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Gamification of Clinical Decision-Making for Medical Physics Residents

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ABSTRACT

Purpose: For medical physics residents, clinical decision-making can be a difficult skill to teach and master – most residents come from academic graduate programs with limited clinical exposure, and the regulatory nature of radiation oncology leads to limited opportunities for independent practice. The purpose of this project was to incorporate clinical reasoning practice into a medical physics residency program.
Methods: To this end, we have created a "Choose Your Own Adventure" case study-based gamified lecture series. This series allows residents to have a safe space to practice making clinical decisions and explore potential outcomes. The residents are given an initial clinical scenario, three options of what could be done next, and asked to choose how they would proceed. The situation then evolves based on the choice that was made. After the "completion" of a scenario, there is a guided discussion, focusing on endpoints different choices might have led to. Finally, the group debriefs and walks through what might have happened in similar live clinical situations.
Results: We have piloted a discussion series on clinical decision-making in radiotherapy simulation and delivery for the past three years. This has been well received by both junior and senior medical physics residents, receiving a rating of 5 out of 5 for Format, Topic, and Content (n=4) in post-session surveys.
Conclusion: We intend to expand this concept to other medical physics clinical duties including Treatment Planning, Patient and Machine Quality Assurance, and Special Procedures. A challenge of this approach is developing comprehensive multi-decision scenarios within the clinical context. We are investigating the possibility of using large language models, with output validated by clinicians, to assist with scenario generation and branching narrative development, and getting senior residents involved in scenario creation as a way to apply their own clinical knowledge.

INTRODUCTION

Clinical decision-making is a cornerstone of effective education, and a vital component of professional competence for clinicians [1]. However, teaching this skill can be challenging for medical physics residency program. The field of medical physics is rooted in objective technical principles, while actual clinical decisions are often subjective and context-dependent.

Studies have shown that gamification can improve critical thinking and problem-solving skills, while giving residents autonomy, extrinsic motivation, and a sense of control over their learning [2]. To this end, we created a 'Choose Your Own Adventure' case study-based lecture series. This allows residents to have a safe space to practice making decisions and explore potential outcomes.

METHODS AND MATERIALS

Game Design
Each scenario starts with a descriptive blurb that puts the learner in the role of the physicist for a particular clinical situation. After the scenario is described, the learner reaches an initial decision point. The narrative then continues based on the initial decision. Subsequent decision points are designed to evaluate further aspects of resident knowledge, clinical reasoning skills and soft skills.

Game Mechanics
As they traverse through the scenario, learners score one point for each decision point reached. They also receive extra points for 'red flags'. Red Flags might include decisions that could lead to patient safety events, or not following through or taking responsibility for your tasks. The learner with the lowest score after everyone has completed a scenario 'wins'!

RESULTS

To illustrate the game design, we present the example scenario in Figure 1.

Game Design
In the example, the learner is called to the machine because the intercom has stopped working during patient treatment. The initial decision options are designed to test residents' knowledge of regulatory requirements for linac-based radiation treatment, as well as survey resident knowledge of resources within the clinical environment. The subsequent decisions rely on clinical reasoning skills and soft skills such as the ability to prioritize patient treatment, the ability to problem solve creatively, task ownership, follow-through, and communication.

Game Mechanics
The fastest path through the scenario is indicated by the stars in Figure 1. Other paths might eventually reach the same conclusion, but the learner would have to go through more decision points. In practice for this scenario, this could lead to treatment delay with the patient on the table. Red flags for this scenario include not taking ownership or following through on tasks, or cancelling patient treatment so you can go home for the day.

This lecture series has been piloted for our residents for the past 3-years. The lecture series has been well-received by both junior and senior residents, receiving a rating of 5 out of 5 for format, topic, and content in post-session surveys. These lectures have also been called out as being the 'most engaging' of our didactic opportunities by by junior residents .

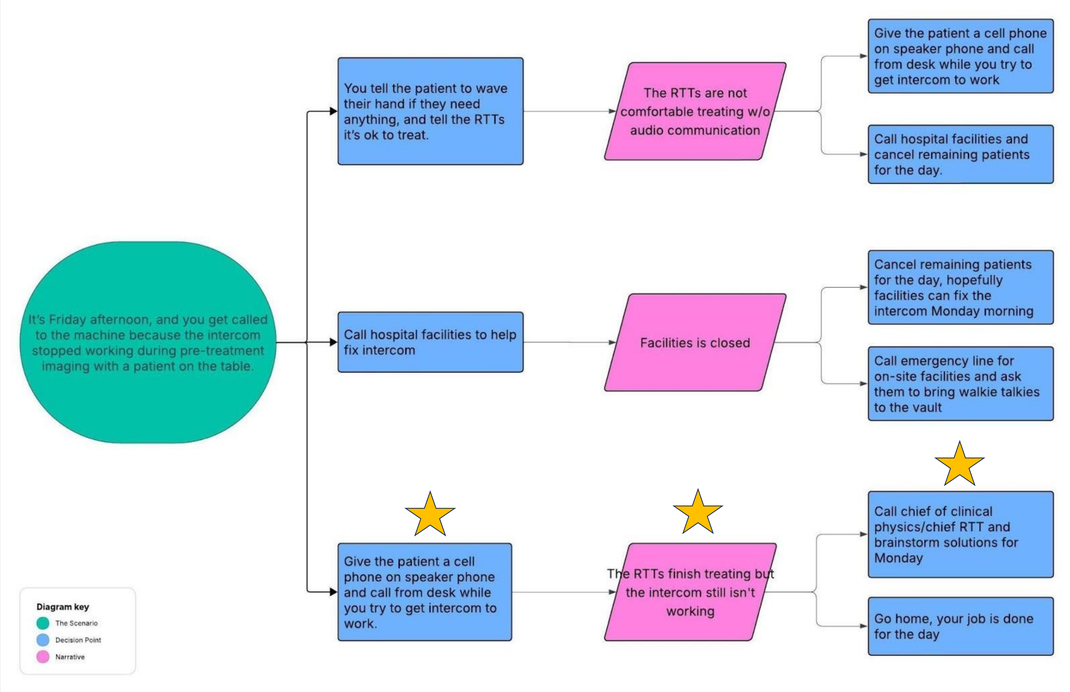

Figure 1 . Example scenario for the gamification of clinical decision making. The initial scenario is in green, decision points in blue, and narrative in pink. Stars indicate the fastest path through the scenario.

DISCUSSION

Challenges encountered during the development of the 'Choose Your Own Adventure' case-based lecture series include the labor-intensity of developing comprehensive, multi-decision scenarios within a realistic clinical context. The initial scenario development and templating took 1-2 hrs per scenario. We are investigating the possibility of using large language models to assist with scenario branching narrative development, or having senior residents contribute as a way to apply their own clinical knowledge and experience. We are also investigating the best way to template the scenarios so they can be more easily created in the future.

Ultimately, we intend to expand the concept to create additional lectures focused on other clinical medical physics duties, including:
- Treatment Planning
- Chart Checks
- Patient Quality Assurance
- Machine Quality Assurance
- Special Procedures

We intend to develop the lecture series in a way that can be shared with and appended by scenarios from other institutions.

CONCLUSIONS

Overall, the "Choose Your Own Adventure" case-based lecture series is a fun way to engage medical physics residents in clinical reasoning practice. It allows an ethical and safe environment for exploring high-stakes decisions in the Radiation Oncology clinical context.

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