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## A medical escape room to build intern workplace social capital in an internal medicine residency program

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### ABSTRACT

**Purpose:** Trainee well-being is a growing focus in graduate medical education. One emerging area in occupational literature is the psychosocial environment of the workplace, of which a large component is workplace social capital (WSC). WSC encompasses how well a group connects to one another. Medical escape rooms (MERs) recently have been studied in various healthcare settings and are one proposed intervention to increase WSC.

**Methods:** This is a single-center before-and-after survey study at the Loyola University Medical Center in 2021 to measure the effect of a MER on WSC amongst interns. Our Chief Resident created a 1-hour MER. WSC scores were measured using a modified version of a validated WSC scale. Scores were analyzed with paired t-test analysis and chi-square analysis. Open-ended feedback was also collected.

**Results:** Of 52 eligible intern residents, 51 (98%) participated in the MER, and 41 (80%) completed the pre- and post-activity survey. All six survey statements had a greater percentage of positive responses following the MER. The average score across all participants and questions was 4.66 out of 5 on the pre-survey, and 4.90 on the post-survey ( $p < 0.001$ ).

**Conclusions:** The MER significantly improved intern resident WSC scores, and proved a valuable addition to our curriculum.

### KEYWORDS

Education environment; internal medicine; medical education research; simulation; escape room; workplace social capital

### Introduction

Issues of poor mental health including depression, anxiety, and burnout have been identified among medical residents. In 2017, the ACGME revised their Common Program Requirements to call all accredited programs to be more direct and comprehensive in tackling issues of trainee well-being. An important contributor to trainee mental health is the psychosocial environment of the workplace. From studies examining the workplace environment, the concept of workplace social capital (WSC) has emerged over the past two decades (Kouvonen et al. 2006; Oksanen et al. 2008; Read 2014). WSC is understood as a work group's connectedness and mutual trust which fosters a sense of support and belonging, increased innovation and productivity, and improved mental health, both individually and collectively (Eguchi et al. 2018; Firouzbakht et al. 2018).

In the setting of the Covid-19 pandemic, social distancing measures that banned large or unnecessary gatherings—including resident outings, holiday parties, retreats, in-person orientation, and graduation—have been a detriment to the development of resident and faculty social capital. This disproportionately affected the 2020–2021 intern resident class who began their training in the midst of a pandemic, and had very limited opportunities to meet and connect with their co-residents outside of service obligations. To facilitate resident bonding and build WSC, the Loyola University Medical Center Internal Medicine residency program leadership designed a medical escape room (MER) activity for our intern residents.

### Practice points

- The psychosocial environment of a training program is important for trainee well-being.
- A medical escape room activity fostered resident camaraderie and connectedness.
- Immersive simulation game-based learning activities are feasible and have a promising future in medical education.

Escape rooms are an opportunity for a group to work together as they explore a space and solve mental and physical puzzles within a time limit. Several skills developed and tested in escape room activities parallel those needed for the real-life practice of medicine: critical thinking to solve medical challenges, communicating and interacting effectively with team members, and working well under time pressure. With all these correlations and the shift toward more immersive simulation-style learning in medical education, there are a growing number of reports on the use of MERs in healthcare training across several disciplines and specialties. Studies have shown that MERs can enhance learning (Adams et al. 2018; Garwood 2020), reinforce knowledge and procedural skills (Eukel et al. 2017; Kinio et al. 2019; Terrasi et al. 2020), advance a culture of safety (Diemer et al. 2019; Zhang et al. 2019), and promote interprofessionalism and communication skills (Clauson et al. 2019; Kutzin 2019; Moore and Campbell

2020). While many studies have suggested beneficial effect on trainee well-being, none to date have examined the MER activity's effect on the relationship between coworkers, or WSC. This study's objective is to model the effective implementation of a MER activity into an internal medicine residency program, and measure the activity's effect on intern resident's WSC scores, with an overall goal of promoting resident well-being.

**Materials and methods**

**Design**

This is a before-and-after survey study completed at the Loyola University Medical Center within the Internal Medicine residency program. All 52 Loyola first-year internal medicine residents (including medicine-pediatrics and preliminary interns) were invited to participate across a 5-week period in February-March of 2021.

**Intervention**

A MER was designed by a Chief Resident with approximately 50 hours of planning. The cost of all supplies to create the escape room was under a budget of \$250. The MER is designed to last up to one hour for groups of four to six residents. Interns were scheduled for time slots while on their ambulatory block, and participation was optional but encouraged. The MER contains 11 puzzles of varying difficulty, testing resident-level medical knowledge, critical thinking, puzzle solving, and skills of observation (Figure 1). Each puzzle is themed to a different medical specialty, and some require application of medical knowledge (Figure 2), while others require use of traditional escape room tools such as an ultraviolet light or scytale. The Chief Resident monitored the game in real-time over zoom and offered in-game clues where necessary. A 5-minute open-ended debrief session was held at the end of each game. The full game guide including technical details and debriefing is available to

educators upon request. The puzzle components are all mobile and are not institution-specific which would allow for ease of replication elsewhere.

**Data collection**

Pre- and post-MER surveys were administered to determine the impact of the activity on WSC and are provided in the supplemental information. Baseline WSC scores were assessed up to one week prior to the MER using a modified version of Kouvonen et al.'s validated WSC scale (2006). Follow-up WSC scores were assessed up to one week after the MER using the same WSC scale. All participants were also given the option to provide open-ended feedback on the post-MER survey.

**Data analysis**

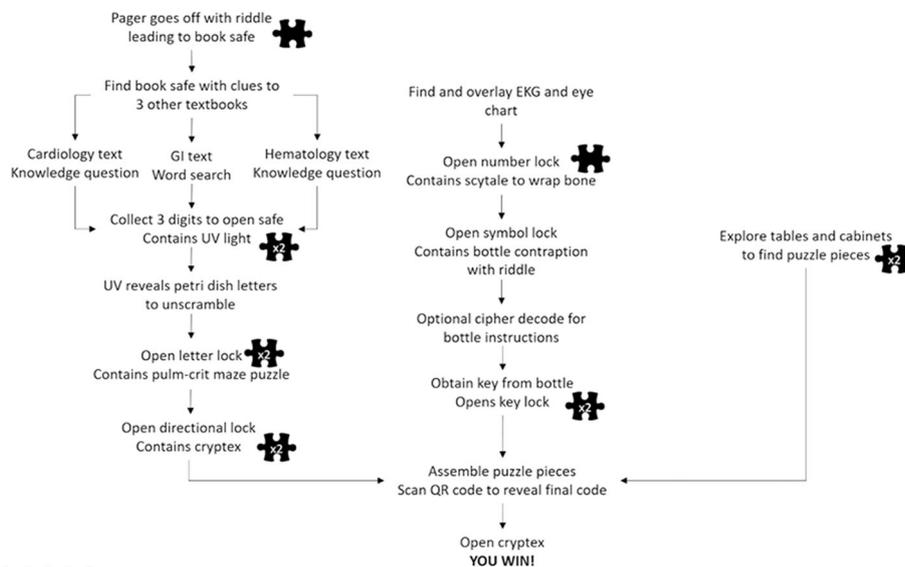
Overall numerical Likert scale scores (averaged for all questions) were compared pre- and post-MER by a paired t-test analysis. Individual questions were presented as ordinal variables. Chi-square analysis was used to compare the overall percentage of responses that agreed or strongly agreed between the pre- and post-survey. Open-ended feedback was analyzed for themes.

**Ethical considerations**

This study was determined to be exempt by the Loyola University Medical Center Institutional Review Board. Participants were informed that their participation in the MER or in the surveys was voluntary and that the data would not affect their standing or evaluation as a resident.

**Results**

A total of 51 intern residents participated in the MER, with an overall participation rate of 98% (N=52 interns). The ages of participants ranged 24–45 years. There were 10 MER sessions held with an average group size of 5.1 (range



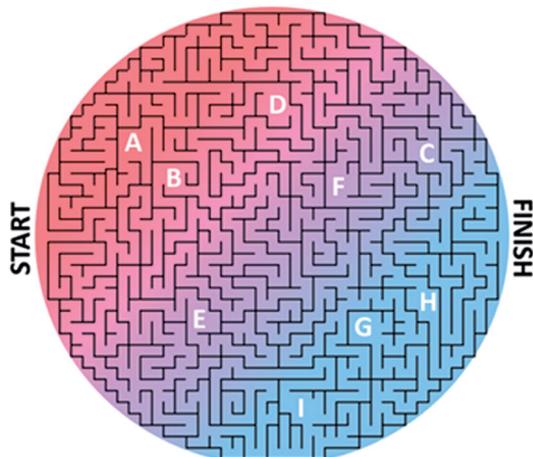
**Figure 1.** An overview of our medical escape room puzzle structure. There are 12 jigsaw pieces unlocked as challenges are solved (indicated by a jigsaw piece symbol) that collectively form a QR code to solve the final puzzle. While the puzzles can be done linearly, it is possible for participants to break off into smaller groups to work in parallel to escape more efficiently.

## Pulmonary & Critical Care

Are you in a hemodynamic state of mind?  
Time to put your shock knowledge to the test.  
Complete both maze and table to find  
Which four directions will guide you best.



Type of shock	Cardiac Output (CO)	Systemic Vascular Resistance (SVR)	Central Venous Pressure (CVP)
Hypovolemic	A	B	C
Cardiogenic	D	E	F
Distributive	G	H	I



Hint: Find the 4 letters you encounter in the maze when taking the shortest path. These correspond to directions from the chart. Use these to open the directional lock. Push the lock together twice to reset after each attempt.

**Figure 2.** A sample of puzzles from our MER which test medical knowledge. The pulmonary & critical care puzzle (left) integrated a traditional maze puzzle with knowledge of hemodynamics through various states of shock. The padlock is opened only by finding the 4 letters encountered in the most direct path through the maze and translating those into directions (up or down) based on the effect on cardiac output, systemic vascular resistance, or central venous pressure. The cardiology puzzle (right) provided a patient case and presented multiple choice answer options. The participants color in the accompanying figure for each correct answer and they are provided with a digit as their solution.

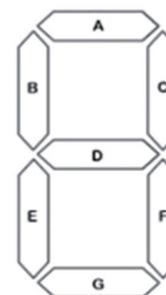
## Digit 1: Cardiology



Mr. Kardeak is a 57-year-old African American male with hypertension, hyperlipidemia, and congestive heart failure with a newly diagnosed ejection fraction of 35% who presents to clinic to establish care. He has marked limitation in activity due to dyspnea on exertion, even when walking a block, but he feels comfortable at rest. His current medications include hydrochlorothiazide and atorvastatin. His temperature is 97.7°F, blood pressure is 134/74 mm Hg, heart rate is 72 beats/minute, and his oxygen saturation is 94% on room air. On examination, his JVP extends 3 cm above the sternal angle. His heart has a regular rate and rhythm, his lungs are clear to auscultation bilaterally, his abdomen is obese but nontender and nondistended, and he has 1+ pitting edema in his legs bilaterally.

Which of the following medications would have a mortality benefit for this patient?

- A. Lisinopril
- B. Losartan
- C. Furosemide
- D. Metoprolol succinate
- E. Digoxin
- F. Spironolactone
- G. Hydralazine with isosorbide dinitrate



4–8). All teams successfully completed the MER with the help of up to 3 clues (average 1.2); the average time to completion was 38.6 minutes (range 24–49 minutes). Of the 51 intern residents who participated in the MER, 41 (80%) completed both the pre- and post-surveys.

### Survey data

Pre- and post-survey responses are shown in Figure 3. The overall numerical Likert score (when averaged for all questions across all participants) was 4.66 on the pre-survey, and 4.90 on the post-survey, out of 5 (CI 4.83–4.97,  $p < 0.001$ ). 96% (237/246) of all responses on the pre-survey were 'agree' or 'strongly agree' compared to 100% (246/246) of responses on the post-survey ( $p = 0.003$ ). 70% (172/246) of responses on the pre-survey were 'strongly agree' compared to 90% (222/246) of responses on the post-survey ( $p < 0.001$ ). All statements had a greater percentage of strongly agree responses following the MER; the items with the greatest improvement were 'Residents cooperate in order to help develop and apply new ideas' and 'Residents feel understood and accepted by each other.'

### Comment themes

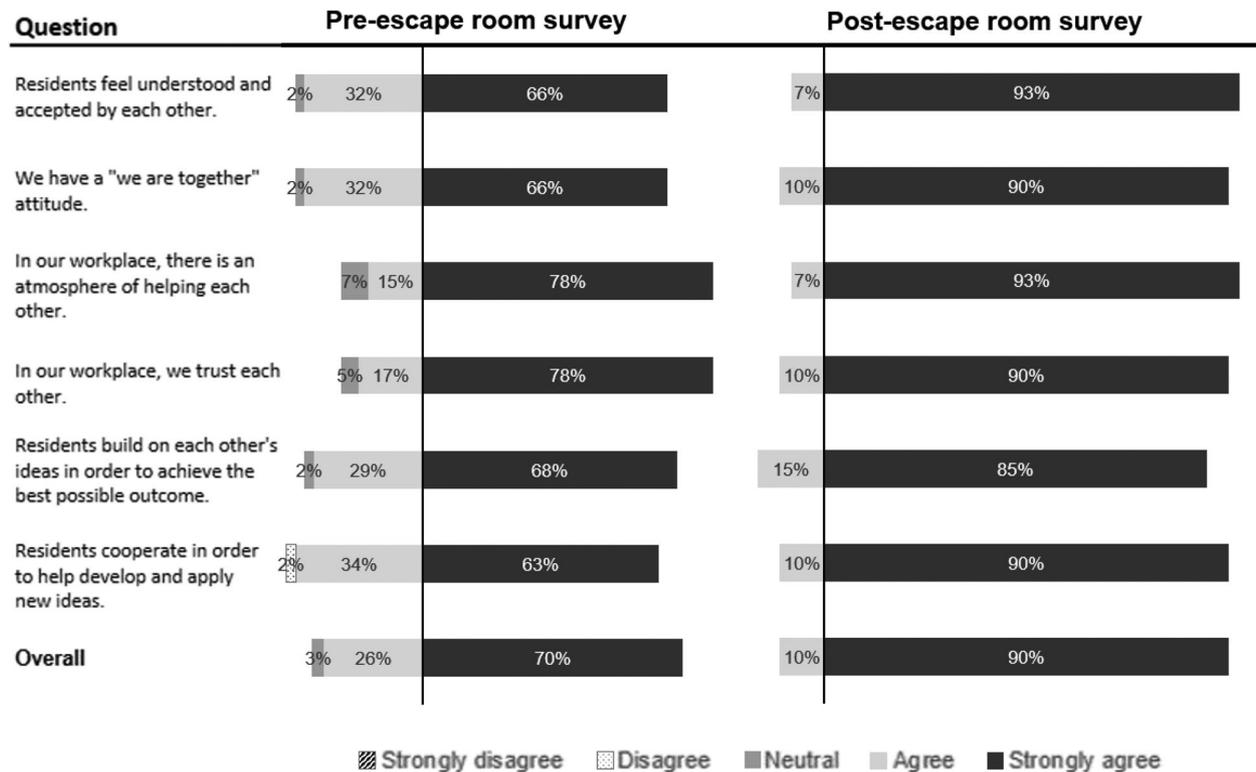
Of the 40 survey respondents, 34 provided comments, all of which were positive. Free responses centered around

three main themes: opportunity for resident bonding, fun, and a reprieve from clinical duties. A couple of comments that highlight the feedback with regards to resident bonding include: 'Great way to promote camaraderie,' 'I think this was a great bonding experience. It's nice to have dedicated time to get together,' 'Amazing activity, we had a blast and absolutely loved it. Definitely worthwhile. We will remember this all of residency and laugh about it,' and 'Brilliant idea for some of us to spend some quality time together.' A complete list of comments is provided in the Supplemental materials.

### Discussion

The pre- and post-MER survey results demonstrate a statistically significant improvement in WSC scores within a week following the MER activity. These findings were supported by free-response comments that highlighted how the activity helped the interns bond with one another. To our knowledge this is the first study to measure a metric of well-being, in this case the psychosocial environment, as affected by a MER activity. This adds to the growing list of ways that medically-themed escape room activities can potentially benefit trainees.

One surprise from the study is that the pre-MER survey had 96% of responses in the 'agree' or 'strongly agree' category for the WSC statements. This was higher than expected given how this group of interns had very limited



**Figure 3.** Workplace social capital survey responses by question and averaged overall before the medical escape room (left) and after the medical escape room (right).

opportunities for bonding and engagement outside of direct work obligations, which would be considered a detriment to WSC development. Nevertheless, even with very positive initial scores, we were still able to detect a significant improvement following our MER intervention, and the open-ended responses indicated that the MER was worthwhile. One area that was not included in our survey but that would have been interesting to study is the activity's effect on the intern resident's perception of support from the residency leadership team. Several of the free response comments expressed gratitude toward the leadership for putting together this activity for them. Anecdotally, it appeared that the intern residents were more comfortable interacting with all the Chief Residents after the activity. A trainee's trust of their supervisor and perception of their supervisor's kindness and concern for them are additional components of WSC (Kouvonen et al. 2006). This is another potential benefit to the MER activity that was not measured in our survey study.

The main limitation of this study is that it is based on self-reported survey data. Also, there is a possible selection bias as 10 intern residents (20%) who participated in the MER did not complete both surveys.

We intentionally timed our intervention during a period of low morale that typically occurs in residency around February, after the holidays have ended and the novelty and adrenaline from starting internship have worn off. Based on the free comments, this timing was appreciated by our intern class. As an alternative option, the escape room could be integrated into orientation when the interns are still settling into their new workplace environment and would benefit even more from increased social connectedness. One next step includes assessing for a sustained change in WSC scores several months after the activity. Since our aims are pointed at resident well-being, a future study could examine the effect of a MER on resident

responses to the ACGME survey wellness questions. Finally, we would like to see this activity expanded to include a broader audience. The game as designed is appropriate for medical students, senior residents, fellows, or faculty members, and would only require minor revisions to be appropriate for interdisciplinary teams.

## Conclusion

Medical escape rooms are a fun and feasible inclusion in a residency training program curriculum and offer many benefits for knowledge and communication skill building. To add to these benefits, a MER designed for our internal medicine intern residents led to a significant increase in workplace social capital scores and was very well-received in the open-ended responses. Our game guide is available upon request to other educators who are interested in implementing this in their programs. Overall, this MER is an engaging addition to our internal medicine residency program, and we plan to continue using it to promote trainee camaraderie. Based on the results of this and other MER studies, there is a promising future for experiential and immersive simulation game-based learning strategies in medical education.

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## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Glossary

**Workplace social capital (WSC):** The network of relationships amongst co-workers which enables the workplace to function effectively. This term is also used to refer to the mutual trust and connectedness of a work group, which fosters a sense of support and belonging.

**Medical escape room (MER):** A medically based and themed activity for a group to work together to explore a space and solve mental and physical puzzles within a pre-determined time limit.

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## Notes on contributors

**Michelle Lundholm**, MD, completed her internal medicine residency and Chief Residency at the Loyola University Medical Center in 2021 and is now an Endocrinology fellow at the Cleveland Clinic. Her interests include trainee wellness and logic puzzles.

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