

## Utilizing Medical Gaming Principles to Teach Emergency Management Strategies and Crisis Leadership during a Botulism Mass Casualty Incident

**Paul Rega\***

*Assistant Professor of Population Health and Emergency Medicine, Department of Emergency Medicine, College of Medicine, School of Population Health, College of Health and Human Sciences, University of Toledo, Ohio, United States*

**\*Corresponding Author:** Paul Rega, Assistant Professor of Population Health and Emergency Medicine, Department of Emergency Medicine, College of Medicine, School of Population Health, College of Health and Human Sciences, University of Toledo, Ohio, United States.

**Received:** October 09, 2019; **Published:** December 31, 2019

### Abstract

Educational gaming has become an accepted platform to heighten student engagement, teach complex issues, and improve knowledge retention. The United States' Federal Emergency Management Agency (FEMA) acknowledges that gaming can be an additional educational adjunct in teaching disaster management principles. To provide this education to as many healthcare professionals as possible and in the most efficacious manner the game should be simple, easily comprehensible, reproducible, economical, and transportable. This is especially important for rare, no-warning, sudden-impact events that demand a judicious, but effective response, vital inter- and intra-agency communications, and crisis leadership. A botulism mass casualty incident (MCI) is one such example. Albeit rare, botulism MCIs do occur globally and sound management demands a fundamental knowledge of the disease, the diverse techniques to assess the patients' criticality, and the specific pharmaceutical interventions required. Time to strategize during an actual event would be extremely limited. This is even more critical when a prior study has revealed a general ignorance among healthcare professionals about botulism, even for one patient. Therefore, the objective of this presentation is to introduce and outline a novel gaming platform that can effectively teach the basics associated with a botulism MCI. Prior studies using a similar model to teach tactical response to an active shooter event in the healthcare environment has demonstrated that this type of gaming can effectively bridge the gap between traditional classroom education and a full-scale exercise.

**Keywords:** *Medical Gaming; Emergency Management; Botulism*

### Introduction

Botulism is a rare disease in industrialized countries. However, because of its acute and long-term impact on humans, the Centers for Disease Control and Prevention (CDC) has listed it as a Category A Bioterrorism Agent [1]. Despite this distinction, a recent study has validated prior research indicating that a community healthcare infrastructure may be incapable of preparing for and responding to a botulism attack [2]. In fact, a 2018 document has declared that the U.S. healthcare system is unable to manage a complex disaster such as a botulism mass casualty incident (MCI) regardless of cause [3].

---

**Citation:** Paul Rega. "Utilizing Medical Gaming Principles to Teach Emergency Management Strategies and Crisis Leadership during a Botulism Mass Casualty Incident". *EC Nursing and Healthcare* 2.1 (2020): 39-45.

The first step in rectifying this situation is education. Knowledge of the pathophysiology, the diagnosis, and its management can be acquired by traditional educational means (reading assignments and lectures). However, the management of a complex MCI requires more. Communication and crisis leadership skills to evaluate treatment options, allocate limited resources efficiently, and triage patients safely cannot be passively procured from books. Drills and exercises are the educational platforms that can supply those intangible characteristics. Unfortunately, these rather novel educational activities are limited by their inherent complexities of development, time, and expense.

However, medical gaming can serve as the bridge between traditional classroom education and full-scale exercises [4-7]. In order to function as that bridge; the game must be simple, accessible, diverting, reproducible, and economical.

### **Purpose of the Study**

The purpose of this paper is to present "Botulopoly" - a medical educational version of most traditional board games. The name was specifically chosen to enhance the idea among players that the game was based on common boardgame principles. The goals of this game are to

- 1) Summarize the essential characteristics of the disease.
- 2) Weigh the medical management options of the botulism patient or patients.
- 3) Triage multiple patients appropriately when immediate resources are lacking.
- 4) Demonstrate the fundamentals of crisis leadership.

The subsequent part of this paper is a summary of the gameplay.

### **Game preparation**

1. Pre-play study: Prior to game day, players are encouraged to review selected material about botulism including pathophysiology, clinical manifestations, and management considerations not only for one patient but, more importantly, for multiple patients [1,8-14].
2. Equipment
  - a. A one-meter x one-meter floorplan of an emergency department would serve as the game board.
    - i. If the players are from one ED, utilizing their own ED floorplan would be preferable. The game would also move faster.
  - b. Standard deck of 52 playing cards
    - i. Each card represents a specific patient case-scenario
  - c. Patient case-scenarios
    - i. Two sets of patient cards are created.
    - ii. One set are those patients currently occupying beds in the ED. The cases are those typically seen in any ED.
    - iii. The second set is the botulism patients.
  - d. Tokens
    - i. Two sets of tokens are used representing:
      1. Caregivers
      2. Patients
3. Players
  - a. ED Personnel: The key people to invite to play the game would be nurses, physicians, respiratory therapists, and key administrators of the hospital.

4. Faculty/Instructors
  - a. Ideally, two instructors should supervise the game.
  - b. The duties of the “Dealer” or “Croupier” are to
    - i. Deal the cards.
    - ii. Relate all necessary patient information.
    - iii. Record patient care interventions.
  - c. The duties of the “Pit Boss” or “Overseer” are to
    - i. Announces ED and regional healthcare parameters
    - ii. Summarize the rules
    - iii. Keep time
    - iv. Provide health department and EMS reports
    - v. Document
    - vi. Facilitate the debriefing

**Start of play**

1. Place ED floorplan on a worktable surrounded by the players, “dealer”, and “pit boss”.
2. The “Pit Boss” announces hospital parameters based upon the goals and objectives of the players. For example:
  - a. Hospital type: Community, academic, etc.
  - b. Number of total beds
  - c. Number of ICU-type beds
  - d. Number of ED stretchers
3. After shuffling the deck of cards, the dealer deals one card to each player.
  - a. The nurse with the highest card is designated as the Charge Nurse and serves as the Incident Commander of the ED when the need arises.
4. Then, the Dealer begins flipping the spades and/or clubs cards (the black suits).
  - a. Each card represents a patient in the ED.
  - b. The number of cards that are flipped is determined by the goals and objectives of the players.
5. The charge nurse’s duties are to:
  - a. Assign each patient a severity level
    - i. Red (critical), Yellow (serious), Green (minimal);
  - b. Assign one or more patients to a player or group of players.
  - c. Indicate a room assignment for both patients and players.
6. Patient and player tokens are placed in the assigned area on the board.
7. The “Pit Boss” simulates an emergency phone call from the State Department of Health to the Charge Nurse.
  - a. The conversation:
    - i. A cohort of prisoners (non-specific gender and number) have been diagnosed as having botulism based on
      1. Initial clinical manifestations
      2. Recent history of “pruno” consumption

- ii. They are increasingly becoming more symptomatic over the past several hours and require further assessment, stabilization, and possible hospitalization at the local hospital (players' hospital) or transfer to a more specialized medical center.
- iii. Proper security measures will be in force at all times.

**8. Phase One of Botulopoly (ED Preparation Plans)**

- a. The objectives of Phase One are to:
  - i. Demonstrate crisis leadership skills of the Incident Commander (IC), i.e. the Charge Nurse.
  - ii. Arrange safe and proper disposition of ED patients to ensure room for the incoming botulism patients.
  - iii. Activate the institutional disaster plan.
  - iv. Summarize tactical management of botulism cases to players.
  - v. Arrange for BAT (Botulism Anti-Toxin) requisition and administration.
- b. During this period, the players (i.e. Incident Commander, ED leadership and the others) accomplish the safe and expeditious disposition of ED patients in order to accommodate the incoming botulism patients. The decisions center around which patients may be discharged, which patients should still be observed in the ED or elsewhere, and which patients should be immediately hospitalized.

**9. Phase Two of Botulopoly (Botulism Triage, Assessment and Management)**

- a. The objectives of Phase Two are to
  - i. Triage botulism patients based on criticality and resources.
  - ii. Utilize validated medical modalities to assess severity of respiratory compromise for each patient.
  - iii. Develop management strategies based on the degree of respiratory compromise.
- b. An announcement is made that the botulism patients are arriving.
- c. To simulate the arrival of each botulism patient, the Dealer flips diamond and/or heart suits (red suits)
  - i. Each card is aligned with a specific botulism patient scenario containing vital signs, physical signs and symptoms.
- d. The Incident Commander's duties during this phase are to
  - i. Assign each botulism patient to one or more players.
  - ii. Assign a level of severity to each patient.
  - iii. Determine the area of care for each patient.
- e. The tokens for both player and patient are placed in the assigned area of the ED.
- f. Once players and patients are positioned in rooms, any further medical information that may be needed by the players will be provided by the Dealer once asked.
  - i. For example, laboratory, imaging, and monitoring results;
- g. Players will document their care for each patient based on information provided (e.g. the need to definitive airway control).
- h. As the patient assessment and care phase wanes, the Pit Boss announces the immediate shipment of BAT to the hospital.

**10. Phase Three of Botulopoly (Disposition of Botulism Patients)**

- a. The objectives of Phase Three are to
  - i. Assess stability of each patient for potential transfer to alternative facilities;
  - ii. Optimize the safe transfer of patients;

- iii. Determine the most suitable means of patient transfer;
- iv. Prioritize BAT administration to patients.
- v. Ensure the proper administration of BAT;
- b. At the most propitious time in the game, the Pit Boss announces the arrival of the first shipment of BAT.
  - i. It is announced that there is sufficient antitoxin for 50% of the patients. The second shipment is expected in eight (8) hours
- c. Based upon each patient report, the Incident Command team (including senior physician) will determine which patient receives initial shipment of BAT.
  - i. Players assist with decision.
- d. Finally, the Incident Commander determines final disposition of each patient based on internal resources and patient condition.
  - i. The choices may include
    - 1. Immediate hospitalization;
    - 2. Immediate transfer to alternative care sites;
    - 3. Delayed transfer to alternative care sites;
- e. Gameplay terminated once all patients receive final disposition.

**11. Phase Four of Botulopoly (Game Has Concluded)**

- a. Debriefing: With faculty input, the players are encouraged to discuss areas of success and areas for improvement regarding their gameplay concerning botulism, mass casualty incidents, and crisis leadership.
- b. Evaluations: The players are invited to complete anonymous evaluation forms as a means to improve the game itself.

**Discussion**

Apart from the entertainment factor, medical gaming has been shown to provide a deeper layer of education and improve knowledge retention compared to more traditional platforms [16-19].

Botulopoly is one type of gaming methodology that provides disaster medical education, and more specifically, botulism education, in an easy, diverting, expeditious, and economical format. Because of those attributes, this type of training can serve as a bridge between traditional classroom teaching and a full-scale exercise. This is especially true when the time gap between the classroom and the functional exercise can be significant (i.e. months to years).

For maximum benefit, the players should review the assigned reading materials prior to Game Day. The educators for this game must have a finely-honed font of knowledge base regarding emergency medicine, botulism, and disaster management principles. With that background, they can easily develop the case scenarios for each patient. That will take the most time.

While generating a gameboard that is representational of the players' ED is optimum, another expedient solution is to appropriate a gameboard from one of the more popular games, such as Monopoly© to simulate an ED.

The case-scenarios should evolve over time. The patient's improvement or deterioration will depend on the early actions of the care team. That can be an improvisational supplement verbally delivered by the faculty to the players. It is incumbent therefore, that the "Dealer" is able to appreciate the team's choices and has the knowledge and flexibility of thought to alter conditions as warranted.

Once the patients have been stabilized to an acceptable degree, consideration must now be given to patient disposition; i.e. which patients require transportation by what means and to what kind of institution.

At the game's termination, the most important phase begins - the debriefing. This is the time when the players and faculty discuss team actions and areas for further study and improvement. Finally, the players' evaluation will determine whether Botulopoly succeeded in improving the players' knowledge about

- The key manifestations of botulism.
- Triaging multiple botulism patients appropriately.
- Identifying and procuring specific therapies based upon patient criticality.
- HBAT (Botulism Antitoxin Heptavalent).

The major limitation of this game is its lack of validation in actual gameplay among emergency department nurses, physicians, and respiratory therapists. However, the object of the paper was simply to present the concept first. Nevertheless, in order to improve the final product, the game was tested with four MPH students who uniformly believed that it was an effective way to teach complex mass casualty concepts and keep students engaged.

On the other hand, the same gaming concepts was developed and tested for a no-warning, sudden-impact event (i.e. active shooter situations). The results of that feasibility study revealed that 42 out of 42 players believed that their knowledge base and comfort level about responding to an active shooter event improved with this type of gaming [15].

The next phase is to evaluate Botulopoly with ED volunteers and assess their level of engagement with gaming and their own appraisal regarding their comfort level in caring, not only for one botulism patient, but for multiple botulism patients presenting virtually simultaneously.

One objective way to validate the game would be to enlist volunteers and divide them into a control group and the "game" group. Both groups would receive the same traditional education on botulism/MCI topics. However, the "game" group will also play Botulopoly to supplement their prior education on the topic. Then, days or weeks later, both groups would be tested on the material and then scored. To eliminate any bias, the test questions would be developed, monitored and scored by faculty who have no connection with the game. A comparison of the test results would prove or disprove the hypothesis that this type of medical gaming is useful in healthcare education of complex, high-impact, low-probability emergencies.

### Conclusion

Medical gaming is an important component of simulation medical education [16-19]. Botulopoly was created to exploit the inherent strengths of certain gaming principles. The objective of this paper is to present the concept and to offer the premise that the virtues of the game are its accessibility, its cost, its expeditiousness and its reproducibility. These attributes can encourage emergency department and hospital administrators to incorporate this type of game into the continuing education program of ED staff as frequently as possible. However, further testing of the game with ED personnel will be required to determine whether board games such as Botulopoly can serve as a competent bridge between conventional medical education and full-scale exercises.

### Bibliography

1. Arnon SS, et al. "Botulinum toxin as a biological weapon: medical and public health management". *Journal of American Medical Association* 285.6 (2001): 1059-1070.
2. Bork CE and Rega PP. "An assessment of nurses' knowledge of botulism". *Public Health Nursing* 29.2 (2012): 168-174.
3. Johns Hopkins Bloomberg School of Public Health and Center for Health Security. "A Framework for Healthcare Disaster Resilience: A View to the Future" (2018): 1-25.

4. Cain J and Piascik P. "Are serious games a good strategy for pharmacy education?" *American Journal of Pharmaceutical Education* 79.4 (2015): 47.
5. de Wit-Zuurendonk LD and Oei SG. "Serious gaming in women's health care". *British Journal of Obstetrics and Gynecology* 118.S3 (2011): 17-21.
6. Wang R., et al. "A systematic review of serious games in training health care professionals". *Simulation in Healthcare* 11.1 (2016): 41-51.
7. Ziv A., et al. "Simulation-based medical education: An ethical imperative". *Simulation in Healthcare* 1.4 (2006): 252-256.
8. Centers for Disease Control and Prevention. Botulism (2018).
9. World Health Organization. Botulism (2018).
10. Rao AK., et al. "Outbreak of Botulism Due to Illicit Prison-Brewed Alcohol: Public Health Response to a Serious and Recurrent Problem". *Clinical Infectious Diseases* 66.S1 (2017): S85-S91.
11. McCarty CL., et al. "Large Outbreak of Botulism Associated with a Church Potluck Meal--Ohio, 2015". *Morbidity and Mortality Weekly Report* 64.29 (2015): 802-803.
12. Rega PP., et al. "Single-Breath-Count Test: an important adjunct in the triaging of patients in a mass-casualty incident due to botulism". *Prehospital and Disaster Medicine* 25.3 (2010): 219-222.
13. Van Rynen JL., et al. "The use of negative inspiratory force by ED personnel to monitor respiratory deterioration in the event of a botulism-induced MCI". *Journal of Emergency Nursing* 35.2 (2009): 114-117.
14. Rega P., et al. "An algorithm for the evaluation and management of red, yellow, and green zone patients during a botulism mass casualty incident". *American Journal of Disaster Medicine* 4.4 (2009): 192-198.
15. Konecki E., et al. "A Pilot Study to Evaluate "Gaming" in Active Assailant Preparedness in the Healthcare Environment". The Society of Academic Emergency Medicine Midwest Regional Conference, Beaumont Conference Center Southfield, Michigan (2019).
16. Abdulmajed H., et al. "Assessment of educational games for health professions: A systematic review of trends and outcomes". *Medical Teacher* 37.S1 (2015): S27-S32.
17. Morris BJ., et al. "Gaming science: the "Gamification" of scientific thinking". *Frontiers in Psychology* 4 (2013): 607.
18. Boeker M., et al. "Game-based e-learning is more effective than a conventional instructional method: A randomized controlled trial with third-year medical students". *PLoS One* 8.12 (2013): e82328.
19. Crocco F., et al. "A proof-of-concept study of game-based learning in higher education". *Simulation and Gaming* 47.4 (2016): 403-406.

**Volume 2 Issue 1 January 2020**

**©All rights reserved by Paul Rega.**