncover authority gradients that affect speaking-up patterns among surgical clinicians. Conclusions: The findings have important implications for safety and quality. Stronger connections in the interaction frequency, close working relationship, socialization, and advice networks were associated with smaller differences in communication effectiveness. The ability of team members to communicate clinical information effectively is essential to building a culture of safety and is vital to progress towards high-reliability. The military faces distinct communication challenges because of policies to rotate personnel, the presence of a clear rank structure, and antifraternization regulations. Despite these challenges, overall 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.

INTRODUCTION

Medical error is the third leading cause of death in the United States[1] and a major contributor to suboptimal care, serious patient injury, and mortality among beneficiaries in the Military Health System (MHS).[2] Recent media reports have scrutinized the safety and quality of military healthcare, including medical errors, infection rates, clinician competence, and a reluctance of leaders to investigate operational processes.[3–7] Particularly, disturbing was that military healthcare was reported to be inferior to civilian hospitals with a higher rate of surgical infections and a lack of transparency.[8] In 2014, Secretary of Defense Chuck Hagel ordered a comprehensive review of the MHS and concluded that "the MHS delivers safe, timely, and quality care that is largely comparable to care delivered in the civilian sector."[9] Maturo and colleagues' work at San Antonio Military Medical Center strengthens these findings. They retrospectively reviewed postoperative complication rates for patients who had general or vascular surgery from 2009 to 2014 and reported significantly less morbidity ($P = 0.0299$) and significantly fewer surgical site infections ($P = 0.0114$) as compared to the average rates of 531 sites participating in the American College of Surgeons National Surgical Quality Improvement Program.[10] However, recent findings from a

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Government Accountability Office report determined that the MHS medical adverse event reporting process was unreliable and fragmented.[2]

Healthcare is a high-risk industry and has the potential to cause catastrophic injuries, much like aviation and nuclear power. Adapting the lessons learned from the aviation and nuclear power industries, high-reliability science enables hospitals to possess comparable levels of quality and safety.[11] In fact, the 2014 Secretary of Defense report contained a strategic recommendation that the MHS implements the principles of high reliability across the system.[9] Chassin and Loeb determined that for health organizations to progress towards high reliability, they must incorporate the principles of a safety culture throughout the institution.[11] Military leaders have aggressively committed to a continuous cycle of process improvement and a culture of safety, with the goal to transform the MHS into a high-reliability organization.[12,13]

The cornerstone of patient safety is effective clinician communication.[14] Ensuring optimal communication is a crucial step to becoming a high-reliability organization. Optimizing communication within and among teams of surgical members at the organizational and microsystem levels could potentially improve healthcare quality and safety, decrease adverse events, improve readiness, and increase patient satisfaction. With an operations tempo requiring the military to continually deploy small, agile surgical teams,[15] effective interpersonal communication is vital to providing life-saving care on the battlefield.

The operating room (OR) is one of the most complex work settings in healthcare[16] with frequent unpredictable events that require a time-crucial interprofessional team response. The urgency of care decisions necessitates effective communication among interprofessional clinicians with different levels of skill, education, and authority. Military surgical teams are particularly susceptible to communication error because of potential barriers created by military rank, clinical specialty, and military culture. However, inadequate research attention has been given to understanding the characteristics of successful military interprofessional healthcare teams.[17] Little is known about how relationships among interprofessional clinicians influence their communication patterns and effectiveness.

Therefore, the purpose of this study was two-fold: (1) to employ social network analysis (SNA) to examine the association between social distance and interpersonal communication in a military surgical setting and (2) to fill a gap with respect to interpersonal communication among military surgical team members.

We addressed the following research question: What relationships influence interpersonal communication effectiveness among military surgical team members?

THEORETICAL FRAMEWORK

Social Network Analysis

We used the tenets of SNA as a theoretical framework to guide the research and provide a pragmatic lens to interpret the findings. SNA originated in graph theory and was advanced through discoveries in the disparate fields of sociology, mathematics, psychology, and social anthropology.[18] SNA is a distinct research perspective that investigates social structures by focusing on the relationships among the participants who comprise the system and how these relationships influence behavior.[19] Participants in social networks are referred to as actors, and their interactions are represented as ties. The relational ties among actors determine the structure of the network and are conduits for the transfer of material resources and social influence.[20] The network structure provides participants with opportunities or constraints and predicts performance and behavior.[19] An advantage of SNA is that the investigation of social structures can occur using multiple levels of analysis. Depending on the research design, social networks are examined from the node level (e.g., individual and collectivities), the dyadic level (pair of actors), or the group level (network).

An important concept to determine the efficiency of the connection between network actors is geodesic distance. Geodesic distance is extensively used in SNA and has been applied to study the social contagion of gunshot injuries,[21] medication advice-seeking interactions,[22] mapping neural networks,[23] and more. Geodesic distance is, in simplest terms, the shortest pathway between actors[24] and is an indicator of information flow efficiency in the network.[19] Geodesic distance ranges from 1 (directly connected) to a maximum of $n-1$. Longer distances between network actors indicate less effective or slower information flows across the network. Conversely, shorter geodesic distances connote more effective or faster information flows between actors.

METHODS

In this study, we employ a methodological approach that is described in greater detail in Stucky et al.[25] Briefly, we conducted an exploratory, prospective, cross-sectional study using SNA to map the relationships and structure of interpersonal communication among surgical team members. We analyzed network relations on the dyadic/pairwise level and used the geodesic or network distance as a quantifiable predictor of team member network position. Our central hypothesis was that the shorter the network geodesic distance between two individuals, the smaller their differences in communication effectiveness, making it more likely that they would communicate more effectively. This research was approved by the Uniformed Services University of the Health Sciences (USUHS) Institutional Review Board as no more than minimal risk.

Participants

We used total population sampling to recruit all interprofessional surgical team members (active duty or civilian nurses, surgeons, anesthetists, and surgical technologists) who directly provide surgical care at a Department of Defense Air Force Military Treatment Facility's (MTF) outpatient surgery center. We targeted an 80% network participation rate to generate robust and generalizable results.[26]

Study Procedures

We expanded a previously used network questionnaire,[27] assessed its content validity, and administered it to surgical teams after the last daily case for three months. Participants responded to questions and statements pertaining to individuals on their current surgical team comprising patterns of interaction frequency (how frequently do you interact in the OR with each of the people on the list below?), socialization (have you socialized with this person outside of work?), close working relationships (would you say that you have a close working relationship with this person?), advice-seeking (have you gone to this person for advice), advice-giving (has this person come to you for advice?), and voice/speaking-up (do you feel comfortable voicing safety concerns and speaking up to the below team member in this surgical case?). Participants also answered basic demographics questions.

Data Preparation, Coding, and Analysis

We used UCINET 6.625 to analyze social network data, NetDraw 2.160 for network visualization, and STATA SE/14 to analyze descriptive data. Participants in dyadic networks are interdependent, which necessitates computing standard errors with a method that is robust to the failure of the independence assumption. If independence is assumed and ordinary least squares regression is used, the results will not be accurate due to the underestimation of standard errors. Therefore, we assessed the relationship of distance to pairwise communication effectiveness with permutation-based quadratic assignment procedures (QAPs) because it is robust to the failure of the independence assumption and considers the autocorrelated errors in analysis. QAP tests for significance by permuting the dataset thousands of times to compute the proportion of times that the random coefficient is larger than or equal to the observed coefficient.

QAP requires the organization of data into square matrices for analysis. We organized the network data into edgelists (two column lists of actors that are connected by a tie with associated values) and then converted the edgelists into matrices in UCINET for QAP analysis. We recoded the demographic variables (Table I) for pairwise analysis. The recoding converted study variables such as "age of participant" to "age difference between dyads."

From the survey questions, we developed six social networks (interaction frequency, close working relationship, socialization, advice-seeking, advice-giving, and speaking-up/voice). We determined the pairwise geodesic network distance in the aforementioned networks by constructing a generalized distance matrix between all participants. We developed two ordinal scale (1–5) communication effectiveness models that were comprised of ratings from the task-specific communication (During the surgical case, how well/clearly did the person below communicate requests/commands related to the case?*)* and general communication (How would you rate the quality of communication with the people below?*)* questions from the questionnaire. We developed a separate matrix containing pairwise differences in communication effectiveness ratings between every pair of dyads.

We used the geodesic or network distance as a predictor of team member network position and assessed the relationship of distance to pairwise communication effectiveness with QAP correlation and QAP regression. For QAP regression, the dependent variable was task-specific communication difference, and the independent variables were the network geodesic distances and the demographic variables.

RESULTS

Participant Characteristics

We administered a network questionnaire to 50 surgical teams comprised of 45 multidisciplinary clinicians with 522 dyadic relationships. We enrolled the entire population of clinicians who directly provided surgical care (47), with 45 participants providing responses, for a response rate of 96%. Briefly, the study participants were predominately Caucasian and, on average, were 35 years old (standard deviation [SD] = 9.1) with 6 years (SD = 4.6) of clinical experience (Table I). Participants were predominately military servicemembers, including 30 officers and 13 enlisted members. We did not include the voice/speaking-up network in the analysis as all participants indicated that they felt comfortable voicing safety concerns to all team members. That is, there was no variance in this network. The summary statistics for the remaining five networks, participant characteristics, and the communication effectiveness models are presented in Table II. The mean general communication effectiveness difference (M = 0.545, SD = 0.485) among participants was slightly higher than the mean task-specific model (M = 0.474, SD = 0.429). The socialization network had the largest mean dyadic geodesic difference (M = 3.724, SD = 1.556), followed by the advice-giving (M = 2.058, SD = 1.025), advice-seeking (M = 1.962, SD = 1.003), close working relationship (M = 1.860, SD = 0.956), and interaction frequency networks (M = 1.202, SD = 0.429). The participants typically had considerable dyadic differences in age (M = 13.255, SD = 7.922) and clinical experience (M = 5.775, SD = 4.177).

QAP Correlation

Table III contains QAP correlations among the variables with P values showing the percentage of random correlations that are as large as the observed correlation in 5,000 permutations. The task-specific communication and general communication effectiveness models were highly correlated (Table III, r = 0.851, P < 0.001). In the interest of economy, only the task-specific communication results are discussed further.

We found a strong positive correlation between task-specific communication difference and the interaction

TABLE I. Study Participant Characteristics ($N = 47$)

Variable	*n*	Percent	*M*	*SD*	Min	Max
Age (Years)	47		35.04	9.06	19	55
Age by Occupational Group (Years)						
Surgical Technologist	13		24	3.91	19	33
Perioperative Nurse	6		40.83	6.61	32	50
Surgeon	15		40	6.94	32	55
Anesthesia Provider (nurse anesthetist or anesthesiologist)	11		39.09	5.57	30	47
Surgical Resident	2		30	2.82	28	32
Years of Clinical Experience			6.0	4.60	0.4	17
Years of Experience by Occupational Group						
Surgical Technologist	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	2.81	3	12
Surgical Resident	2		2.25	1.06	1.5	3
Years worked in the OR at MTF			2.04	1.60	167	6
Years worked in the OR at MTF by Occupational Group						
Surgical Technologist	13		2.26	1.57	0.33	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
Surgical Resident	2		2.04	0	0.5	0.5
Gender						
Female	19	40.43				
Male	28	59.57				
Military Status						
Civilian	4	8.51				
Enlisted	13	27.66				
Officer	30	63.83				
Military Rank						
Airman	2	4.65				
Airman First Class	5	11.63				
Senior Airman	4	9.30				
Staff Sergeant	2	4.65				
Second Lieutenant	1	2.33				
Captain	5	11.63				
Major	15	34.88				
Lieutenant Colonel	7	16.28				
Colonel	2	4.65				
Race						
Asian or Pacific Islander	4	8.51				
Black or African American	6	12.77				
Hispanic	5	10.64				
White/Caucasian	30	63.83				
Multiple Ethnicity	2	4.26				
Days worked in OR per month						
1–4 days	18	38.30				
5–9 days	8	17.02				
10–15 days	2	4.26				
>15 days	19	40.43				

SD, standard deviation; *M*, Mean; Min, minimum; Max, maximum.

frequency, close working relationship, socialization, advice-seeking, and advice-giving networks ($r = 0.729$–0.834, $P < 0.001$ for all networks). This confirms our hypothesis that the shorter the network geodesic distance between two individuals across the networks, the smaller the difference between their communication effectiveness.

QAP Regression

Table IV displays the QAP regression standardized coefficients of the independent variables and the *R*-squared of each relational network. All relational networks had an *R*-squared of >0.82 ($R^2 = 0.827$–0.891), suggesting that the variables in the regression model were a major factor in

TABLE II. Dyadic Summary Statistics for Communication Effectiveness, Geodesics, and Participant Characteristics

Variable	N	*Mean*	Min	Max	*SD*
Pairwise Communication Effectiveness Differences					
1. General Communication	522	0.545	0	2.500	0.485
2. Task-Specific	522	0.474	0	2.670	0.429
Network *Geodesic* Differences					
3. Interaction Frequency	522	1.202	1	3	0.429
4. Close Working Relationship	522	1.860	1	5	0.956
5. Socialization	522	3.724	1	6	1.556
6. Advice-Seeking	522	1.962	1	5	1.003
7. Advice-Giving	522	2.058	1	6	1.025
Demographics					
8. Race (Same)	522	0.335	0	1	0.472
9. Rank (Same)	522	0.269	0	1	0.444
10. Work Frequency (Same)	522	0.388	0	1	0.487
11. Experience Difference	522	5.775	0	16	4.177
12. Age Difference	522	13.255	0	36	7.922
13. Gender (Same)	522	0.512	0	1	0.500

SD, standard deviation; Min, minimum; Max, maximum.

determining interpersonal differences in communication effectiveness. Geodesic distance was significant and positive with task-specific communication in all networks ($\beta = 0.056$–0.163, $P < 0.001$ for all networks). This suggests that as pairwise geodesic distance decreases, so does the pairwise differences in communication effectiveness. Due to the similarity of the regression models across the five networks, we will focus the discussion of the results on the interaction network.

The greater the age difference between clinicians ($\beta = 0.064$, $P < 0.001$), the greater the interpersonal differences in communication effectiveness. The smaller the difference in experience between clinicians ($\beta = -0.068$, $P < 0.001$), the greater differences in communication effectiveness. Similarities in rank ($\beta = 0.187$, $P < 0.001$), work frequency ($\beta = 0.428$, $P < 0.001$), and gender ($\beta = 0.095$, $P < 0.01$) were associated with greater differences in communication effectiveness. Conversely, racial similarity ($\beta = -0.065$, $P < 0.01$) was associated with a smaller differences in communication effectiveness.

Network Graph Visualization

Visualization of network data is important to understand the underlying network structure and to identify groups or individuals that are influential or overburdened. The sociogram presented in Figure S1 is a graphical depiction of network relationships and represents the distribution of pairwise tie connections among all study members. Visualization of the data in this manner is helpful to distribute targeted interventions to the participants with the highest network involvement. The participants or actors in the sociogram are referred to as nodes, and the ties between nodes represent relationships. Network involvement is represented by node size and actor occupational group is represented by node color and shape. STECH10 (surgical technologist no. 10) is the network node with the highest involvement (a member of 20 surgical teams) and is the most observed pairwise connections (32) to other actors in the network.

DISCUSSION

The principal findings from our study are that as geodesic distance decreases between two individuals in the interaction frequency, 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 were associated with smaller differences in communication effectiveness. The geodesic distance variables for the networks were the stable predictors of communication effectiveness and can be used as the basis for interventions to improve OR communication.

Homophilous actors share common beliefs, meanings, and mutual understandings, which lead to more effective communication.[28] Participants in social networks typically prefer homophilous communication and are often frustrated with the ineffective communication that heterophilous relationships breed.[28] However, the demographic characteristics did not neatly follow the rules of homophily. Our results indicate that if a pair of clinicians share the same gender, rank, work frequency, or similar clinical experience (years), they will have greater differences in communication effectiveness.

We set out to model both general and task-specific communication in the expectation that they could capture different dimensions of communication among OR team members. Instead, we found that the two communication models were highly correlated, signifying that there was no distinct difference between task-specific and general

TABLE III. Quadratic Assignment Procedure Correlation Results for Pairwise Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
Pairwise Communication Effectiveness Differences													
1. General Communication	1												
2. Task-Specific Communication	0.851***	1											
Network *Geodesic* Differences													
3. Interaction Frequency	0.862***	0.734***	1										
4. Close Working Relationship	0.838***	0.729***	0.869***	1									
5. Socialization	0.894***	0.814***	0.943***	0.920***	1								
6. Advice-Seeking	0.819***	0.778***	0.864***	0.759***	0.898***	1							
7. Advice-Giving	0.821***	0.834***	0.893***	0.812***	0.885***	0.861***	1						
Demographics													
8. Race (Same)	0.496**	0.265**	0.620**	0.379**	0.51**	0.389**	0.463**	1					
9. Rank (Same)	0.494***	0.203**	0.506***	0.466***	0.454***	0.424***	0.361***	0.407**	1				
10. Work Frequency (Same)	0.661***	0.651***	0.509***	0.573**	0.601**	0.562***	0.507***	0.152*	−0.003	1			
11. Experience Difference	0.652***	0.593***	0.737***	0.704***	0.802***	0.715***	0.677***	0.544**	0.446***	0.493***	1		
12. Age Difference	0.734***	0.766***	0.759***	0.706***	0.854***	0.782***	0.750***	0.498***	0.285**	0.475***	0.901***	1	
13. Gender (Same)	0.699***	0.638***	0.595***	0.494***	0.643***	0.601***	0.548***	0.286*	0.529**	0.399***	0.632***	0.689***	1

$^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

communication effectiveness in this setting. Because the task-specific and general communication models were highly correlated, we chose only to analyze and discuss task-specific communication, which reflects the task dense surgical environment.[29]

Military communication often follows a top-down direction and is sometimes one-way. Although one-way communication is appropriate for a tactical environment, in healthcare, clinicians of all ranks are encouraged to immediately voice safety concerns. The most predominant root cause of surgical adverse events is communication error,[30] which is influenced by hierarchy and authority gradients.[31] Hierarchy creates a power imbalance that impedes effective communication by preventing clinicians from reporting a potential safety concern.[31] We did not uncover authority gradients that affect speaking-up patterns as all clinicians reported that they feel comfortable voicing safety concerns to other team members. It is possible that in situations where mostly military clinicians provide care, there is less hierarchical or lateral constriction of voicing safety concerns. Potentially, the presence of speaking-up patterns indicates that the MTF is not an overtly toxic work environment[32] and possesses factors promoting a safety culture.

Our work shows that critical communication is influenced by informal relationships among surgical team members. This is an important finding that emphasizes the importance of non-technical skills, such as clinician relationships, in delivering safe patient care. Efforts to increase clinical proficiency have frequently focused on the technical skills of the surgical team despite the fact that nontechnical skills, such as teamwork[33] and communication,[34] contribute more prominently to surgical errors, adverse events, and patient harm.

Socialization outside of work was associated with smaller differences in communication effectiveness and potentially increased the likelihood of having a close working relationship with another team member. However, the socialization network had the largest geodesic distances ($M = 3.724$, $SD = 1.556$), suggesting that socialization occurred infrequently. Socialization among military members has its challenges and is discouraged due to fraternization policies. However, leaders can encourage socialization outside of work in a military context through participation in military balls, formal military dinners (dining out/in), hail and farewell events, intramural sports events, and through military branch and corps birthday celebrations. The merit of socialization in healthcare teams is potentially undervalued by the military.

We found that strong pairwise bonds among surgical clinicians in interaction frequency, close working relationships, socialization, and advice were associated with smaller differences in communication effectiveness. The findings align with evidence that interaction frequency and shared mental models improve communication, patient safety, and team performance.[35] The presence of a shared mental model fully leverages the ability of the team to communicate efficiently.

TABLE IV. Multiple Regression Quadratic Assignment Procedure Results for Task-Specific Communication Differences

Variable	Interaction Frequency	Close Working Relationship	Socialization	Advice-Seeking	Advice-Giving
DV = Task-Specific Communication Difference					
Geodesic	0.163***	0.089***	0.118***	0.056***	0.144***
	(0.012)	(0.007)	(0.013)	(0.006)	(0.006)
Age Difference	0.064***	0.064***	0.058***	0.067***	0.051***
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Experience Difference	−0.066***	−0.068***	−0.064***	−0.068***	−0.057***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.002)
Gender (Same)	0.020*	0.095**	0.052*	0.019*	0.069**
	(0.020)	(0.024)	(0.022)	(0.025)	(0.020)
Race (Same)	−0.200**	−0.065**	−0.118**	−0.084**	−0.146***
	(0.024)	(0.020)	(0.018)	(0.024)	(0.017)
Rank (Same)	0.224***	0.187***	0.199**	0.296***	0.177**
	(0.018)	(0.018)	(0.023)	(0.026)	(0.022)
Work Frequency (Same)	0.441***	0.428***	0.412**	0.487***	0.393***
	(0.022)	(0.022)	(0.031)	(0.025)	(0.016)
Intercept	0.000***	0.000***	0.000***	0.000***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.843	0.836	0.835	0.828	0.891
Adjusted R^2	0.843	0.836	0.834	0.827	0.890
Permutations	2,000	2,000	2,000	2,000	2,000
Observations	1,980	1,980	1,980	1,980	1,980

Note: The standard errors are in parentheses.
$^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

Thus, a concerted effort should be made to develop and staff cohesive surgical teams with strong pairwise bonds.

A limitation of this study is that we enrolled predominately military participants at a single Air Force MTF. Due to the special characteristics of the setting, the generalizability of the findings is potentially limited and may not transfer to larger Air Force or Army and Navy facilities. Additionally, the responses for the socialization network were potentially influenced by the Uniform Code of Military Justice law pertaining to fraternization. The strength of the study is that we sampled all interprofessional surgical team members. Interprofessional communication studies are typically narrow in scope and do not include all team members, which inhibits the ability for the improvement of error.[36] The interprofessional design provided a deeper context and understanding of factors that influence military surgical team communication.

IMPLICATIONS FOR SAFETY

This study is congruent with prior research that informal relationships influence communication, and interaction frequency and team familiarity are important factors that affect team performance. Frequently, OR surgical teams are assembled ad hoc to staff the daily surgical schedule without the consideration of team consistency or prior team performance. Teams that have worked together longer have improved communication,[37] are more likely to ask for help,[38] and perform better on many metrics including shorter operative time,[37] improved team performance, and lower surgical morbidity rates.[39] However, little has been done with this information.

The military needs to reconsider its policies for building safe and efficient surgical teams. The Surgical Services Service Line (3SL) collects and computes metrics such as surgical workload, OR caseload, OR performance, turnover time, and surgical return on investment.[40] These metrics are helpful indicators of highly proficient surgical teams and could inform the development of new tools that help surgical service managers assign personnel based on team performance and interaction frequency. Constructing consistent teams based on performance measures and familiarity could have a profound and immediate effect on the care provided in the Department of Defense facilities and will be the focus of our future work.

Military healthcare is transforming into a modernized and integrated system of readiness and health. To deliver expeditionary trauma care and save lives on the battlefield and in other operational settings, the military now deploys small and highly mobile surgical teams such as the Expeditionary Resuscitation Surgical Team[41] and Forward Resuscitation and Surgical Teams.[42] In these small teams, the consequences of communication errors are high.

Therefore, the military should consider policies that reduce the rotation or relocation of medical personnel. Military policies dictate that active duty members relocate frequently, which hinders team stability. About one-third of military service members experience a permanent change of station every year.[43] With one-third of the military healthcare teams relocating on an annual basis, this challenges surgical team cohesion, quality, and predictability of performance.[44,45]

Military performance can be enhanced by developing cohesive teams that exhibit the characteristics of mutual trust, and effective communication.[17] Varpio and colleagues[17] noted that a chief reason for the lack of cohesion among military interprofessional healthcare teams is insufficient time spent together. The policies to rotate military personnel challenge the ability to maintain stable and cohesive teams. Our study characteristics found the mean years worked in the OR at the MTF was 2.04 (SD = 1.60), which is much less than comparable civilian hospitals ($M = 10.0$, SD = 9.08).[46] Therefore, team-training exercises that enhance cohesion and improve socialization, advice, and interaction are important tools to promote operational readiness, team performance, and safety.

CONCLUSION

The findings have important implications for safety and quality. The ability of team members to communicate clinical information effectively is essential to build a safety culture. Our work shows that critical communication is influenced by informal relationships. The military faces distinct communication challenges because of policies to rotate personnel, the presence of a clear rank structure, and antifraternization regulations. Despite these challenges, overall 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.

SUPPLEMENTARY DATA

Supplementary data are available at *MILMED* online.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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