

## Brief Report

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# Integrating Disease Investigation Escape Room and Preparedness Simulation into Nursing Education

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## Abstract

**Objective:** This report describes the implementation and evaluation of a unique escape room game/unfolding public health preparedness simulation into nursing education. The innovative approach was designed to teach disease investigation, epidemiological principles, and technical skills such as the tuberculosis (TB) skin testing techniques.

**Methods:** The escape room/unfolding health preparedness simulation was implemented with 29 pre-licensure nursing students and involved game-like activities as well as a realistic disaster simulation scenario with standardized patients.

**Results:** The project yielded positive outcomes, with students demonstrating increased knowledge and confidence. Students also recommended the simulation for teaching disaster preparedness, highlighting its effectiveness. Evaluation data also suggested refinement of the simulation around the nurses' roles.

**Conclusions:** While implementing this teaching innovation had challenges, the approach enhanced active learning, critical thinking, and teamwork in nursing education, preparing students for real-world health care challenges. The project underscores the importance of such simulations in training nursing students for public health emergencies. It also highlights the need for further research to assess long-term impacts on student outcomes, indicating the potential for continued improvement and development in the field.

In recent years, innovative teaching methodologies have gained traction in nursing education to enhance students' real-world application of knowledge through dynamic and immersive learning experiences.<sup>1,2</sup> One such innovative approach is escape room game simulations. Initially designed as recreational activities, escape room games involve immersive scenarios where players work together to solve puzzles and unlock clues to complete a mission, typically under a time constraint. These games have been adapted for educational purposes due to their potential to foster teamwork, critical thinking, and decision-making skills.

Multiple studies support the use of escape rooms as a teaching methodology. They have been shown to improve knowledge across various nursing education topics, are well-received by nursing students,<sup>3</sup> and enhance professional performance, critical thinking, and learning engagement.<sup>4</sup> Most applications of escape room teaching activities center around providing nursing care in acute care settings or teaching fundamental nursing skills. In this paper, we report our use of an escape room approach to teach public health nursing knowledge and skills, particularly around preparedness for disease outbreaks and natural disasters, as well as related epidemiologic principles. We also provide evaluation data regarding its effectiveness in bolstering students' knowledge and confidence in disaster response.

## Method

The American Association of Colleges of Nursing (AACN) has identified competencies pertinent to emergency preparedness in pre-licensure nursing programs, underscoring nurses' crucial role in responding to emergencies and disasters.<sup>5</sup> Emphasizing areas such as public health preparedness, disaster triage principles, and the nursing role in disaster response, these competencies equip pre-licensure nursing students with the essential knowledge and skills to address community and public health challenges during crises. Escape room games offer a unique way to teach nursing students competencies related to disaster preparedness by immersing them in realistic

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scenarios that simulate high-stakes situations, mirroring the dynamic challenges they may face in real-life disaster response.

Our escape room game and unfolding simulation were developed to prepare nursing students for disaster preparedness and outbreak investigation using guiding principles for escape room games outlined by Hawkins *et al.*,<sup>6</sup> Tassemyer, Rowland, and Barnason,<sup>7</sup> and the National League of Nursing's (NLN) Simulation Design Template.<sup>8</sup> We implemented a multi-component escape room game and unfolding simulation involving standardized patients for 29 pre-licensure nursing students within a population health/community health nursing course, within a private university in the southeastern region of the United States. To prepare the students for the experience, in the week preceding the escape room game and unfolding simulation, students received classroom content in a lecture format covering key topics such as public health

preparedness, principles of disaster triage, and the nursing responsibilities in disaster response. Students were also required to complete online modules on the principles of epidemiology, notifiable diseases, and the nurse's role in outbreak investigation.

On the day of the escape room and unfolding simulation, students attended a 30-minute pre-brief where faculty reviewed the simulation objectives, clarified role expectations, and provided an overview of the scenario. Students were then divided into 6 groups of 4 and 1 group of 5. Each student was assigned a role with its just-in-time description: Team leader, Assistant/Runner, Bedside Nurse, and Communicator. Two faculty were present during the escape room/simulation to facilitate the students and assure that students with challenges solving the escape room clues could receive adequate assistance.

In their groups, students first completed an escape room challenge to solve a tuberculosis (TB) outbreak in a nursing home using 6 clues related to epidemiology concepts, infection control, and disease testing. Students completed 6 tasks: completing a crossword puzzle (see Figure 1), calculating an incident rate quiz, answering a reportable disease quiz, interpreting a message written with invisible ink, finding a clue hidden in a wall clock, and creating a TB testing station set up. Each correctly executed task yielded a clue or key to open the next task. If the students wrongly completed a task, they could use a clue card to obtain assistance from the faculty. Students had up to 45 minutes to complete the escape room. After completing the escape room, students participated in a 30-minute standardized debrief where they were prompted to discuss their reactions and lessons learned, and to clarify information from faculty.

Students next participated in a second pre-brief (20 minutes duration) to receive background information regarding the unfolding simulation. While in their previously assigned groups, students completed a "rapid-response" (15 minutes duration) disaster simulation related to a tornado at the same nursing home as in the earlier escape room game. To support the simulation being as realistic as possible, the room was set-up with little to no light, a smoke machine to mimic poor air quality and visibility, the presence of debris and downed electrical wires, and 3 expired or injured nursing home residents played by trained standardized patients. The realistic simulation required students to demonstrate disaster triage, evacuation of residents, and disaster communication with the media. Upon the simulation's conclusion, students received feedback from standardized patients well-trained in giving general and scenario-specific feedback (10 minutes duration).

Students then repeated the scenario, incorporating this feedback for another 45 minutes. During the repeated scenario, students provided the rationale for their interventions and discussed actions/decisions with their teammates. The unfolding simulation concluded with a 45-minute standardized debrief, during which faculty trained in the scenarios and the standardized debriefing content discussed concepts related to the simulation objectives and lessons learned. The time frame from the initial pre-brief to the final debrief was 4 hours.

The implementation and evaluation of this educational approach was deemed as non-human subjects research by the University's Institutional Review Board (IRB) and consequently, informed consent to participate in the evaluation was not required, although the evaluation survey included a statement to confirm consent. After participating in the escape room, students completed a 24-item investigator-developed questionnaire consisting of Likert-scale items, select-all-that-apply items, and open-ended questions designed to measure the

**Table 1.** Evaluation data for escape room (n = 29) and disaster simulation (n = 11)

Post-escape room survey evaluation (n = 29)	
Item	Frequency (%) reporting "Agree" or "Strongly Agree"
After completing the escape room activity, I feel MORE knowledgeable about epidemiology than before the activity.	29 (100%)
After the escape room, I feel confident in recognizing emerging epidemics in both the United States and the world.	27 (93%)
I found the escape room format engaging.	28 (96.6%)
I prefer the escape room format of class over the traditional lecture.	27 (93%)
The escape room format did NOT help me learn to collaborate in a team environment.	2 (6.9%)
The escape room format helped me learn to communicate with other health care professionals.	28 (96.6%)
The escape room format did NOT help me learn to interpret key epidemiological data.	2 (6.9%)
The escape room format helped me to apply concepts of epidemiology.	29 (100%)
Post-unfolding disaster simulation evaluation (n = 11)	
Item	Frequency (%) reporting "Agree" or "Strongly Agree"
AFTER participating in this exercise, I have a better understanding of how to handle unforeseen situations.	10 (91%)
When confronted with a disaster scenario, I can efficiently work in a team to handle an emergency situation.	10 (91%)
It was easy to understand my role during the disaster scenario.	5 (45.4%)
It was easy to execute my role during the disaster scenario.	6 (54.5%)
My level of knowledge AFTER this training was enhanced.	11 (100%)
My level of self-confidence regarding disaster preparedness AFTER this training was enhanced.	11 (100%)

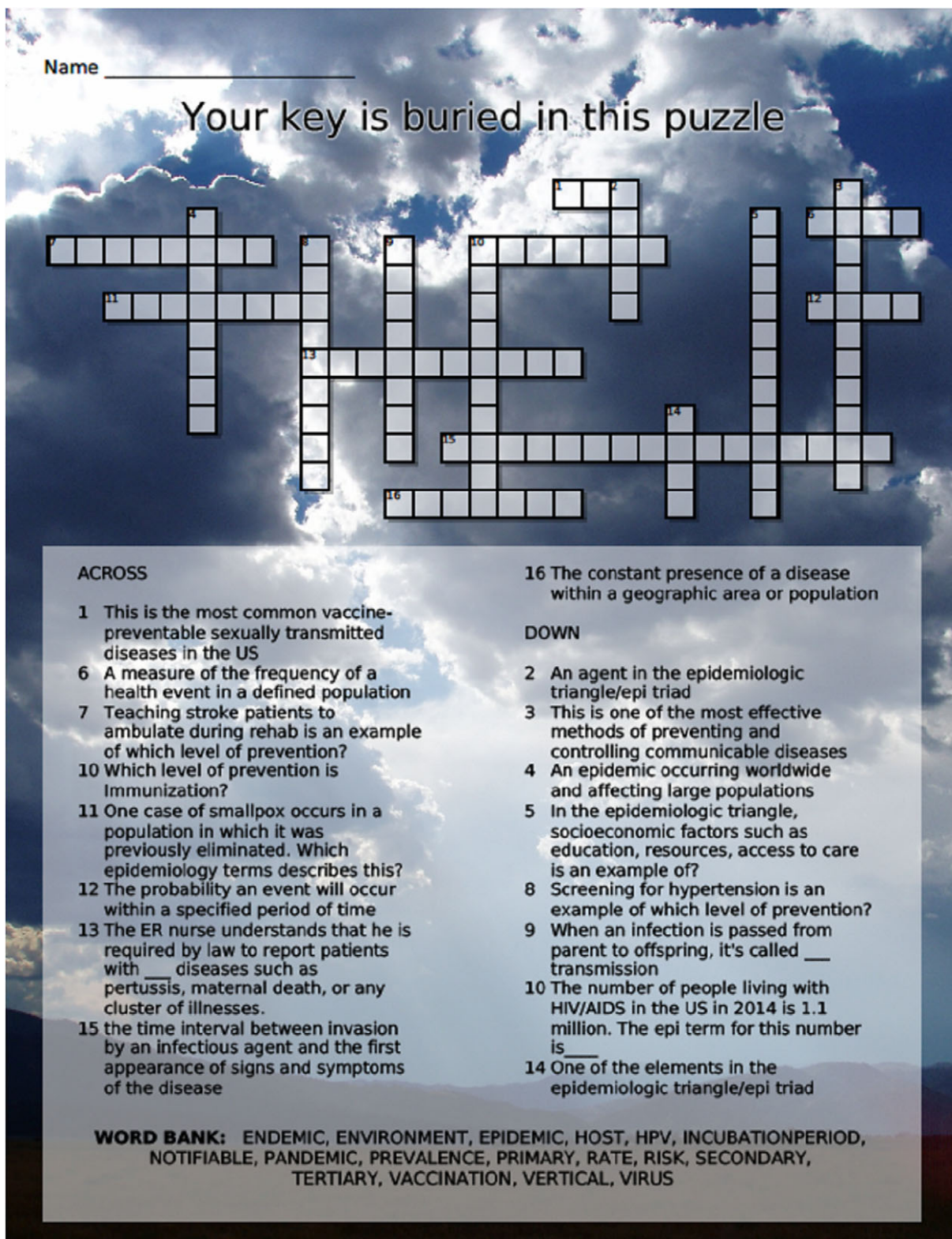


Figure 1. Crossword puzzle.

escape room’s effectiveness in improving students’ knowledge of epidemiological concepts and improving students’ confidence in applying the concepts to a disease outbreak investigation. The survey also measured students’ perceptions of the appropriateness of the escape room format for learning epidemiological concepts and disease

outbreak investigation, and students’ recommendations for improving the escape room game.

After participating in the unfolding simulation, students completed a 13-item, validated questionnaire,<sup>9</sup> designed to measure the simulation’s effectiveness in improving students’ confidence in

participating in disaster response and knowledge of disaster preparedness. The post-simulation survey also measured students' perceptions of the appropriateness of the simulation for learning disaster response and students' recommendations for improving the simulation.

## Results

Evaluation data varied in completeness. All 29 students (100%) completed the post-escape room survey, and 11 students (38%) completed the post-simulation survey. All participants found the escape room/unfolding simulation format engaging and recommended it for teaching disaster preparedness and epidemiological concepts. Overall, the evaluation data was highly positive. Students were in less agreement around the clarity of their roles during the simulation, suggesting that further refinement of the simulation could focus on role clarity during disaster response. The open-ended responses provided positive feedback and constructive suggestions for improvement, with 96.5% of participants stating they felt the exercise was excellent for teaching collaboration, a crucial skill in disaster response.

## Discussion

Within this nursing education context, the escape room/unfolding simulation effectively built student confidence and increased knowledge in disaster preparedness and outbreak investigation skills. Evaluation data were highly positive and supported continuing to use this approach to educate students in our community health/population health courses. For the simulation experience, students did not report as strong agreement around understanding their various roles within the simulation. Role clarity is a key aspect of disaster preparedness, and the course faculty will continue to refine this aspect of the simulation scenario. There were also challenges in implementing the experience. One main challenge was in relation to the space required such that student groups completing the scenario would not overhear each other and potentially compromise the integrity of the learning. There was also cost associated with implementation related to the use of standardized patients and faculty time/effort to supervise the scenarios. Some students felt the escape room game was too easy and did not enjoy the wall clock clue format. However, students enjoyed the game atmosphere and perceived it as a novel approach to bridge theoretical knowledge and practical application.

By presenting students with complex scenarios involving infectious diseases, faculty could assess students' ability to identify symptoms, trace the source of an outbreak, and implement appropriate interventions. The hands-on experience within a simulated environment enhanced students' confidence and competence in performing disaster triage and TB skin testing procedures.

## Limitations

While this pilot project underlines students' perceived strengths and weaknesses of the simulation, the number of students included in the sample size was small ( $n = 29$ ). The evaluation questionnaire did not collect the participants' demographic data such as age, gender, and prior experience with disaster scenario or preparedness education. With a limited number of participants, the findings may not accurately reflect the experiences of all learners, hindering the development of a widely applicable implementation framework for these simulations in different learning environments and with different learner groups, such as those with more life experience.

Future longitudinal research is also required to understand how students' involvement in simulations impacts future nursing practice and skills.

## Conclusion

Integrating escape room game simulations into nursing education represents a promising avenue for teaching disease investigation, epidemiological principles, and technical skills like the TB skin testing technique. This innovative approach fosters active learning, critical thinking, and teamwork, providing students with a well-rounded educational experience that aligns with the dynamic demands of health care practice. While the experience has practical application for students after they graduate from nursing school and enter practice, assuring nursing students are prepared to respond to disasters is also relevant while they are students. Several trained nursing students were recruited to respond to the mpox mass vaccination at one of the public health clinical partners immediately after the simulation. Nursing students can be valuable supplemental staff during disasters and public health emergencies if prepared to do so. However, students often are not trained to assist in disease outbreak investigation or provide support during disasters. Teaching these skills during a real-world situation would be unsafe and delay care. Simulation allows replicating real-world scenarios while offering a safe environment in which to make mistakes. Public health agencies can use escape rooms and simulations to teach epidemiological concepts and disaster preparedness to practicing public health nurses, maintaining readiness to respond. Future evaluation work should focus on assessing the long-term impact of escape room simulations on students' retention of knowledge, clinical performance, and readiness for real-world health care challenges.

**Competing interests.** All authors declare no competing interests.

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