Dynamics of a Zombie outbreak on Stevens campus

Course: Dynamic Modeling of Systems and Enterprises (SYS 681)

Abstract

The dynamics of a zombie outbreak is a complex and fascinating topic that has been studied by scientists, mathematicians, and social scientists for many years. There are many factors that can influence the course of an outbreak, including the nature of the zombie virus, the population density of the affected area, and the effectiveness of the human response. One of the most important factors in determining the course of a zombie outbreak is the nature of the zombie virus. Some viruses are more contagious than others, and some are more deadly. The zombie virus must be able to spread quickly and easily to cause a major outbreak. Another important factor is the population density of the affected area. In a densely populated area, zombies will be able to spread more easily and quickly than in a sparsely populated area. This is because there will be more potential victims for the zombies to infect. The effectiveness of the human response is also a major factor in determining the course of an outbreak. If humans are able to quickly identify and contain the outbreak, it is less likely to become a major disaster. However, if humans are slow to respond or if they are unable to contain the outbreak, it is more likely to spread and cause widespread devastation. The dynamics of a zombie outbreak is a complex and ever-changing topic. As scientists learn more about the nature of zombie viruses and the human response to them, they will be better able to predict the course of future outbreaks and develop strategies for mitigating their impact. The dynamics of a zombie outbreak are a fascinating and complex topic. By understanding the factors that can influence the course of an outbreak, we can better prepare for the possibility of a zombie apocalypse. As a result, in this project, we consider a population in Stevens where the Zombie virus has affected the patient zero. Also, we'll see how quickly it spreads to the other population.

Problem definition

It's important to note that the scenarios are based on fictional depictions of zombie outbreaks and not grounded in real-world possibilities. If a zombie outbreak were to occur, it would have severe consequences and impact various aspects of society. Here are some potential consequences and actions that might take place in the event of a fictional zombie outbreak. The initial discovery of zombies would likely cause widespread panic and chaos. People would scramble to protect themselves and their loved ones, leading to a breakdown in law and order. Governments and authorities would activate emergency response plans. Police, military forces, and medical personnel would be mobilized to contain the outbreak, establish quarantine zones, and provide assistance to survivors. Infected areas or entire cities might be quarantined to prevent the spread of the outbreak to unaffected regions. Evacuation efforts would be initiated to relocate survivors to secure locations away from the infected areas. Individuals and communities would arm themselves and fortify their homes or establish safe zones to protect against zombie attacks. People would scavenge for food, water, and supplies to sustain themselves during the crisis. As the outbreak spreads, essential services and infrastructure would start to break down. Power outages, disrupted communication networks, and shortages of basic necessities would further exacerbate the situation. Governments, international organizations, and scientific communities would work together to find a solution. Research institutions would study the zombies, searching for weaknesses, possible cures, or methods to eradicate them. Humanitarian organizations would step in to provide aid and support to affected regions. They would focus on delivering medical supplies, food, clean water, and other necessities to survivors. : Efforts would be made to reinforce secure locations, establish barricades, and implement defensive strategies to protect against zombie attacks. Military forces would be

deployed to defend critical areas and support containment efforts. Scientists and medical professionals would prioritize finding a cure or developing a vaccine to combat the zombie infection. Extensive research and testing would be conducted to understand the nature of the virus and develop effective countermeasures. : If the outbreak is eventually contained or eliminated, society would begin the long process of rebuilding. Infrastructure would be repaired, communities would be re-established, and efforts would be made to heal the psychological scars left by the zombie apocalypse. Zombie outbreaks can be identified by a set of symptoms, some of which are discussed below. The symptoms of a zombie outbreak can vary depending on the fictional portrayal and the creative imagination behind it.

- ***Aggression and Violence:*** Infected individuals exhibit extreme aggression, often targeting and attacking other people. They may show signs of agitation, growling, or making guttural sounds.
- ***Loss of Cognitive Abilities:*** Zombies typically lose their ability to think logically, solve problems, or communicate effectively. They may stumble or walk in an uncoordinated manner, displaying a lack of motor skills.
- ***Pale and Decaying Appearance:*** Zombies often have a deathly pale or grayish complexion. Their skin may appear bruised, torn, or decomposed, with exposed bones or organs in severe cases.
- ***Hunger for Human Flesh:*** A key characteristic of zombies is an insatiable craving for human flesh, specifically brains or any living tissue. This relentless hunger drives them to attack and feed on their victims.
- ***Lack of Awareness:*** Zombies exhibit a diminished awareness of their surroundings. They may ignore obstacles, walk into walls, or mindlessly wander without a clear purpose.

- ***Infectious Bite:*** In many zombie narratives, a bite or scratch from a zombie can transmit the infection to a healthy individual. The bitten person may exhibit flu-like symptoms initially before eventually transforming into a zombie.
- ***Loss of Pain Sensation:*** Zombies typically do not respond to pain stimuli. They may sustain severe injuries without showing any signs of distress or altering their behavior.
- ***Slow or Lethargic Movements:*** Zombies often move at a slow pace, shuffling or dragging their feet. This characteristic is commonly portrayed in zombie movies, games, and literature.

Imaginary Case Scenario

It was a seemingly ordinary day at Stevens Institute of Technology, with students attending lectures, studying in the library, and preparing for upcoming midterms. Unbeknownst to everyone, a mysterious virus had silently infiltrated the campus, transforming some individuals into bloodthirsty zombies. Here's a case scenario of a zombie outbreak at the university campus.

Patient Zero:

The outbreak began with an unsuspecting student named Sarah, who had recently returned from a backpacking trip in a remote part of South America. Unbeknownst to her, she had been bitten by an infected animal during her travels and unknowingly brought the virus back to campus. Sarah attended her classes and interacted with her friends before exhibiting the first symptoms of the infection.

Phase 1-Initial Infection:

As the virus took hold, Sarah experienced severe flu-like symptoms, including a high fever, fatigue, and dizziness. She dismissed these symptoms as mere exhaustion from her trip. However, within hours, Sarah's condition rapidly deteriorated. She became disoriented and aggressive, attacking her roommate in a fit of rage. The roommate, alarmed by Sarah's behavior, managed to escape their shared dorm room and notify campus security.

Phase 2-Spreading Chaos:

As campus security responded to the incident, they encountered Sarah in a transformed state—pale, with bloodshot eyes and a relentless hunger for flesh. She attacked the security officers, biting them in the process. Within minutes, the officers joined her in her violent frenzy. Chaos erupted as the infected security personnel roamed the campus, attacking students, faculty, and staff members.

Phase 3-Campus Lockdown:

Recognizing the severity of the situation, the university authorities initiated a campus-wide lockdown. Automated alarms blared through the campus, urging students and staff to seek shelter and stay away from the infected individuals. The security office became the command center, coordinating emergency response efforts, while campus police, aided by the local law enforcement, attempted to contain the outbreak.

Phase 4-Student Survival:

Locked in their dormitories, classrooms, and other secure locations, students banded together to defend themselves against the growing horde of zombies. Using

makeshift weapons, they barricaded doors and windows, strategizing their escape routes if necessary. Some students with medical backgrounds formed makeshift infirmaries, attending to the wounded and trying to find a cure for the infection.

Phase 5-Rescue and Quarantine:

With the situation escalating, the local authorities, in collaboration with the military, were called in to assist in evacuating survivors and containing the outbreak. A designated area on the outskirts of the campus was established as a quarantine zone, where individuals suspected of infection were screened and provided medical attention. The military enforced a strict cordon around the university, preventing the infected from escaping and infecting the surrounding areas.

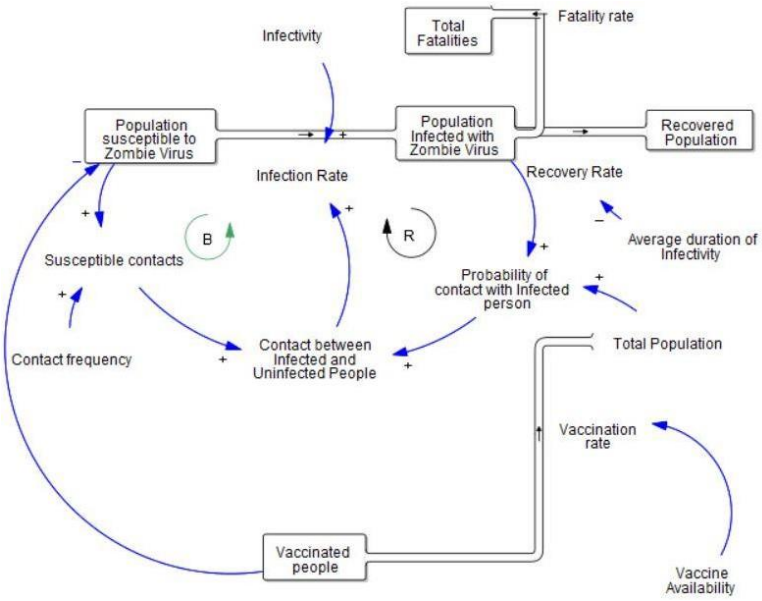
Phase 6-Research and Containment:

Meanwhile, a team of scientists, virologists, and medical experts arrived on campus to study the virus, searching for a cure or a way to halt its spread. They conducted experiments on captured zombies and analyzed Sarah's blood samples to understand the nature of the virus better. The clock was ticking as the fate of the university and its inhabitants hung in the balance.

The scenario above outlines a fictional zombie outbreak at Stevens Campus, highlighting the initial stages, campus lockdown, student survival, rescue and quarantine efforts, and scientific research. While the outcome remains uncertain, it emphasizes the importance of preparedness, teamwork, and quick decision-making in the face of a catastrophic event.

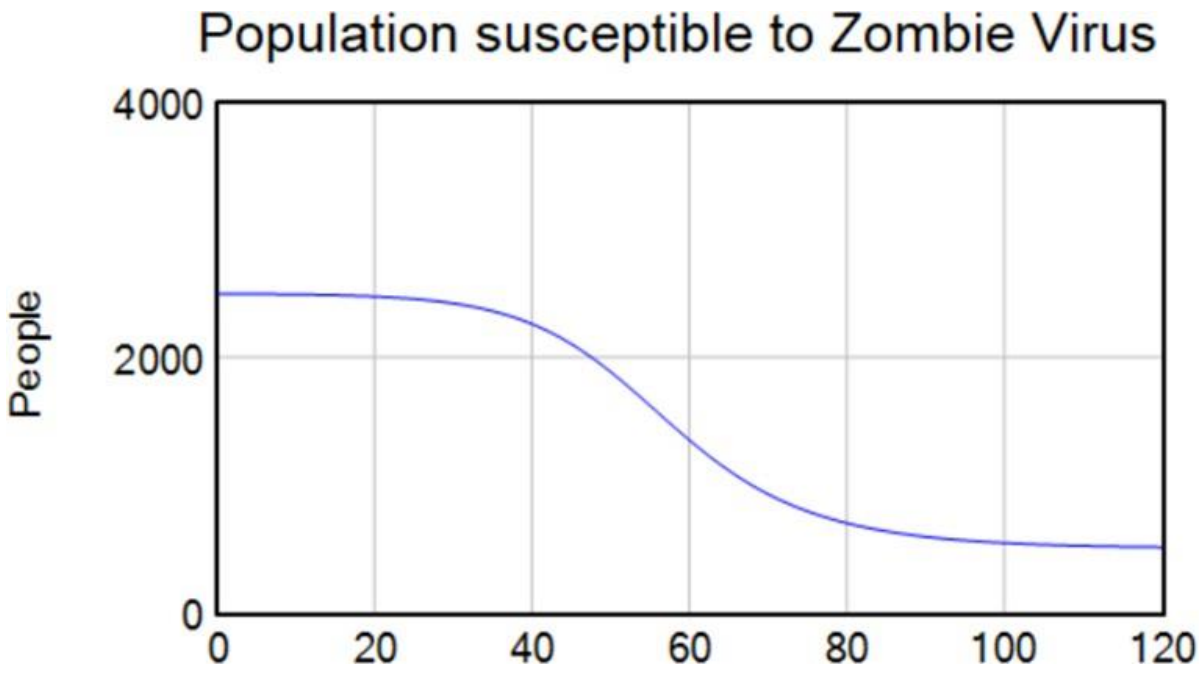
Vensim Model

In this project, it is assumed that zombie virus transmission between humans occurs through contact between infected and uninfected people in the Stevens campus. A patient zero was identified as someone who had been infected with the virus. This patient is thought to be the primary source of the infection. Stevens has a total population of 2500 people.

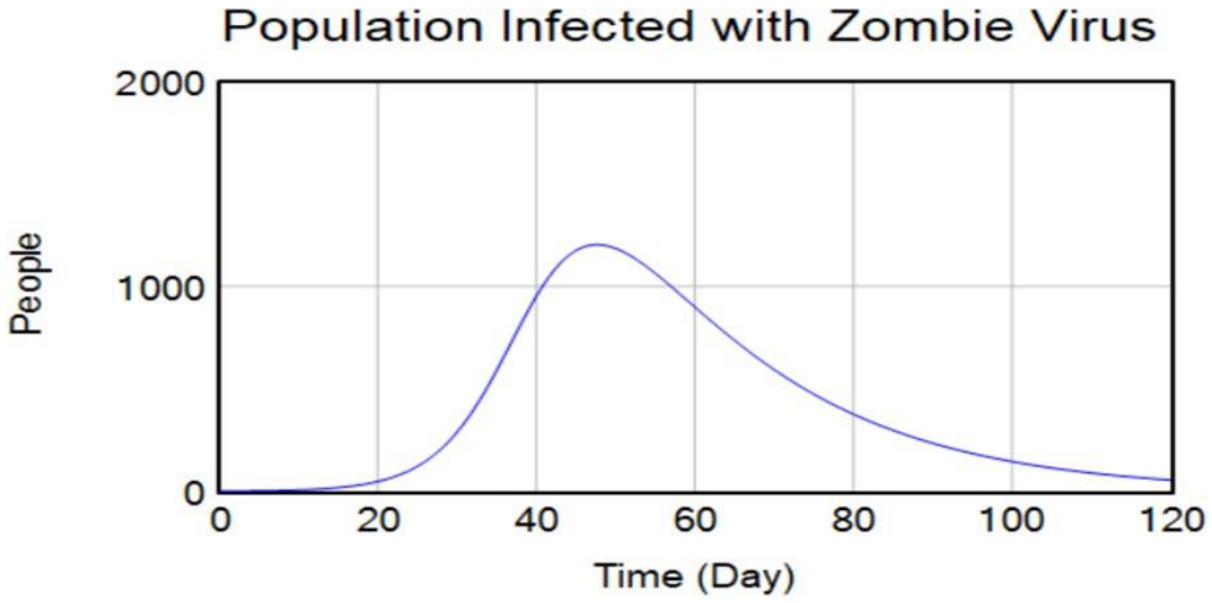


The above figure represents the Vensim model deployed

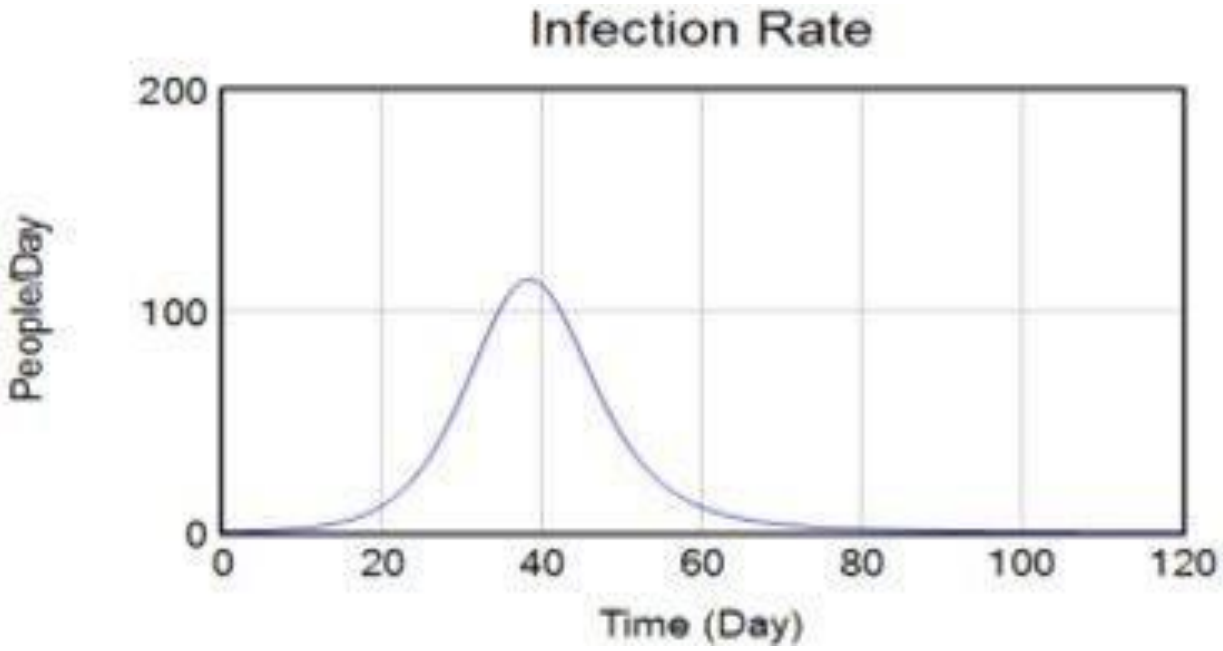
For this project, we have assumed the infectivity of the virus to be **0.025** and the contact frequency is **10** people/day. By running the model in Vensim software with the manipulated data, we get the following graphs as the result.



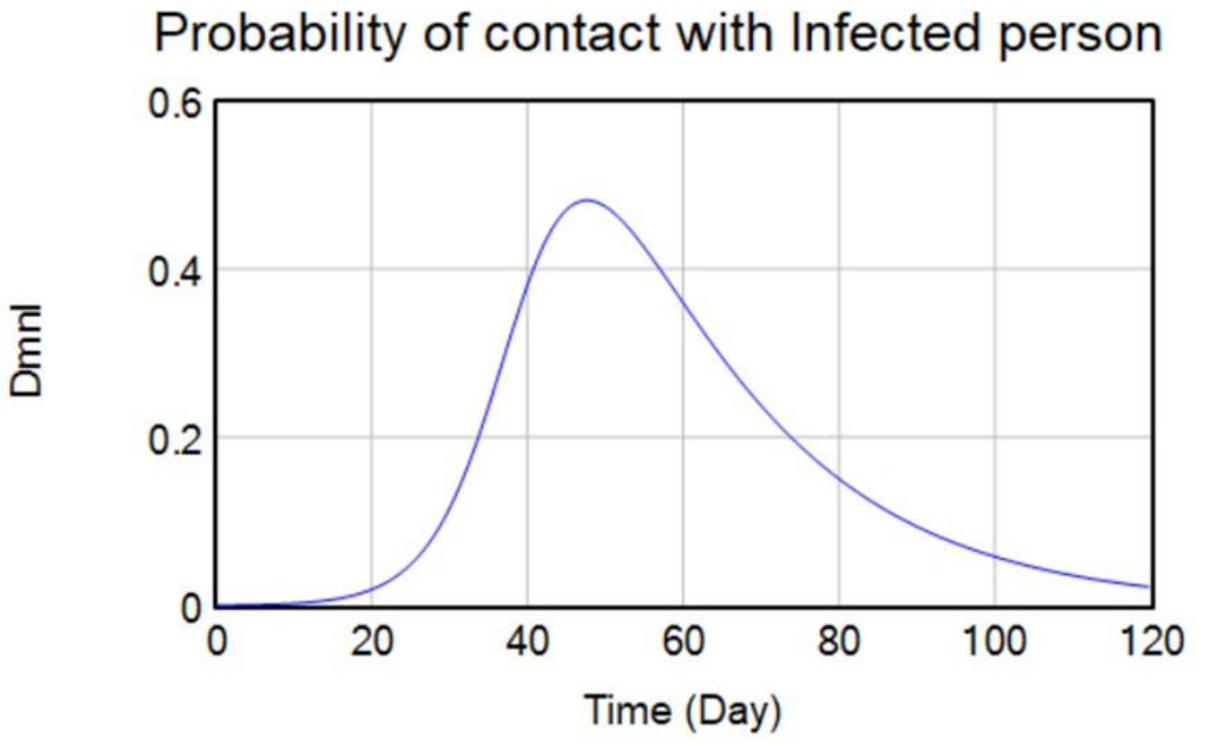
According to the graph, the population susceptible to the Zombie virus is the entire population (2500 people) at the start, and it gradually decreases as more people become infected each day. The population susceptible to the virus hits between 0 and 120 days, implying that almost the entire population would be affected in 120 days.



According to the graph's findings, people infected with viruses come into contact with the unaffected population, increasing the number of people infected until the entire population of 2500 people is infected.



According to the graph above, the infection rate peaks between 30th to 40th day. This means that most people are affected between day 30 and 40 (Approximately 38th day). After the 60th day, the infection rate falls because the affected population grows faster than the unaffected population, lowering the infection rate.



As the days pass, more and more people become infected with the Zombie virus, increasing the probability of coming into contact with infected people until it reaches 1 (Probability of 1 = 100%) after 100 days, indicating that almost the entire population is infected with the Zombie virus, and it is certain that there will be contact with an infected person because everyone in the campus is infected with the virus.

Recommendations

Based on the insights gained from this presentation, it is recommended the following steps for the Stevens campus community to prepare for a hypothetical zombie outbreak. Develop a comprehensive outbreak response plan: This plan should include procedures for identifying and reporting suspected cases of the zombie virus, protocols for quarantine and isolation, and communication strategies for keeping the campus community informed about the outbreak. Stockpile emergency supplies: In the event of an outbreak, access to basic necessities such as food, water, and medical supplies may become limited. It is therefore important to stockpile these supplies in advance to ensure that the campus community has access to essential resources. Promote good hygiene practices: As we have discussed, the zombie virus is transmitted through bodily fluids, so it is important to promote good hygiene practices such as hand washing, covering coughs and sneezes, and avoiding close contact with infected individuals. Encourage vaccination: If a vaccine for the zombie virus becomes available, it is important to encourage members of the campus community to get vaccinated in order to prevent the spread of the virus. Conduct regular outbreak drills: Finally, it is important to conduct regular outbreak drills to ensure that the campus community is prepared to respond in the event of an actual outbreak. These drills should test the effectiveness of the response plan and identify any areas that need improvement. By taking these steps to prepare for a hypothetical zombie outbreak, the Stevens campus community can better protect itself in the event of an actual infectious disease outbreak.

Conclusion

In a nutshell, from this experiment the rate of spread of the virus is analyzed using statistical methodologies. The experiments conducted help to conclude that the sample population gets infected within 120 days of the spread. From the infection bell curve, it is concluded that the rate of spread was high between day 30 to day 40. In conclusion, exploring the potential dynamics of a hypothetical zombie outbreak on Stevens campus has provided us with some valuable insights into how we might respond to a real-life infectious disease outbreak. While a zombie outbreak is an extreme scenario, the principles of disease transmission and outbreak management that we have discussed are applicable to a wide range of infectious diseases. By preparing for the worst-case scenario, we can better protect ourselves and our community in the event of an actual outbreak.

References

[1] *"Matt's Journal: The Zombie Apocalypse of 2013",* https://www.oregonlive.com/runoregon/2013/10/post_65.html.

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[4] "*Zombie Apocalypse: Modeling the social dynamics of infection and rejection*" , *Jan R Riebling and Andreas Schmitz.*