Interprofessional Escape Room: Evaluating Teamwork among Healthcare Profession Students

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ABSTRACT

Purpose: The aim of this study is to evaluate interprofessional teamwork amongst health professions students in an escape room and compare the evaluation of teamwork to the time it takes to "escape the room."

Methods: 42 interprofessional student teams of MD, PA, PT, and OT students participated in an escape room and 40 teams were included in the final data analysis. Each team was evaluated using a modified version of the Jefferson Teamwork Observation Guide (JTOG). Primary outcomes: total JTOG score, overall impression of teamwork score, and escape room time. Secondary outcomes: IPEC theme scores (themes represented in the JTOG) of leadership, communication, roles and responsibilities, and values and ethics.

Results: Total JTOG scores had little correlation to escape room time (correlation coefficient = 0.084). Teams with higher overall impression scores tended to escape faster; for every 1-point increase in score, escape room time decreased by 4.78 minutes (95% CI -7.01, -2.55; $p<0.001$). For every 1-point increase in the leadership theme, teams took 1.07 minutes longer to escape (95% CI 0.11, 2.04; $p=0.031$). For every 1-point increase in the teamwork theme, teams took 15.2 minutes longer to escape (95% CI 6.61, 23.7; $p=0.001$). For every 1-point increase in the communication theme, teams escaped 2.55 minutes faster (95% CI -5.33, 0.23; $p=0.07$).

Conclusion: Teams that escaped the room the fastest had higher overall impression scores of teamwork and higher communication theme scores. Overall, greater team functioning and communication clinically translates to teams being faster and more efficient at problem-solving and moving through tasks.

INTRODUCTION

The original concept of escape rooms originally began in Japan in 2007, reaching Eastern Europe by 2011, and finally the U.S. mainland by 2012.[1] Participants in escape rooms are locked in a room with clues, puzzles, and challenges they must solve in order to "escape the room" before time runs out. Escape rooms require critical thinking and teamwork. Teams that include a variety of personalities and thinkers best mirror realistic professional teams. Additionally, communication is necessary and helpful for the distribution of tasks and makes effective use of time.[2] Originally developed from computer gaming and designed for group entertainment, the escape room concept has recently gained interest from the workplace and educational programs. Additionally, incorporating opportunities for peer-group learning amongst students helps foster the development of leadership and teamwork skills through real life practice and application.[3]

Many health profession programs are utilizing escape rooms as an interactive game-based learning experience to reinforce concepts and clinical knowledge for their respective programs.[4-5] Specifically, medical education is increasingly making efforts towards providing active learning processes that engage students outside of traditional didactic models. Thus, escape rooms could serve as an effective activity to enhance and promote teamwork of multidisciplinary teams of health professions students, while also providing a setting to evaluate and observe teamwork amongst these teams.

According to the National Center for Interprofessional Practice and Education, team-based and collaborative care models are needed, starting with students and

continuing into professional settings, to ensure the highest quality of care in all settings and professions.[6] The goal of interprofessional practice and education (IPE) is to create high-functioning teams to improve the overall experience and outcomes of healthcare. Interprofessional practice became a topic of interest after the Institute of Medicine produced reports that brought concerns about medical errors, patient safety, and the quality of healthcare delivered in the US.[7] These reports demonstrated a lack of teamwork, collaboration and communication that lead to adverse and costly outcomes, thus the need and importance for health professionals to work better together in teams.

IPE is now a strong recommendation or requirement among accrediting bodies of many health professions.[8] A critical component of implementing IPE is assessing the performance of teams and team members in order to provide guidance on improving team functioning. Currently, most literature on IPE examines attitudes towards other professions or knowledge about interprofessional care. There is a lack of research regarding assessments of concrete teamwork behaviors and clear definitions and objectives of team behaviors. Thus, in order for IPE to have a successful impact within institutions and generate positive change of modifiable behaviors, these behaviors must be measured objectively. As the first of its kind, our study aims to objectively evaluate interprofessional teamwork of health professions students during an escape room and compare the evaluations to the time it takes to "escape the room." This study hopes to lay the groundwork for institutions to use escape rooms as means of assessing interprofessional team functioning.

METHODS

Participants

Medical, physician assistant, physical therapy, and occupational therapy students were placed into interprofessional teams at the University of Arizona College of Medicine - Phoenix and Northern Arizona University Graduate Program as part of their Longitudinal Patient Care Course. The team members were previously familiar with one-another as part of their course and participated in a healthcare-related escape room. There were 42 total teams with 5-6 students per team, with a minimum of one student from each program in every team. The study was approved by the University of Arizona's Institutional Review Board and consent was obtained from participants.

Escape Room

The escape room was held in the simulation center at the Phoenix Biomedical Campus. The escape room was designed to include puzzles and challenges from each health profession, and each team had identical puzzles and setup. Prior to participation each participant recorded if they had ever participated in an escape room prior this event. The teams had 30 total minutes to "escape" and each team was video recorded.

JTOG Observation Tool

A modified version of the Jefferson Interprofessional Observation Guide (JTOG) was used as the observation tool for evaluating teamwork and collaboration. The original JTOG was designed to help assess the extent to which a team being observed is behaving as an interprofessional team, and was developed by an interprofessional evaluation

committee consisting of individuals knowledgeable about IPE from the professions of medicine, nursing, physical therapy, occupational therapy, pharmacy, and an educational and experimental psychologist and medical sociologist.[9] The original JTOG is a 14-item Likert-scaled tool, ranging from [1] strongly disagree to [4] strongly agree, or [0] not applicable, and contains identifiable characteristics of well-functioning teams. The items were examples of effective team functioning based on the literature of team building and collaboration that reflect the Interprofessional Education Collaborative (IPEC) Expert Panel IPE domains of communication, roles and responsibilities, teamwork, and values and ethics, with the addition of a leadership domain from the JTOG evaluation committee.

The evaluators watched several example videos of teams from the escape room trial-runs and created a set of guidelines and behaviors for each item of the JTOG. Some items of the JTOG were not applicable to the 4-point Likert-type scale in an escape room setting and team behaviors presented as binary, either present or not during the escape room. Therefore, we modified our JTOG to select either [2] disagree or [3] agree for eight items (see Figure 1). We automatically selected [0] not applicable for three items that represented the “roles and responsibilities” IPEC competencies, as we were not able to identify individual student roles/professions in the escape room event.

Jefferson Interprofessional Observation Guide

Team Characteristic	Strongly Disagree [1]	Disagree [2]	Agree [3]	Strongly Agree [4]	NA [0]
1. There appeared to be a team leader that coordinated the discussion (L)		☐	☐		☐
2. The team leader facilitated the discussion rather than dominated it (L)		☐	☐		☐
3. Members of the team came prepared to discuss the case/situation from their profession specific perspective (R)					X
4. Members of the team who were involved in the case/situation contributed to the discussion (C)		☐	☐		☐
5. Discussion was distributed among all team members (C)		☐	☐		☐
6. Members of the team appeared to understand the roles and responsibilities of other members of the team (R)					X
7. Team members appeared to have respect, confidence, and trust in one another (v)	☐	☐	☐	☐	☐
8. Team members listened and paid attention to each other (C)	☐	☐	☐	☐	☐
9. Team members listened to and considered the input of others before pressing their own ideas (C)		☐	☐		☐
10. Team members added other supporting pieces of information from their profession specific perspective regarding the case/situation (R)					X
11. The opinions of team members were valued by other members (V)	☐	☐	☐	☐	☐
12. Team members appeared to feel free to disagree openly with each other's ideas (V)		☐	☐		☐
13. Team members sought out opportunities to work with others on specific tasks (T)		☐	☐		☐
14. Team members engaged in friendly interaction with one another (T)		☐	☐		☐

Figure 1. Our modified version of the JTOG. Not applicable was selected for the roles and responsibilities items. Eight items were binary selections of either [2] disagree or [3] agree and three items remained as a Likert-scale ranging from [1] strongly disagree to [4] strongly agree.

Evaluators also provided an overall impression score of team performance at 7:00 minutes into the escape room, by selecting [1] poor team performance, [2] average team performance, or [3] good team performance. 7:00 minutes was selected as the cutoff to provide a score in order to limit potential bias that would arise after learning if a team successfully escaped the room and how quickly they escaped after watching the entire recording. The time it took to complete the escape room was recorded. If a team did not successfully complete the escape room by the allotted 30-minute window, 30 minutes was automatically recorded.

Evaluators

Two out of the four original evaluators were able to achieve unanimous scoring after scoring several trial run of example videos. Thus, these two evaluators scored the teams for the final data analysis. The evaluators were a fourth-year medical student who created the escape room puzzles and one program faculty from the medical campus who also helped assemble the individual puzzles. The medical student evaluated a medical class of a graduation year different from their own. Each evaluator watched the recording of each team after the event and completed the modified JTOG.

Statistical Analysis

Participant characteristics were reported as means with standard deviations for continuous and Likert variables, and frequencies with percentages for categorical variables. Kappa statistics were used to assess inter-rater reliability for survey components between the raters. Finally, multivariable linear regression was used to

assess the mean difference in time relative to participant characteristics and the IPEC themes. Multivariable ordinal logistic regression was used to associate the number of students with previous escape room experience and IPEC themes with the odds of having an increased overall impression score. All p-values were two-sided and $p<0.05$ was considered statistically significant. All data analyses were conducted using STATA version 15 (College station, Texas).

RESULTS

In total, 42 teams participated in the escape room event. One team did not consent, and one team had an incorrect room setup for the event. Data was collected from 40 total teams; however, the overall impression score was reported for only 33 teams due to the addition of this metric after beginning our data collection, and we were unable to re-watch the previously viewed videos to capture this metric without bias. As shown in Table 1, the mean total JTOG score of the 40 teams was 30.9 (SD±1.68). Of note, JTOG item #4 and JTOG item #13 had unanimous scoring, in which each team received a score of [3] strongly agree (SD±0). As shown in Table 3, the majority of teams (N=17/33, 51.5%) scored average for overall impression scores and the mean escape room time was 22.8 minutes (SD±5.22). The comparison of total JTOG scores to escape room time for all teams is represented in Figure 1, with a correlation coefficient of 0.084.

JTOG Item Number, Description, and IPEC Theme	**Mean Score, Scored by Raters (SD)**
1. There appeared to be a team leader that coordinated the discussion (Leadership)	2.20 (0.41)

2. The team leader facilitated the discussion rather than dominated it (Leadership)	0.50 (1.04)
4. Members of the team who were involved in the case/situation contributed to the discussion (Communication)	3.00 (0)
5. Discussion was distributed among all team members (Communication)	2.61 (0.49)
7. Team members appeared to have respect, confidence, and trust in one another (Values and Ethics)	3.87 (0.40)
8. Team members listened and paid attention to each other (Communication)	3.95 (0.22)
9. Team members listened to and considered the input of others before pressing their own ideas (Communication)	2.06 (0.23)
11. The opinions of team members were valued by other members (Values and Ethics)	3.73 (0.67)
12. Team members appeared to feel free to disagree openly with each other's ideas (Values and Ethics)	2.97 (0.16)
13. Team members sought out opportunities to work with others on specific tasks (Teamwork)	3.00 (0)
14. Team members engaged in friendly interaction with one another (Teamwork)	2.95 (0.22)
Total JTOG Score	30.9 (1.68)

Table 1. Mean scores of individual JTOG items.

IPEC themes	**Mean (SD)**
Values and Ethics	10.6 (1.04)
Communication	8.62 (0.62)
Teamwork	5.95 (0.22)
Leadership	2.70 (1.43)

Table 2. Mean scores of IPEC themes.

Overall Impression of Teamwork Scored at 7 minutes	**N (%)**
Poor	5 (15.2)
Average	17 (51.5)
Good	11 (33.3)
Escape Room Time	**Mean (SD)**
Time	22.8 (5.22)

Table 3. Overall impression of teamwork scores and mean escape room time.

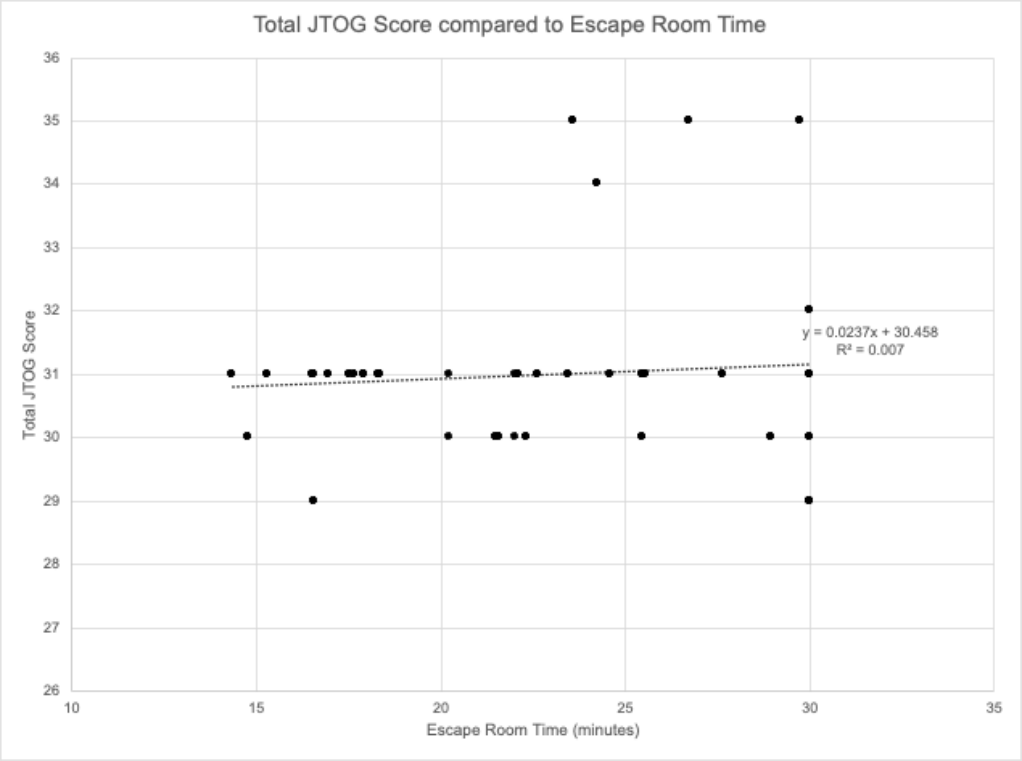

Figure 2. Correlation of total JTOG score to escape room time. Correlation Coefficient = 0.084.

The results from Table 4 were separated into three categories of escape room time for purposes of statistical analysis. There were 13 teams in the 0-20 minute escape room time group, 16 teams in the 20-28 minute group, and 9 teams in the 28-30 minute group. The overall impression score increased with teams that had shorter escape room times. Of statistical significance, every 1-point increase in overall impression score correlates to teams escaping 4.78 minutes faster (95% CI -7.01, -2.55; $p<0.001$). Every 1-point increase in the teamwork theme score correlates to teams taking 15.2 minutes longer to escape (95% CI 6.61, 23.7; $p=0.001$). For every 1-point increase in the leadership theme score, teams took 1.07 minute longer to escape (95% CI 0.11, 2.04; $p=0.031$). While not statistically significant, for every 1-point increase in communication theme

score, teams escaped faster and escape room time decreased by 2.55 minutes (95% CI -5.33, 0.23; p=0.07). Lastly, the values and ethics theme scores had little effect on escape room time, where 1-point increase in scores in this theme correlates to an additional 0.64 minute in escape room time (95% CI -1.26, 2.54; p=0.49). Additionally, the mean number of students in each team with previous experience with an escape room was 2.20 (SD±1.38) and did not have any statistically significant effect on escape room time (p=0.28) or overall impression score (p=0.97).

	Time 0-20 min (n=13)	**Time 20-28 min (n=16)**	**Time 28-30 min (n=9)**		
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Beta (95% CI)***	**p-value**
IPEC Theme: Values and Ethics	10.8 (0.81)	10.8 (0.84)	10.0 (1.45)	0.64 (-1.26, 2.54)	0.49
IPEC Theme: Communication	8.84 (0.37)	8.67 (0.47)	8.22 (0.94)	-2.55 (-5.33, 0.23)	0.07
IPEC Theme: Teamwork	5.92 (0.27)	5.94 (0.23)	6.00 (0)	15.2 (6.61, 23.7)	0.001
IPEC Theme: Leadership	2.23 (0.81)	2.67 (1.51)	3.44 (1.68)	1.07 (0.11, 2.04)	0.031
Overall Impression Score at 7 minutes	2.55 (0.68)	2.32 (0.54)	1.57 (0.51)	-4.78 (-7.01, -2.55)	<0.0001
Number of Students with Previous Escape Room Experience	2.53 (1.47)	1.87 (1.23)	2.44 (1.38)	-0.59 (-1.72, 0.52)	0.28

Table 4. Correlations of escape room time compared to themes, overall impression score, and number people with previous escape room experience. *Multivariable linear regression.

DISCUSSION

To date, studies have investigated participant satisfaction, usefulness, and attitudes of escape rooms in an educational and/or interprofessional setting. However, this study was the first of its kind to directly measure teamwork amongst interprofessional student teams in the setting of an escape room and compare teamwork evaluations to the time it took teams to escape. Overall, the scores of the JTOG did not vary widely between teams, as the mean was 30.9 with a standard deviation of 1.68. Each team had a score of 'agree' for two items in the JTOG: item #4 (Members of the team who were involved in the case/situation contributed to the discussion) and item #13 (Team members sought out opportunities to work with others on specific tasks). This unanimous score for each team contributed to the low variability between total JTOG scores. Scores for item #4 indicate that each person in the interprofessional team contributed to working through challenges in the escape room. Item #13 scores indicate that each team attempted to work with others to complete puzzles in the escape room. Additionally, by modifying the JTOG for the purposes of the escape room setting, only 3 items had the full Likert 4-point scale, and 8 items were binary on a 2-point scale of disagree or agree, which also contributed to the low variability between total JTOG scores.

Originally, we hypothesized that teams with greater total JTOG scores would escape faster. To our surprise, very little correlation exists between total JTOG scores and escape room time, with an insignificant correlation coefficient of 0.084 (see Figure 2.) We found that some teams were stuck on certain puzzles in the escape room and despite

displaying good teamwork behaviors, could not move forward and did not successfully complete escape the room on time. Of note, the number of participants in each team with prior escape room experience was not a confounding factor to our results. While we did not see a correlation between total JTOG scores and escape room time, there were statistically significant correlations when comparing the various IPEC themes within the JTOG to escape room time. Interestingly, the teamwork theme had a negative correlation to escape room time. For every 1-point increase in teamwork score, it would take teams an additional 15.2 minutes to escape. We infer that teams with greater teamwork behaviors (represented in the JTOG by friendly interactions and working together with task-solving) may not be as time-efficient in an escape room setting. This may clinically translate to the idea that successful teamwork in interprofessional teams may not be as quick to problem-solve and move through tasks.

Another finding that had a negative correlation is the leadership theme. Teams that had higher leadership scores took 1.07 minutes longer to escape for every 1-point increase in score. Perhaps in the purposes of an escape room, having a team leader may have the opposite effect on efficiency of completing tasks when there are so few team members, and the team would benefit with an additional member to solve puzzles instead of directing tasks. Additionally, JTOG scores are innately higher if a leader is present in the team. Item #2 in the JTOG (assessing team leader behaviors) can only be given a numerical score if a team leader is present. If no team leader is present, then the score defaults to not applicable with a score of 0, which may have skewed the results.

Lastly, the communication theme has a positive correlation worth discussing. For every 1-point increase in communication scores, teams escaped 2.55 minutes faster. While not statistically significant likely due to the small sample size of the study, this may be clinically significant, indicating interprofessional teams that have greater communication are more efficient, moving through tasks and problem-solving quicker.

The overall impression scores of teamwork scored at 7 minutes into the escape room had a positive correlation with escape room time. Teams that had greater overall impression scores tended to escape the room faster. For every 1-point increase in overall impression scores, teams escaped 4.78 minutes faster. No bias was present at 7 minutes of knowing whether a team escaped or not, nor how quickly they escaped, because no team escaped in under 10 minutes and raters were not aware prior to scoring whether a team successfully escaped. This finding suggests that teams that have higher overall perceived team functioning, particularly at the early stages of a group activity like an escape room, move through their activity more efficiently and quicker. However, this finding has the potential for bias, as this score is innately subjective and based on rater impressions.

Limitations

Our study had several limitations, one limitation being the small sample size of 42 total teams in the course within the professional programs. Currently, no validated observation tool exists to assess interprofessional teamwork in the setting of an escape room. Thus, while the JTOG is intended to be used in a variety of settings, the escape

room was not a perfectly applicable setting for that tool. This required us to significantly modify the JTOG, removing 3 items that assessed roles and responsibilities, and adjusting 8 items to a binary format instead of a Likert-scale. Additionally, there were a few technical recording and escape-room setup errors that caused some gaps in our data collection. Thus, of the 42 initial teams, 1 did not consent, 1 had incorrect room setup, and of the remaining 40 teams, only 38 had escape room times that could be recorded, and only 33 had overall impression scores due to the late addition of this data point. Lastly, while our evaluators reached unanimous scoring using the modified JTOG and our individual guideline for escape room behaviors associated with each JTOG item, neither evaluator had received prior training on evaluating and assessing interprofessional teamwork behaviors or previous experience with interprofessional education and collaboration.

Future Research

For future studies, we recommend creating an observation tool to assess teamwork that is specific to the setting of an escape room. Additionally, in the future institutions can use escape rooms as a means of assessing teamwork and providing immediate feedback regarding team functioning. Lastly, larger studies with a greater sample size should be done to expand on our results from the study.

CONCLUSION

In conclusion, our study showed that interprofessional student teams with greater overall impression scores escaped the room faster. Clinically, this translates to observed

high-functioning interprofessional teams being faster and more efficient with tasks and problem solving. Additionally, teams with greater communication scores escaped fastest, demonstrating communication as a key component of time-efficient problem solving. However, teams that had team leaders emerge in their group tended to take longer to escape. This indicates that team leaders may not necessarily help how quickly groups can move through tasks and problem-solve in an escape room activity, and ultimately slows teams down. These findings should be expanded with larger studies that use a direct observation tool that is specific to an escape room setting.

[1]**REFERENCES**

Miller, S. (2015, May 01). The art of the escape room. *Newsweek, 164* Retrieved from http://ezproxy.library.arizona.edu/login?url=https://search-proquest-com.ezproxy2.library.arizona.edu/docview/1675126754?accountid=8360

[2] Galbraith S. (2016, November 5). What in the world is an escape room, and how do you survive it?? In *KOMONEWS.com*. Retrieved from www.komonews.com

[3] Wu, C. , Wagenschutz, H. and Hein, J. (2018), Promoting leadership and teamwork development through Escape Rooms. *Med Educ*, 52: 561-562. doi:10.1111/medu.13557

[4] Adams V, Burger S, Crawford K, Setter R. Can You Escape? Creating an Escape Room to Facilitate Active Learning. *J Nurses Prof Dev*. 2018 Mar/Apr;34(2):E1-E5. doi: 10.1097/NND.0000000000000433.

[5] Eukel HN, Frenzel JE, Cernusca D. Educational Gaming for Pharmacy Students - Design and Evaluation of a Diabetes-themed Escape Room. *Am J Pharm Educ*. 2017 Sep;81(7):6265. doi: 10.5688/ajpe8176265.

[6]About Interprofessional Practice and Education. National Center for Interprofessional Practice and Education. https://nexusipe.org/informing/about-ipe.

[7] Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, DC: National Academy Press.

[8] Zorek J, Raehl C. Interprofessional education accreditation standards in the USA: a comparative analysis. *J Interprof Care*. 2013;27(2):123-130. http://dx.doi.org/10.3109/13561820.2012.718295

[9] Lyons, K. J., PhD, Giordano, C., PhD, Speakman, E., EdD, RN, Smith, K., EdD, RN, & Horowitz, J. A., RN, PhD. (2016). Jefferson Teamwork Observation Guide (JTOG): An Instrument to Observe Teamwork Behaviors. Journal of Allied Health, 45(1), 49-53.