



Principles of Biomedical Science

Virtual Learning

9-12 / PLTW[®] PBS

May 4, 2020



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Lesson: May 4, 2020

Objective/Learning Target:

Students will be able to: describe the differences between contagious (infectious, communicable, transmissible) and virulent (toxic, deadly, lethal, fatal) and give examples of each. (*Reference: PLTW[®] 5.1.1 Contagious*)



Let's Get Started (Bell Ringer):

Watch the following videos, some pretty amazing things to think about when it come to these terms: **Contagious** (infectious, communicable, transmissible) **Virulent** (toxic, deadly, lethal, fatal)

[Infectious Diseases - An Introduction](#)

[How pandemics spread](#)



Lesson/Activity:

Start by... Watch the following video [Learning from smallpox: How to eradicate a disease](#) and answer the following questions:

1. How did we stop/remove small pox from the planet?
2. What were some factors that allowed for the eradication of smallpox to occur?
3. What makes some diseases hard to get rid of?
4. Was Smallpox a very **contagious** and **virulent** disease?



Answers:

1. How did we stop/remove small pox from the planet?

Vaccination, isolation, were the two major factors, once industrialized countries were taken care of. 3rd world countries were involved, lots of personal visitations by health care workers.

2. What were some factors that allowed for the eradication of smallpox to occur?

Humans are essential no other organisms are involved. Easy to identify victims, short incubation periods, long term vaccination, proof of principle was established.

3. What makes some diseases hard to get rid of?

Other animal vectors, humans not getting along, easy international travel.

4. Was Smallpox a very **contagious** and **virulent** disease?

Smallpox was considered extremely contagious and very virulent with 3 of 10 people dieing 30% that is considered very virulent.



Lesson/Activity continued:

How do we determine just how Contagious a disease is. Watch the following video clip [Why Is The Measles Virus So Contagious?](#) and answer the following questions.

1. R_0 is based on what factors?
2. Is R_0 a fixed number?
3. What is it considered when $R_0 < 1$?
4. Measles has a contagious or infectious rate of what?
5. Why have we developed vaccines against diseases?



Answers:

1. R0 is based on what factors? **Rate of contact between infected and susceptible people, How long an infected person is contagious, and Probability that an uninfected person will contract the disease.**
2. Is R0 a fixed number? **No**
3. What is it considered when $R_0 < 1$? **The disease is considered self-limiting.**
4. Measles has a contagious or infectious rate of what? **R0 between 5 and 100 depending on outside factors, with no vaccinated in population 1 person could infect more than a dozen people.**
5. Why have we developed vaccines against diseases? **Because they have become so contagious.**



Lesson/Activity continued:

How do we determine just how **Virulent** (toxic, deadly, lethal, fatal) a disease is. Diseases that are very Virulent normally die off quick because they skill the person quickly and do not have time to spread. Having a disease that is very contagious and virulent is a very bad disease. Read the section on Virulence Factors from the following website: [NCBI Bacterial Pathogenesis](#) scroll down until you find the section **Virulence Factors** and answer the questions on the next page. (note this is specific for bacteria but works universally).



Lesson/Activity continued:

Virulence Factors questions:

1. What virulence factors help bacteria to do what?
2. How many major factors of virulence are there?
3. What are the major factors that affect virulence?



Answers:

1. What virulence factors help bacteria to do what?

(1) invade the host, (2) cause disease, and (3) evade host defenses.

2. How many major factors of virulence are there?

6

3. What are the major factors that affect virulence?

Adherence Factors, Invasion Factors, Capsules, Endotoxins, Exotoxins, and Siderophores



Practice:

Additional Resources to Explore:

Work some R_0 numbers with [Epidemiology Basics: Reproductive Number \(\$R_0\$ \)](#) they work through some actual cases of outbreaks and show how the numbers with infection are determined.

[How Scientists Quantify the Intensity of an Outbreak Like COVID-19](#)



Additional Practice:

Additional Resources to Explore:

[What You Need To Know About Infectious Disease](#)

[Understanding R nought | Current events in health and medicine |](#)

[Health & Medicine | Khan Academy](#)