

Factors Affecting the Interprofessional Communication and Teamwork Skills in a Simulation-
Based Course

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Key words: TeamSTEPPS, interprofessional, simulation, teamwork, communication

ABSTRACT

Objective. To identify factors that affect teamwork and communication skills development among interprofessional teams of health professional students in a simulation based course.

Methods. 3 cohorts of 2-3 student teams completed 3-4 evaluated simulations. Interprofessional communication and teamwork skills were evaluated using a 16-question tool that awarded 0-2 points per question. Anomalies in team score trends were matched to course schedules coded by types of course activities.

Results. Average team scores were 84.38%, 100% and 100% in 2011; 48.96%, 97.92%, 92.71% and 97.92% in 2012; and 72.92%, 98.96%, 98.96% and 100% in 2013. In 2012, individual team scores were 100%, 100% and 78.13% for Simulation #3 and 100%, 96.88% and 96.88% for Simulation #2. Simulations #2 and #3 in 2012 were 6 weeks apart.

Conclusion. To maintain a high level of competency in teamwork and communication skills, interprofessional teams should consider doing simulations at least once every 4 weeks.

INTRODUCTION

Interprofessional teamwork and collaborative practice are becoming increasingly important in delivering safe, quality and cost effective healthcare to patients.¹ However, one of the leading root causes of sentinel events in the current healthcare setting is a deficiency in communication and teamwork among healthcare team members.² Given this trend in healthcare practice, many

health professional programs are now required to incorporate interprofessional education (IPE) into the curriculum to better prepare health professional students to better prepare health professional students to work in such a workplace setting.^{3,4,5} Implementation of IPE activities in health professional programs, though, are impeded by limited research on the best methods to use for IPE.

There is currently insufficient research on which IPE training models are most effective, though there are multiple IPE models available to choose from.¹ One training models that has demonstrated great success and continues to be used in the healthcare setting is Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS). TeamSTEPPS is an evidence-based teamwork approach to developing communication and teamwork skills among team members. Based on 25 years of research, it was originally developed by the Department of Defense and the Agency for Healthcare Research and Quality for use to improve team performance in the healthcare system.⁶ Furthermore, TeamSTEPPS has been shown in previous IPE studies to be an effective training model for health professional students, but these previous studies measured changes in attitudes and perceptions rather than changes in competency in communication and teamwork skills.^{7,8} Previous studies also typically used a one-time intervention utilizing a combination of didactic teaching and simulation and analyzed short term outcomes of the training rather than long term outcomes of the intervention.⁷

Information on which tools would be most cost effective to use in implementing IPE is also lacking. Interprofessional team simulations have been shown to be an effective tool in team training and developing technical skills in the healthcare setting.⁹ Yet, there is insufficient

evidence demonstrating that such IPE activities are effective in improving patient safety outcomes in the long term. Major barriers to establishing a causal relationship include cost and logistical concerns involved in conducting simulation-based training programs.^{1,9} As such, more information is needed on what factors should be considered in developing an interprofessional simulation-based training program in order to build a more cost-effective research study. Therefore, this hypothesis generating study was conducted to determine what factors may affect the development of interprofessional communication and teamwork skills in a TeamSTEPPS simulation-based course.

METHODS

This retrospective observational study analyzed 3 cohorts of the TeamSTEPPS based interprofessional course taught at University of North Carolina at Chapel Hill (UNC). The 3-credit hour elective course was taught and organized by an interprofessional team of faculty that included 1 MD, 1 PharmD, and 1 RN who were all well versed in TeamSTEPPS. The study was reviewed by the Biomedical IRB of the UNC Office of Human Research Ethics and was granted IRB exemption.

Student teams. Students included second-year medical students, third- and fourth-year nursing students and third-year pharmacy students. Team demographics between cohorts varied depending on student enrollment (Table 1). Number of teams per cohort and the number of members per team were dependent on the total number of students enrolled in the course. Since the course focused on performance in contingency teams – teams formed spontaneously during

emergent situations – students were assigned to new teams for each simulation. Team assignments were not randomized; teams were created so that most had at least one representative from each health profession.

Simulations. All simulations were completed as student teams. Faculty members in charge of the course were all involved in creating the simulations used in the course with input from faculty and staff of the Clinical Skills and Patient Simulation Center (CSPSC) within the UNC School of Medicine. Interprofessional communication and teamwork skills in graded simulations were evaluated using a 16-question tool based on the Mayo High Performance Teamwork Scale (Appendix 1).¹⁰ Each question was worth a maximum of 2 points: “no action was taken” was awarded 0 points, “unacceptable/borderline performance” was awarded 1 point, and “acceptable performance” or above was awarded 2 points. Team skills were evaluated by graders that assessed students either in the room or remotely via real-time video. Graders were trained by CSPSC by going through a 45 minute training curriculum to understand the terminology related to the skills they would be assessing. Graders then spent another 45-60 minutes watching simulations, grading said simulations individually and discussing their grades as a group before comparing their grades to the original grades awarded to the videos watched.

Course schedules and activities. Classes were held once a week for 3 hours for 14 sessions within the 1 semester in the fall. A 2 consecutive week break occurred between Class 6 and Class 7 for all 3 cohorts. Course schedules differed between cohorts. Course schedules were coded based on the types of activity completed. Outside of simulations, other course activities included (1) group activities, (2) individual clinical activities, (3) lectures, (4) videos, and (5) exams.

Group activities included team building exercises and group presentations. These group presentations were prepared predominantly out of class throughout the semester before Class 13. Individual clinical activities were live encounters with standardized patients that students completed without teams. Scenarios included disclosing errors and delivering difficult news to patients. Lectures included classes in which only faculty lectures, guest lectures and guest panels took place with no other concurrent course activity for the class session. Videos were sessions where students spent the majority of class watching and participating in discussion about a video. All students in all 3 cohorts took a multiple-choice final exam at the end of the semester.

Data analysis. Team scores were analyzed using descriptive statistics to determine existing trends in team performance. Anomalies in identified trends were qualitatively compared to course schedules that were coded for the different types of activities completed. Significance testing was not done due to insufficient power.

RESULTS

Simulation scores. Average team scores in the 2011 cohort were, in order of the simulations completed, 84.38%, 100% and 100%. Average team scores in the 2012 cohort were 48.96%, 97.92%, 92.71% and 97.92%. Average team scores in the 2013 cohort were 72.92%, 98.96%, 98.96% and 100%. No decreases in average team scores occurred between simulations in 2011 and 2013, but a 5.21% decrease in 2012 average team scores occurred between Simulations #2 and #3 (Figure 1). In 2012, individual team scores for Team 1 were 56.25%, 100%, 100% and 100%. Individual team scores for Team 2 were 43.75%, 96.88%, 100% and 93.75%. Team 3 had

individual team scores of 46.88%, 96.88%, 78.13% and 100%. No decrease in individual team scores occurred between simulations for Team 1. A 6.25% decrease in individual team scores occurred between Simulations #3 and #4 for Team 2. An 18.75% decrease in individual team scores occurred between Simulations #2 and #3 for Team 3 (Figure 2).

Differences in course schedules. In 2011, Simulations #2 and #3 were 8 weeks apart while Simulations #3 and #4 were 2 weeks apart. However, the 2011 cohort also completed 3 ungraded simulations – one simulation occurred the week before Simulation #2, another occurred the week before Simulation #3, and the last occurred the week after Simulation #2. The shortest gap between simulations, graded or ungraded was 1 week while the longest gap between simulations was 7 weeks in 2011. In 2012, Simulations #1 and #2 were 2 weeks apart, Simulations #2 and #3 were 6 weeks apart, and Simulations #3 and #4 were 3 weeks apart. The 2012 cohort also completed 2 ungraded simulations where both simulations occurred consecutively in the weeks between Simulations #3 and #4. The shortest gap between simulations, graded or ungraded, in 2012 was 1 week while the longest gap between simulations was 6 weeks. In 2013, Simulations #1 and #2 were 2 weeks apart, Simulations #2 and #3 were 5 weeks apart, and Simulations #3 and #4 were 4 weeks apart. The 2013 cohort also completed 2 ungraded simulations that both occurred in consecutive weeks between Simulations #3 and #4. One ungraded simulation occurred 2 weeks after Simulation #3, and the second ungraded simulation occurred 1 week after the previous ungraded simulation. Although lectures, individual clinical activities and videos occurred in the time between simulations, no group activities occurred in the time between graded and ungraded simulations (Figure 3).

DISCUSSION

All cohorts showed improvement in interprofessional teamwork and communication skills, as measured by team scores, throughout the semester. Of all the cohorts, only the 2012 cohort showed any decrease in average team scores. Sub-analysis of the individual team score trends in the 2012 cohort showed that the largest decrease in team scores occurred between Simulations #2 and #3. This decrease corresponded with the longest gap between simulations, graded or ungraded, in 2012.

However, the longest gap between simulations among all the cohorts was 7 weeks, which occurred in 2011, but since the gap occurred between a graded simulation (Simulation #2) and ungraded simulation, the effects of the long duration between simulations could not be measured since there was no team score recorded for the ungraded simulation that occurred after the graded simulation. The next longest gap between simulations was 5 weeks, which occurred in 2013 and occurred between two graded simulations (Simulations #2 and #3). No decrease was seen in average team scores in this intervening time period, which suggests that teamwork and communication skills may start to degrade after 5 weeks of no simulations.

Theoretically, group activities involve teamwork and communication skills and therefore could possibly be used to substitute simulations in maintaining those skills throughout the semester. However, since no group activities occurred between simulations in any of the cohorts, it is not possible to determine if group activities might be able to substitute simulations as an activity that can be used to prevent teamwork and communication skills degradation. As group activities

potentially are less expensive than simulations to implement in the educational and clinical setting, future studies should consider looking to see the feasibility of substituting simulations with group activities to maintain competency in acquired teamwork and communication skills.

The largest gap between graded and ungraded team simulations among all cohorts was 7 weeks in 2 that separated the 2nd team simulation and 3rd team simulation. The 6 week gap corresponded with the decreased average team score in Fall 2012. The 4 week gap in Fall 2013 between the 2nd and 3rd simulations did not match with a decreased average team score.

Limitations of this study include a lack of control group, the retrospective nature of the study, and an insufficient power due to a small sample size. The maximum number of 3 teams among all the cohorts was due to limitations in staff, resources (facilities, mannequins, standardized patients, and the cost associated with utilizing those resources), time, and course enrollment. As course enrollment and funding for the course increases, it may be possible for newer cohorts to have more teams, which will allow for power analysis and statistical significance testing.

CONCLUSIONS

Interprofessional teams of health professional students acquired a high level of competency in teamwork and communication skills after completing at least 2 simulations together. Frequency of simulations may affect maintenance of teamwork and communication skills. Interprofessional student teams should consider doing simulations at least once every 4 weeks to maintain competency in teamwork and communication skills.

ACKNOWLEDGEMENT

The authors would like to acknowledge the faculty and staff of the UNC Clinical Skills and Patient Simulation Center for conducting simulations and evaluating team performance during simulations. The authors would, in particular, like to acknowledge Jackson Szeto and Shelby Marx for their technical assistance. Drs. Jacqui McLaughlin and Julia Khanova provided invaluable initial statistical consultation.

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Table 1. Demographics of All Cohorts

Cohort	Fall 2011	Fall 2012	Fall 2013
Total number of students	9	16	15
MD students	2	3	4
PharmD students	4	6	7
RN students	3	7 ^a	4
Number of teams	2-3 ^b	3	3
Size of teams (Number of members per team)	3-5 ^b	5-6 ^c	5
Number of total simulations	6	6	6
Number of graded simulations	3	4	4

- a. In Fall 2012, 2 students of unidentified affiliation participated in Simulation #1 before dropping the course before Simulation #2. The demographics of the cohort for Simulation #1 included 3 MD students, 6 PharmD students, 6 RN students and 2 students with unknown affiliations. 1 RN student added the course after Simulation #1 but before Simulation #2.
- b. In Fall 2011, students were divided into 2 teams for Simulation #2 where 1 team had 4 members and the other team had 5 members. For Simulation #3 and Simulation #4, students were divided into 3 teams, each having 3 members.
- c. In Fall 2012, students were divided into 2 teams of 6 members and 1 team of 5 members for Simulation #1. For Simulations #2, #3 and #4, students were divided into 1 team of 6 members and 2 teams of 5 members.

Figure 1. Comparison of average team scores between cohorts.

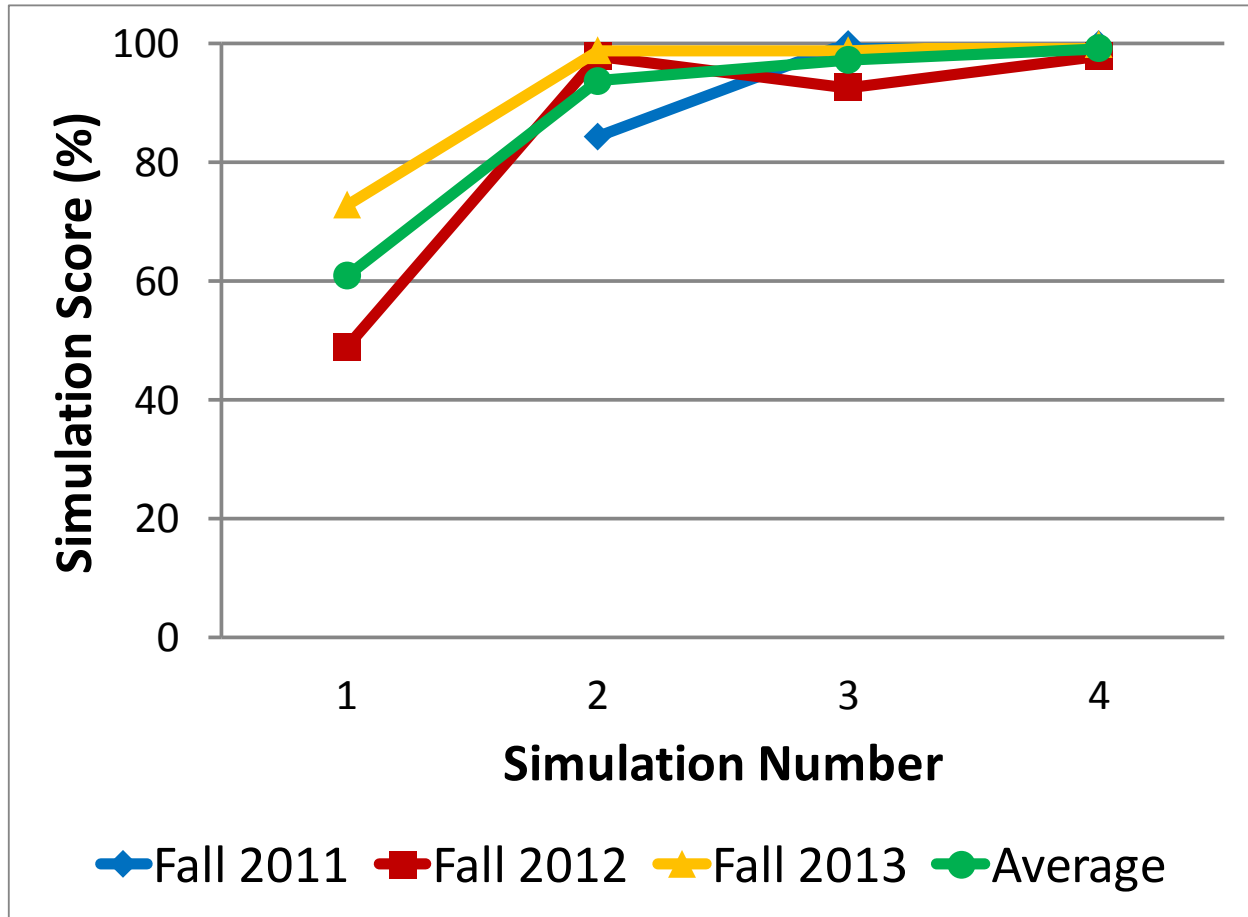


Figure 2. Comparison of individual team scores in the Fall 2012 cohort.

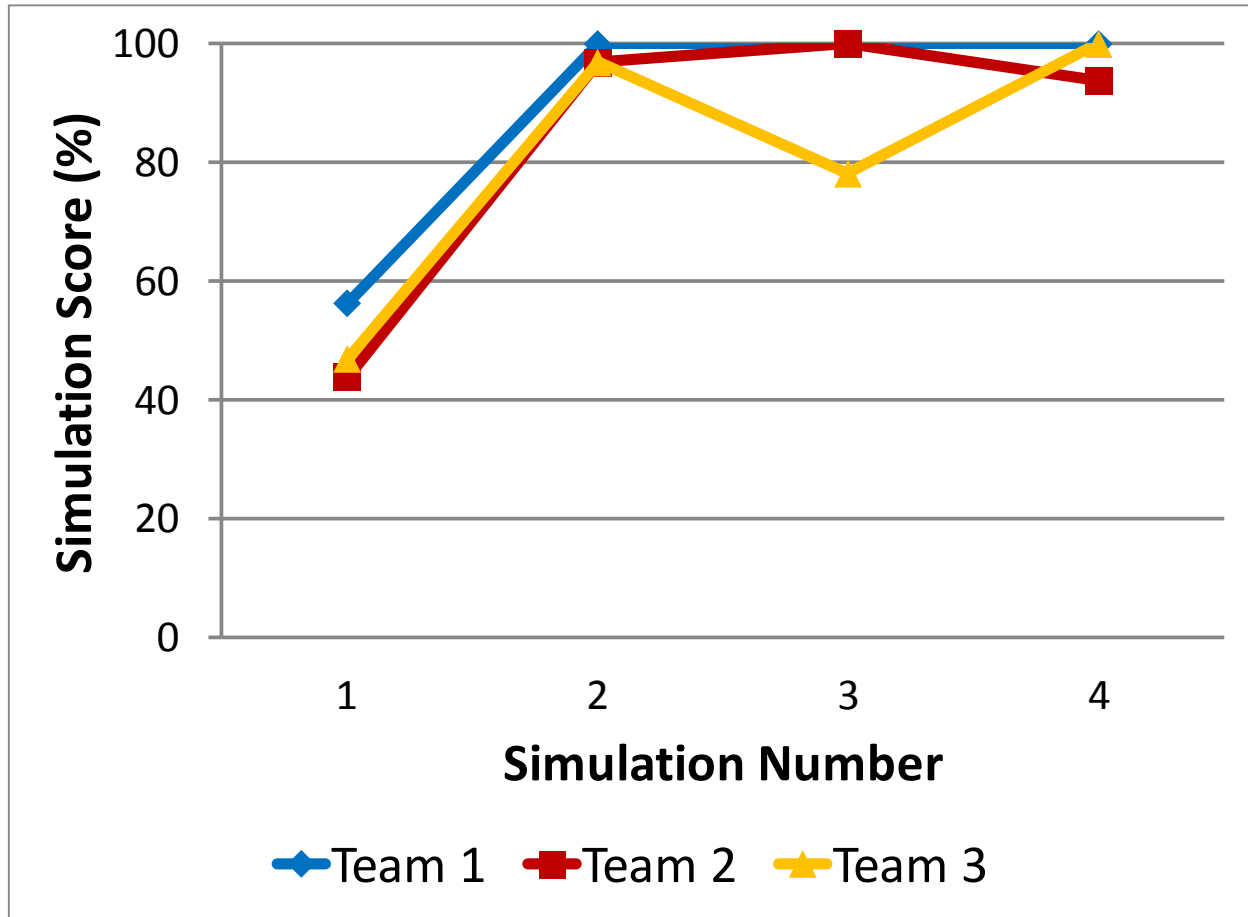


Figure 3. Comparison of course schedules and types of course activities between cohorts.

Class #	Fall 2011 Cohort (n =2-3)	Fall 2012 Cohort (n = 3)	Fall 2013 Cohort (n = 3)
1	Group activity ^a	Group activity	Group Activity
2	Simulation (ungraded)^b	Simulation #1	Simulation #1
3	Simulation #2	Individual clinical activity	Individual clinical activity
4	Individual clinical activity	Simulation #2	Simulation #2
5	Lecture ^c	Lecture	Lecture
6	Video ^d	Video	Video
Break	(2 weeks)	(2 weeks)	(2 weeks)
7	Lecture	Lecture	Simulation #3
8	Simulation (ungraded)	Simulation #3	Lecture
9	Simulation #3	Simulation (ungraded)	Simulation (ungraded)
10	Simulation (ungraded)	Simulation (ungraded)	Simulation (ungraded)
11	Simulation #4	Simulation #4	Simulation #4
12	Individual clinical	Individual clinical	Individual clinical

	activity	activity	activity
13	Group activity	Group activity	Group activity
14	Exam	Exam	Exam

- a. For all 3 cohorts, team building exercises were completed during Class 1 while group presentations occurred during Class 13.
- b. The first ungraded simulation for the Fall 2011 cohort was the “Intro – Cocaine” simulation that was then used as Simulation #1 for in 2012 and 2013.
- c. Lectures occurred in the majority of classes for all 3 cohorts up to Class 13. Exceptions for the Fall 2011 cohort were Classes 6, 8 and 9. Exceptions for the Fall 2012 cohort were Classes 6, 9 and 11. Exceptions for the Fall 2013 cohort were Classes 6, 9 and 11.
- d. The video shown in the class was “The Story of Lewis Blackman” from “The Faces of Medical Error...From Tears to Transparency” video series produced by Transparent Learning Inc.

Appendix 1. Interprofessional Communication and Teamwork Skills Tool based on the Mayo High Performance Teamwork Scale

1. Members of the group: _____
2. Graded by: _____

PROCESS – Leadership

3. Does the team identify a leader at the onset of assessment?
 - 0 – No Action
 - 1 – Unacceptable / Borderline Performance
 - 2 – Acceptable Performance
 - 3 – Above Average Performance
 - 4 – Exemplary / Model Performance
4. Does the leader solicit input from other team members? (SBAR, triage note, expert opinion)
 - 0 – No Action
 - 1 – Unacceptable / Borderline Performance
 - 2 – Acceptable Performance
 - 3 – Above Average Performance
 - 4 – Exemplary / Model Performance
5. Does the leader guide team members through process? (Intervene as needed, elicits team member participation)
 - 0 – No Action
 - 1 – Unacceptable / Borderline Performance

- 2 – Acceptable Performance
 - 3 – Above Average Performance
 - 4 – Exemplary / Model Performance
6. Does the leader ensure patient comprehension of process and final recommendation?
- 0 – No Action
 - 1 – Unacceptable / Borderline Performance
 - 2 – Acceptable Performance
 - 3 – Above Average Performance
 - 4 – Exemplary / Model Performance

PROCESS – Shared Mental Model

7. Does the team identify and voice the task at hand? (Situation Awareness; team identifies problem)
- 0 – No Action
 - 1 – Unacceptable / Borderline Performance
 - 2 – Acceptable Performance
 - 3 – Above Average Performance
 - 4 – Exemplary / Model Performance
8. Does the team assess the tools at hand? (Identifying team member expertise and equipment available)
- 0 – No Action
 - 1 – Unacceptable / Borderline Performance
 - 2 – Acceptable Performance

- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

9. Do team members recognize their role/responsibility for the case?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

10. Do team members share information with each other throughout the case? (Voice activities aloud, offer input as necessary)

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

11. Do team members call attention to actions that they feel could cause errors or complications?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

12. Does the team effectively use huddles to assess situations?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

13. Do team members adjust procedures to avoid errors?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

14. Do the team members ensure team comprehension of process?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

15. Does the team use appropriate structured-language? (CUS words, SBAR, checkback, call-out)

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance

- 4 – Exemplary / Model Performance

16. Does the team use positive and/or encouraging language with each other?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

17. Does the team use positive and/or encouraging language with the patient?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

18. Do the team members provide feedback after encounter?

- 0 – No Action
- 1 – Unacceptable / Borderline Performance
- 2 – Acceptable Performance
- 3 – Above Average Performance
- 4 – Exemplary / Model Performance

19. Feedback

- Yes: _____
- No

Appendix 2. Descriptions of Graded and Ungraded Simulations Completed by Interprofessional Student Teams

Simulation Number	Simulation Name	Simulation Scenario
1	Intro – Cocaine	Team sees a patient (high-fidelity mannequin ^a) that was brought to the ER and need to determine the cause of patient's condition.
2	Sara Tomlin	Team encounters a patient (high-fidelity mannequin) while on rounds and needs to determine the cause of the patient's worsening condition. A family member (actor) and a significant other (actor) are available for the team to interview.
3 or 4 ^b	Heparin	Team encounters a patient (high-fidelity mannequin) while on rounds and needs to determine the cause of the patient's newly occurring condition. A nurse from the prior shift (actor) is available for the team to interview.
3 or 4 ^b	Rodriguez	Team sees a patient (high-fidelity mannequin) in the ER and needs to decide on initial treatment and whether to admit the patient with a family member (actor) in the room.
N/A (ungraded)	Mock Trial ^c	Students role-play a malpractice civil court hearing with the assistance of law students and a lawyer. Health professional students are assigned to act as jury member, expert witness (for either defense or plaintiff) or defendant. Law students act

		as attorneys while the lawyer presided as judge.
N/A (ungraded)	Basic Life Support (BLS) ^d	Team responds to a rapid response call where BLS needs to be performed on the patient (mannequin) while a family member is in the room (actor).

- a. Dialogue for all the high-fidelity mannequins used in the simulations throughout the semester for all 3 cohorts were done by CSPSC faculty and staff and differed for each team depending.
- b. For the Fall 2011 cohort, the Rodriguez simulation was Simulation #3 while the Heparin simulation was Simulation #4. For the Fall 2012 and Fall 2013 cohorts, the Heparin simulation was Simulation #3 while the Rodriguez simulation was Simulation #4.
- c. For the Fall 2011 cohort, the Mock Trial simulation occurred during Class 8. For the Fall 2012 and 2013 cohorts, the Mock Trial simulation occurred during Class 9. The simulation took place at the court room at the UNC School of Law.
- d. For all 3 cohorts, the BLS simulation occurred during Class 10.