Moving Along: Team Training for Emergency Room Trauma Transfers (T^2ERT^2)

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OBJECTIVES: To determine whether high fidelity simulation-based training (SBT) of interprofessional teams involving trauma transfers has an immediate impact on participants' team-based attitudes and behaviors.

DESIGN: A quasi-experimental, pre-/postintervention comparison design examined high fidelity SBT of interprofessional teams using a 2 scenario format with immediate after action structured debriefing. Pre-/postsession Readiness for Inter-Professional Learning Scale (RIPLS, 19 items, Likert-type) surveys as well as Interprofessional Teamwork (IPT, 15 items, Likert-type) questionnaires, and postscenario participant- and observer-rated Teamwork Assessment Scales (TAS, 3 subscales, 11 items, Likert-type) were completed during each training session. Mean RIPLS, IPT, and TAS scores were calculated and matched pre-/postscore differences compared using paired t-test or analysis of variance with Bonferroni adjustment.

SETTING: A large, urban, academic, state health sciences institution in the Southeastern United States during the 2014 to 2015 academic year.

PARTICIPANTS: General surgery residents, emergency medicine residents, and senior undergraduate nursing students comprising ten interprofessional teams.

RESULTS: From approximately 48 participants, matched pre-/postsession IPT surveys were available for 42 individuals; 45 had an observer TAS evaluation for both scenarios; and 40 completed TAS peer evaluations for both scenarios. 47 participants had matched RIPLS surveys. Statistically significant improvements in matched pre-/postscore differences occurred for all 15 IPT items. Observer TAS scores significantly improved on 2 of the 3 subscales comparing the second to the first scenario. Peer evaluations statistically improved comparing the second to the first scenario. Two of the 19 RIPLS items demonstrated statistically significant improvement.

CONCLUSIONS: Interprofessional trauma team transfer training using SBT changes attitudes toward key team-based competencies and leads to learning them in the simulated environment. Such improvement in team-based skill and attitudes is an important first step in adopting team-based behaviors in the actual clinical environment and improving transfer care. (J Surg Ed 76:1402–1412. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

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COMPETENCIES: Interpersonal and Communication Skills

INTRODUCTION

Trauma care is a complex, dynamic process in which multiple professions must quickly come together to evaluate

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and treat critically ill patients in an efficient manner. A crucial component of such care is the so-called "golden hour" after the initial traumatic event. During this period, life threatening conditions must be expeditiously identified and taken care of to ensure patient survival.[1] Often, such care during this critical time is initiated in the trauma resuscitation bay in the emergency department and must then be continued up in the operating room, requiring an intrahospital transfer of a critically ill patient.

Inter- and intrahospital transfers of critically ill patients are often rife with potential problems. Although adverse events are relatively low during transfers, they can be potentially catastrophic (i.e., extubation of a patient, cardiac arrhythmia, and malfunction of a chest tube).[2] Often, they result from the high number of intravenous solutions and pumps being used.[3] Familiarity with monitors and technical equipment is key to addressing such technical glitches during transfer.[4] Delays in transfer in these situations have a detrimental effect on patients, and they tend to prolong hospitalizations.[5] Finally, without standardized transfer practices and checklists to aid in coordinating teamwork, small events have the potential of spiraling out of control during transfers.[6]

Clearly, effective teamwork is essential for safe intrahospital transfers of critically ill trauma patients. In healthcare, however, teamwork tends to be ineffective. Often, failed communication,[7] role confusion,[8] poor team interaction,[9] and divergent interprofessional interpretations of the quality of collaboration[10,11] are the norm rather than the exception. In addition, the silo mentality[12] and tribalism[13] that is ubiquitous in healthcare exists in the trauma bay among emergency medicine and surgical specialists. Overcoming these barriers can be challenging.

High fidelity simulation (HFS) training provides a realistic, safe learning environment in which participants can encounter uncommon clinical situations and learn from "mistakes" without serious repercussions.[14] Such simulation-based training (SBT), employed in situ[15] and ex cura,[16] has improved team trauma care in the clinical environment. Most importantly, it can enhance the communication and teamwork of ad hoc teams in the trauma setting.[17] Its application, however, to trauma patient transfers is limited.

In an effort to build on prior work in interprofessional SBT team training at LSU Health New Orleans,[18-20] we examined the impact of a high fidelity SBT curriculum targeting trauma team transfer from the resuscitation bay to the operating room.

METHODS

Study Design

A quasi-experimental pre-/postintervention comparison design was used. Participants acted as their own controls completing evaluations before and after the educational intervention. Prior exempted institutional review board approval was obtained with waiver of documentation of informed consent given the educational nature of the training intervention.

Training Setting

Training occurred at the LSU Health New Orleans Health Sciences Center. Participant teams began sessions at the LSU Health New Orleans School of Nursing in their HFS room located on the second floor of the building. They ended the sessions at the LSU Health New Orleans School of Medicine Learning Center located on the fifth floor of the adjacent Lions Building after having transferred their "patient" from one building to the other building via an elevated, enclosed walkway (Fig. 1). The mannequin used as the "patient" for the training sessions was a full-scale, wireless computer-operated human patient simulator (HPS) mannequin (CAE Inc., Montreal, Canada). Teams used equipment for trauma resuscitation to conduct the transfer, and a portable camera (GoPro, San Mateo, California) attached to the gurney recorded each session.

Training Format

The training format was similar to prior in situ[21] and ex cura[18-20] HFS curricula developed for interprofessional team training at LSU Health New Orleans Health Sciences Center, consisting of a 2 hour dual scenario format with immediate structured debriefing employing several techniques.[22-25] The debriefing focused on 9 team-based competencies (i.e., shared mental model (SMM), role clarity, situational awareness, anticipatory response, resource management, open communication, cross monitoring, flattened hierarchy, and mental rehearsal) as well as techniques for effective hand offs (i.e., Situation, Background, Assessment, Recommendation). At the conclusion of the session, each participant was asked to identify one team-based competency that he/she would attempt to practice/adopt in clinical practice.

Each session had 5 instructors: 2 instructors (VR, VK) operated the computer-based mannequin; the other instructors (DG, JP, PD) assisted with the debriefings and served as raters of team-based behaviors immediately after each scenario. For each scenario, an attempt was made to have at least 2 raters perform the evaluations. Prior to implementation, all raters had participated in a training/recalibration session using the assessment tool.

Training Participants

Residents and students from various professions and disciplines participated in the training. Teams had approximately 4 to 7 members. Each team had 1 to 2 junior

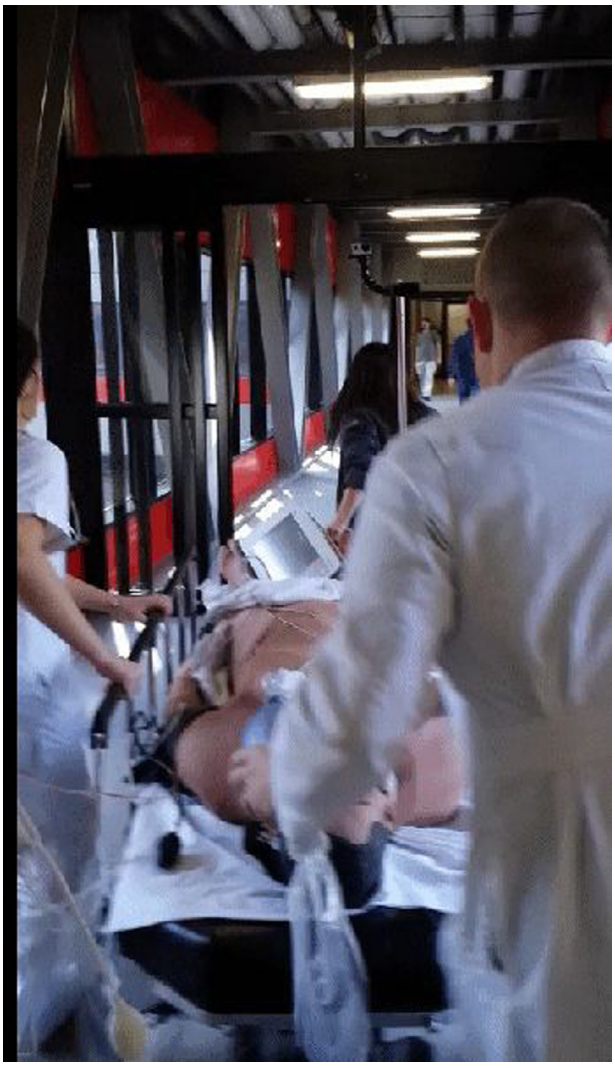

FIGURE 1. Team Training for Emergency Room Trauma Transfers (T^2ERT^2). Residents and students participate in a simulated transfer of a critically ill trauma patient from an Emergency Room in one building to an Operating Room in another building via a walking bridge connecting the two structures.

emergency medicine residents (i.e., postgraduate years [PGY] 2 or 3), 1 senior (i.e., PGY level 5), and 1 to 2 junior (PGY 1) general surgery residents rotating on the trauma surgery service, and up to 2 senior undergraduate nursing students taking an intensive care course.

Each team member assumed a role during the entire period of each scenario: (1) primary nurse, responsible for the immediate care of the patient such as intravenous line placement and drug administration; (2) medication nurse, responsible for getting the appropriate medications and blood products in the room for the primary nurse to administer and assisting the primary nurse as necessary; (3) trauma chief resident, responsible for helping to oversee the resuscitation according to advanced trauma life support (ATLS) guidelines and deciding when to transfer the patient to the operating room (OR); (4) emergency medicine attending, responsible for helping to oversee the resuscitation according to ATLS guidelines from the beginning of the resuscitation; (5) emergency medicine airway resident, responsible for airway management and directing the resuscitation according to ATLS guidelines; (6) trauma intern, responsible for assisting with resuscitation as directed; (7) trauma medical student, responsible for assisting with resuscitation as directed; or (8) anesthesia, responsible for airway management (when present). For teams with greater than 6 members, additional roles were added. Roles were reversed on the second scenario among the undergraduate nursing students and the emergency medicine residents in order to allow them the opportunity to practice each role that they might undertake during trauma resuscitation. They were kept the same among the general surgery residents, due to the defined nature of such roles based on their PGY level.

Training Scenarios

An authentic, standardized trauma resuscitation scenario was adapted from the existing third year medical student surgery clerkship SBT curriculum for the team training. It involved a blunt trauma victim (i.e., pedestrian walking across the street outside the emergency room who was hit on the left side by a motor vehicle) with intra-abdominal hemorrhage and open book pelvic fracture. This hemorrhage was secondary to splenic rupture requiring emergent transport of the patient to the OR from the trauma resuscitation room for definitive treatment. The scenario design purposefully involved a patient who was injured in close proximity to the emergency room in order to mimic a clinical situation in which a trauma victim presents unannounced and unanticipated to the emergency room. In this manner, initial resuscitation would be led by the emergency department staff and physicians present and would require their recognition of the severity of injuries and decision to initiate a Level 1 Trauma Activation to have the trauma surgical team become involved. The trauma surgical team would then be required to make the decision to bring the patient to the OR based on the patient's status. The scenario utilized a software algorithm developed in-house.[18,21]

Evaluation

Evaluation followed Kirkpatrick's model of training effectiveness.[26] Level 1 (i.e., participant reaction) effectiveness was evaluated qualitatively via inquiry of participants at the conclusion of each training session. Questioning focused on the value of the SBT to the learners and how to improve it.

Level 2 (i.e., participant learning) effectiveness was evaluated in 3 ways. First, the Teamwork Assessment Scales

(TAS), an 11-item, 2 scale instrument using a Likert-type rating system (1 = Definitely No to 6 = Definitely Yes), assessed individual team-based and overall performance. The first scale comprises a 5-item multisource evaluation individual performance tool assessing team-based behaviors (TBB); the second scale is an overall teamwork evaluation divided into a 3-item SMM subscale and a 3-item adaptive communication and response (ACR) subscale. The TAS has evidence of generalizability[18] and convergent validity.[19] Participants performed self-, peer-, and overall team-based evaluations after each scenario using the TAS. Peer-based evaluations involved participants rating every other member of the team using the multisource evaluation TBB scale. Approximately 2 observers rated individual- and team-based performances after each scenario (i.e., after both the first and second scenario for each training session). Mean subscale scores were calculated for observer and participant ratings. Differences between mean calculated observer- and participant-rated performances after each scenario were evaluated using a one-way analysis of variance. An ad hoc method was employed in which any incomplete paired data set was discarded prior to comparison.

Second, the Readiness for Interprofessional Learning Scale (RIPLS) questionnaire,[27] a 19-item instrument employing a Likert-type scale that has undergone modification[28] and is one of the most mature interprofessional student attitudinal questionnaires in the literature[29] assessed participants interprofessional attitudes. Participants completed the RIPLS just prior to each training session and immediately following the completion of the after action debriefing of the second scenario. Mean subscale scores were calculated for each RIPLS item. Matched pre-/posttraining item scores were compared using paired t-test with Bonferroni correction. An ad hoc method was employed in which any incomplete paired data set was discarded prior to comparison.

Third, the Interprofessional Teamwork (IPT) questionnaire, a 15-item instrument employing a Likert-type scale, measured participants' interprofessional teamwork self-efficacy. The IPT has been used in prior publications related to in situ and ex cura interprofessional OR team training.[18,21] Mean subscale scores were calculated for each IPT item, and a comparison of matched pre-/post-training item scores using paired t-test with Bonferroni correction was performed. An ad hoc method was employed in which any incomplete paired data set was discarded prior to comparison.

RESULTS

Participant Breakdown

Forty-eight individuals participated in the team training exercises over the course of the 2014 to 2015 academic year. Table 1 lists the breakdown according to training level and discipline/profession. General surgery and emergency medicine residents and senior undergraduate nursing students comprised over 90% of the participants who participated in the trauma transfer training sessions.

Participant Reaction

In general, participants would affirm that the SBT experience was worthwhile when queried orally at the end of a training session. When asked what made the SBT worthwhile, comments centered around 3 main themes: (1) practice of clinical skills; (2) autonomy; and (3) interprofessional collaboration. Participants appreciated the opportunity to practice transferring a critically ill trauma "patient" using a simulated mannequin in order to be prepared for the actual event in clinical practice. They felt that this experience helped to reveal gaps in learning that could be addressed prior to the actual treatment of a trauma patient. In addition, senior surgery residents liked the opportunity to lead a trauma resuscitation just as they were about to do so on the trauma service (senior residents were drawn from chiefs rotating on the trauma service that month), since they had not rotated on the trauma service for several years. This autonomy in the SBT helped them, as well as the emergency medicine residents, to have the chance to "call the shots" in a safe environment without consequences for patients. Finally, participants expressed a satisfaction in working with members of other disciplines and professions. For many nurses, this was the first experience in IPE, and

TABLE 1. Summary of Participant Breakdown for Simulation-Based Team Training for Emergency Room Trauma Transfers

Education Level	Discipline/Profession	Number of Participants
Postgraduate (i.e., resident)	General Surgery	16
	Emergency Medicine	15
	Anesthesia	1
Undergraduate	Senior Nursing Student	13
Other	Other	3
Total		48

they felt that it helped build bridges and clarify roles. For the surgery and emergency medicine residents, this SBT was an opportunity to work together and understand better each other's roles and responsibilities in trauma resuscitation. One of the most common responses to the final question of how to improve the SBT experience was to have more such sessions bringing together interprofessional teams.

Participant Learning–IPT Questionnaire

A total of 41 to 42 pre-/post-training IPT scores were available for each item. Differences between mean pre- to posttraining scores for each item are listed in Table 2.

After Bonferroni correction, statistically significant improvements were seen on all items.

Participant Learning–TAS

Matched observer ratings of both scenarios were available for 45 TBB scores and 32 overall teamwork scores. Matched self-assessment ratings were available for 32 TBB scores and 27 overall teamwork scores (27 for SMM; 23 for ACR). Matched peer-assessment scores were available for 40 TBB scores.

Self-, peer-, and observer-based mean scores and differences for components of the TAS are listed in Tables 3a-c, respectively.

Overall, self-, peer-, and observer-based assessments demonstrated mean score gains on every subscale from scenario 1 to scenario 2, except for observer ratings of TBB. Mean scores were higher on self- and peer-based ratings compared to observer-based scores. Observer-based ratings of participants demonstrated a statistically significant improvement for the overall teamwork subscales from scenario 1 to scenario 2. Self-assessed ratings of participants demonstrated statistically significant improvements in every subscale. Peer-assessed changes in TBB were significant as well.

Participant Learning–RIPLS Questionnaire

A total of 46 to 47 pre-/posttraining RIPLS scores were available for each item. Differences between mean pre- to posttraining scores for each item are listed in Table 4.

After Bonferroni correction, statistically significant improvements were present on 2 items: (1) Shared Learning with other healthcare students will increase my ability to understand clinical problems and (2) I would welcome the opportunity to work on small-group projects with other healthcare students.

DISCUSSION

Our 2 hour, HFS curricula focusing on trauma transfers of interprofessional teams of surgery residents, emergency medicine residents, and senior undergraduate nursing students demonstrated Kirkpatrick Level 2 training effectiveness[26] in several domains. Over the course of a training session, participants improved their team-based performance. In addition, they had positive changes in attitudes toward teamwork, and they demonstrated some improvements related to their readiness for interprofessional learning. Consistent with other curricula developed at LSU Health New Orleans Health Sciences Center focusing on teamwork and team training,[18-21] this trauma team transfer SBT succeeded in exposing students and residents to concepts needed for highly reliable team function in the healthcare setting and their translation to actual use in simulated practice. Another benefit of the training included its progressive nature. By requiring participants to physically move a computer-based mannequin from one building to another, discussion of important systems-based issues could occur, especially given that this program was occurring right before a move to a new hospital in which transfer from the emergency department to the OR would require an elevator trip. Finally, the training allowed an opportunity for surgery residents and emergency medicine residents to work together outside of the actual clinical environment, helping them to understand better their roles and to work on providing effective feedback to one another. Such interaction between disciplines and professions is a recognized benefit of IPE sessions in the literature.[30,31]

Although self- and peer-ratings demonstrated a statistically significant improvement in TBB scores from pre- to posttraining, the observer-based improvement in TBB scores did not reach statistical significance. As with other team training episodes, these participant-generated scores once again over-estimated ratings for the subscales compared to the observer-based values, and this fact might have contributed to the difference. Since the surgery residents may have participated in other team training exercises that are conducted during the residency (i.e., OR crisis management with anesthesia residents), they may have had distributed opportunities to learn key team-based competencies, potentially skewing the TBB results. These self-generated scores, however, may play an important role in formative evaluation of teamwork after clinical events, and, if conducted frequently enough, these multisource evaluations may help to calibrate each individual's evaluation to allow for more accurate and useful information to help improve team function.

TABLE 2. Summary of Participant Interprofessional Teamwork (IPT) Pre-/Post-training Score Analysis for Simulation-Based Team Training for Emergency Room Trauma Transfers

IPT Questionnaire Item*	N (Matched)	Presession Score†	Postsession Score†	Δ (Post − Pre)†	p Value‡
Before management of a critical patient, I can communicate effectively with team members to ensure that we. . .					
Have a common understanding of the patient's condition.	42	4.40 (0.91)	5.24 (0.66)	0.83 (0.88)	0.000§
Have a common understanding of the specific goals to be achieved	42	4.36 (0.91)	5.24 (0.62)	0.88 (0.94)	0.000§
Know clearly the task responsibilities of each team member.	42	4.05 (0.88)	5.14 (0.72)	1.10 (0.91)	0.000§
Achieve sufficient familiarity with how each team member will approach his/her task responsibilities (e.g. strengths, weaknesses, preferences)	42	4.12 (0.97)	5.24 (0.62)	0.88 (0.94)	0.000§
Have all of the anticipated human and material resources ready and "at hand"	42	3.95 (0.96)	4.88 (0.71)	0.93 (0.95)	0.000§
Use cues within the situation to coordinate my tasks with others	41	4.34 (0.97)	5.17 (0.70)	0.83 (1.05)	0.000§
During management of a critical patient, I can. . .					
Use my understanding of a patient's situation to anticipate team members needs	42	4.29 (1.02)	5.14 (0.81)	0.86 (1.00)	0.000§
Monitor my own and other team members' efforts to ensure that proper procedures and tasks occur as expected	42	4.17 (1.10)	5.12 (0.71)	0.95 (0.94)	0.000§
Adapt my performance to accommodate changes that may occur	42	4.38 (1.06)	5.24 (0.73)	0.86 (0.93)	0.000§
Use specific communication strategies to confirm that messages are received and the content is accurately understood (i.e. closed-loop communication)	42	4.33 (1.00)	5.19 (0.71)	0.86 (1.07)	0.000§
Interact with others to maximize their strengths and manage the workload effectively	42	4.43 (1.06)	5.19 (0.74)	0.76 (0.96)	0.000§
Facilitate quality and continuous improvement (e.g. encouraging others, speaking up when concerns arise, offering critique)	41	4.34 (1.04)	5.10 (0.77)	0.76 (0.99)	0.000§
Use strategies effectively to promote team cohesion and effective work interactions	42	4.31 (0.98)	5.26 (0.70)	0.95 (1.01)	0.000§
Use strategies to effectively provide feedback to team members	42	4.24 (1.10)	5.21 (0.68)	0.98 (0.95)	0.000§
Use strategies effectively to resolve differences/disputes among team members	42	4.19 (1.11)	5.05 (0.88)	0.86 (1.00)	0.000§

*Scale: 1 = Not confident at all to 6 = Completely confident.
†Mean (standard deviation).
‡Paired 2 tail t-test.
§Statistically significant after Bonferroni adjustment.

TABLE 3a. Summary of Participant Self-Rated Teamwork Assessment Scales (TAS) Subscale Analysis for Simulation-Based Team Training for Emergency Room Trauma Transfers:
Scenario 1 vs. Scenario 2

	Scenario 1			Scenario 2				
	N	Mean	SD	N	Mean	SD	Change*	p†
Individual performance (5 items)‡								
Team-based behaviors, 5 items	32	4.36	0.91	32	5.34	0.46	0.98	<0.001
Overall teamwork (6 items)								
Shared mental model, 3 items	27	4.30	0.89	27	5.62	0.47	1.32	<0.001
Adaptive communication and response, 3 items	23	4.00	1.01	23	5.49	0.51	1.49	<0.001

*Scenario 2 – Scenario 1.
†One way ANOVA.
‡Mean combined score of third year medical and senior undergraduate nursing students.

TABLE 3b. Summary of Participant Peer Rated Teamwork Assessment Scales (TAS) Subscale Analysis for Simulation-Based Team Training for Emergency Room Trauma Transfers:
Scenario 1 vs. Scenario 2

	Scenario 1			Scenario 2				
	N	Mean	SD	N	Mean	SD	Change*	p†
Individual performance (5 items)‡								
Team-based behaviors, 5 items	40	4.96	0.54	40	5.43	0.37	0.47	<0.001

*Scenario 2 – Scenario 1.
†One way ANOVA.
‡Mean combined score of third year medical and senior undergraduate nursing students.

TABLE 3c. Summary of Observer Rated Teamwork Assessment Scales (TAS) Subscale Analysis for Simulation-Based Team Training for Emergency Room Trauma Transfers:
Scenario 1 vs. Scenario 2

	Scenario 1			Scenario 2				
	N	Mean	SD	N	Mean	SD	Change*	p†
Individual performance (5 items)‡								
Team-based behaviors, 5 items	45	4.47	7.12	45	4.89	0.49	0.42	0.694
Overall teamwork (6 items)								
Shared mental model, 3 items	32	3.40	0.71	32	5.05	0.40	1.64	0.000
Adaptive communication and response, 3 items	32	3.76	2.30	32	4.76	0.34	1.00	0.020

*Scenario 2 – Scenario 1.
†One way ANOVA.
‡Mean combined score of third year medical and senior undergraduate nursing students.

Improving teamwork in the clinical setting requires breaking down long-held attitudes and beliefs that each profession has toward one another. These attitudes are deep-seated and are set early in professional development. To break down such barriers to effective teamwork, therefore, educators must intervene early in training to try to promote interprofessional attitudes that foster collaboration and understanding. The finding that only 2 of the 19 RIPLS questionnaire items had statistically significant changes underlines the importance of such early intervention. This training involved both surgery and emergency medicine residents who likely had become more set in their attitudes toward collaboration and interprofessional training. Thus, it was hard to overcome the interprofessional attitudes and beliefs that can be detrimental in the clinical environment.[12,32,33]

Limitations to this study do exist. First, it is from a single institution with a limited number of participants. We chose to use a convenience sample, given the difficulty with logistics in trying to mesh a semester-based (i.e., undergraduate nursing students) and year-round based (i.e., surgery and emergency medicine residents) education calendar. Second, data reconciliation revealed gaps

TABLE 4. Summary of Participant Readiness for Interprofessional Learning Scale (RIPLS) Pre-/Post-training Score Analysis for Simulation-Based Team Training for Emergency Room Trauma Transfers

RIPLS Questionnaire Item*	N (Matched)	Presession Score†	Postsession Score†	Δ (Post − Pre)†	p Value‡
Learning with other students will help me become a more effective member of a health-care team	47	4.53 (0.58)	4.64 (0.49)	0.11 (0.48)	0.133
Patients would ultimately benefit if health-care students worked together to solve patient problems	47	4.55 (0.62)	4.70 (0.46)	0.15 (0.51)	0.051
Shared Learning with other health-care students will increase my ability to understand clinical problems	47	4.40 (0.71)	4.66 (0.52)	0.26 (0.53)	0.002§
Learning with other health-care students before qualification would improve relationships after qualification	47	4.34 (0.73)	4.51 (0.59)	0.17 (0.70)	0.103
Communication skills should be learned with other health-care students	47	4.53 (0.58)	4.68 (0.47)	0.15 (0.51)	0.051
Shared learning will help me think positively about other professionals	47	4.43 (0.65)	4.60 (0.54)	0.17 (0.64)	0.073
For small group learning to work, students need to trust and respect each other	47	4.64 (0.49)	4.66 (0.48)	0.02 (0.53)	0.785
Team-working skills are essential for all health-care students to learn	46	4.74 (0.44)	4.65 (0.53)	-0.09 (0.43)	0.209
Shared learning will help me to understand my own limitations	46	4.50 (0.59)	4.63 (0.71)	0.13 (0.65)	0.183
I don't want to waste my time learning with other health-care students	47	1.77 (1.03)	1.51 (0.80)	-0.26 (0.12)	0.044
It is not necessary for undergraduate health-care students to learn together	47	1.87 (1.05)	1.57 (0.80)	-0.30 (0.75)	0.009
Clinical problem solving skills can only be learned with students from my own department	47	1.79 (0.98)	1.70 (0.93)	-0.09 (0.97)	0.552
Shared learning with other health-care students will help me communicate better with patients and other professionals	47	4.30 (0.81)	4.55 (0.65)	0.26 (0.85)	0.044
I would welcome the opportunity to work on small-group projects with other health-care students	47	4.26 (0.82)	4.57 (0.62)	0.32 (0.66)	0.002§
Shared learning will help to clarify the nature of patient problems	47	4.28 (0.71)	4.49 (0.59)	0.21 (0.62)	0.024
Shared learning before qualification will help me become a better team worker	47	4.34 (0.67)	4.55 (0.54)	0.21 (0.59)	0.017
The function of nurses and therapists is mainly to provide support for doctors	46	2.39 (1.13)	2.65 (1.39)	0.26 (1.44)	0.224
I'm not sure what my professional role will be	46	2.15 (0.97)	1.83 (0.85)	-0.33 (0.94)	0.024
I have to acquire much more knowledge and skills than other health-care students	46	2.96 (1.10)	3.24 (0.92)	0.28 (0.87)	0.036

*Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree.
†Mean (standard deviation).
‡Paired 2 tail t-test.
§Statistically significant after Bonferroni adjustment.

for all instruments used. For this study, we chose to only evaluate matched pre-/postintervention surveys, since we felt this analysis is a more powerful comparison. Thus, we did not conduct unmatched analyses of pre- and postsurveys that would allow a larger number of participants to be included. Third, the target learner group was very specific: surgery and emergency medicine residents and undergraduate nursing students. Thus, findings might not be generalizable. Nonetheless, when taken with similar work done here and elsewhere, they do reveal trends that point to more general conclusions. Fourth, the unequal team sizes may have biased results. For example, larger sized teams might have functioned less smoothly; smaller sized teams might have been overburdened with tasks. Furthermore, the larger team size does have an impact on the ability of observers to rate accurately the teamwork.[34] This varying size of the team, however, more accurately reflects the actual clinical environment for trauma resuscitations. Finally, the training sessions only occurred once for each participant, and, as such, we were not able to look at retention of learning over time with a repeat training session months later. Such repeat training might have demonstrated continued improvement in teamwork skills, suggesting that the silo mentality and tribalism between the professions was successfully being addressed. Our prior work, however, does indicate that even one interprofessional training session leads to retention of skills for health professional students,[20] suggesting that such retention would occur in the participants in the transfer training, potentially influencing cultural attitudes.

Future directions include conducting such longitudinal follow-up of participants to see if benefits from the training persist and the tribalism is mitigated. In addition, expanding such training to the in situ environment is another goal. In this manner, the advantages and disadvantages of each form of training could be analyzed.

CONCLUSIONS

In summary, high fidelity SBT of interprofessional teams in transfers of critically ill trauma patients is well received by participants, has an immediate impact on participants' performance in individual and overall team-based competencies as well as attitudes toward team-based competencies in the simulation-based setting. Participants tend to overestimate their own individual as well as their peers' team-based performances during these SBT sessions. Such inflation of scores, however, might be overcome by additional training, acquisition of team-based knowledge, skills, and abilities, and use of team evaluation tools. Such training has the potential of helping to transform the surgical work culture to promote highly reliable team function.

CONTRIBUTIONS

Concept and design: Paige, Garbee. Acquisition, analysis, or interpretation of data: Paige, Garbee, Yu, Rusnak, Kiselov, Detiege.

Drafting of manuscript: Paige, Garbee, Yu. Critical revision of manuscript: Paige, Garbee, Yu, Rusnak, Kiselov, Detiege.

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Drs. Paige and Garbee had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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SUPPLEMENTARY INFORMATION

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jsurg.2019.03.013.