

Pathogen: Polio

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Basic Biology

- Acute, highly contagious disease caused by poliovirus.
- The virus is made up of a single strand of positive-sense RNA and a protein capsid
- Polio is spread through contact with saliva, feces, or droplets from an infected person.
- It can also contaminate food and water
- Type of enterovirus from family Picornaviridae
- Attacks the nervous system which can lead to spinal and respiratory paralysis
- Resistant to stomach acids and can survive for long periods of time in sewage or water
- Symptoms generally develop within 5-35 days of infection, with an average of 7-14 days
- Severe cases affect breathing and lead to death, and those who recover may have long-term complications such as permanent paralysis, chronic pain, or muscle shortening
- Invades the central nervous system and motor nervous which causes cell death and deterioration of the system

Key Historical Events

- [Mayo Clinic Timeline](#)
- [WHO Vaccine Development Timeline](#)
- [Polio Eradication Timeline](#)
- 1916 outbreak in New York City killed over 2,000 individuals and infected more than 27,000
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Present-day status/relevance

- WHO is meeting this week in Genva to review global polio eradication efforts
- As reported by the CDC: in 2023 524 reported cases of polio
- CDC Recommends all gildren get 4 doses of polio vaccine (routine childhood vaccine schedule)
 - Adults who have increased exposure -> one lifetime IPV booster
 - <https://www.cdc.gov/polio/hcp/vaccine-considerations/index.html>
- Polio outbreak in Gaza
 - <https://time.com/7014075/gaza-polio-outbreak-history-vaccination-campaign/>
 - Lack of polio vaccinations
- Two new cases of WPV1 (Wild poliovirus) in Pakistan reported in April 2024
 - <https://www.who.int/news/item/08-04-2024-statement-following-the-thirty-eighth-meeting-of-the-ihf-emergency-committee-for-polio>
- Silent polio outbreaks- few paralytic cases so goes undetected as polio

Other Resources

- [Our World in Data: Polio](#)

9/4 Discussion

- Endemic/outbreak: because of how much it relies on geographical location and access to water
 - Environmental factors
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Pathogen: STIs

Group Members: Samantha Rich, Fiona Cloud Hickey, Jillian Sacksner, Vyomesh Patel, Lauren Haines

Basic Biology:

- Most STIs are bacterial or viral, passed through bodily fluids including blood, semen, etc.
 - Mostly passed through sexual contact but can also spread through shared needles, pregnancy, childbirth, and breastfeeding
- 8 pathogens linked to the most common STIs: syphilis, gonorrhea, chlamydia, trichomoniasis (curable), hep B, herpes, HPV, HIV (treatable)
- [If STIs are left untreated, they can lead to serious neurological and cardiovascular disease](#)
 - Viral STIs lack or have limited treatment options

Key Historical Events

- [Timeline of STI history](#)
- [CDC's STI Treatment Guidelines Timeline](#)
- [History of STIs](#)
- [The History of STIs](#)

Present-day status/relevance

- [More than 1 million curable STIs acquired everyday](#)
- [2020: estimated 374 million new infections for people 15-49 \(chlamydia, gonorrhea, syphilis and trichomoniasis\)](#)
- [STIs continue to increase in the U.S. with more than 2.5 million cases of gonorrhea, chlamydia, and syphilis reported to the CDC in 2022.](#)
- [HPV associated with cervical cancer \(311,000 deaths per year\)](#)
- [1.1 million pregnant people infected with syphilis → adverse birth outcomes](#)
- [254 million people were living with hepatitis B in 2022](#)

Pathogen: 1918 Flu

Group Members: Lilly Stevens, Hannah Stovall, Arul Rajeswaran, Sophia Spiotti

Basic Biology

- Started as a normal influenza case consisting of fever, cold, etc. but then the virus attacked the hosts [lungs](#)
- Attacked everyone similarly however some people succumbed to respiratory failure much faster than others, some only taking a few [hours](#)
- Developed from an “unknown source,” “eight genome segments differ from contemporary avian influenza genes, especially at synonymous sites.” [ncbi](#).

WHO Quick Facts about the Seasonal Influenza

- There are around a billion cases of seasonal influenza annually, including 3–5 million cases of severe illness.
- It causes 290 000 to 650 000 respiratory deaths annually.
- Ninety-nine percent of deaths in children under 5 years of age with influenza-related lower respiratory tract infections are in developing countries.
- Symptoms begin 1–4 days after infection and usually last around a week.
- Safe and effective vaccines have been used for more than 60 years. Immunity from vaccination goes away over time so annual vaccination is recommended to protect against influenza.

Key Historical Events

- Believed to have originated in the United States, one of the first reported cases was in Kansas
- This flu came during the closing offensives of WWI; with close quartered troops and ship crews, the virus spread rapidly and was taken overseas by troops and spread in wartime areas
- Communicable disease spread was greatly encouraged by the social/historical context; “new forms of mass transportation, mass media, mass consumption, and mass warfare had vastly expanded the public places in which communicable diseases could spread”

Present-day status/relevance

WHO Website

- In the Northern hemisphere, influenza activity in temperate countries remained at interepidemic levels. Activity was elevated in countries in Central America and the Caribbean (primarily due to A(H3N2) viruses), Western Africa (due to A(H3N2) and B viruses), Middle Africa (due to A(H3N2) viruses), Southern Asia (due to A(H1N1)pdm09 viruses), and South East Asia(due to A(H1N1)pdm09 viruses). Activity increased in some countries in Western Africa, Middle Africa, Southern Asia, and South East Asia.
- In the Southern hemisphere, influenza activity remained elevated in countries in South America (due to influenza A(H3N2) and B viruses), Eastern Africa (due to A(H1N1)pdm09 and A(H3N2) viruses), Southern Africa (due to B viruses), and Oceania

(due to A(H3N2) viruses). Activity increased in some areas of Eastern Africa and declined or was similar in most other countries.

- The 1918 Flu, 100 Years Later (DOI [10.1126/science.aas9565](https://doi.org/10.1126/science.aas9565))
 - Technological advances made reconstruction of the 1918 virus possible; now, continued research, vaccine development, and preparedness are essential to ensure that such a devastating public health event is not repeated. Over the past 20 years, studies of individual genes and the fully reconstructed live 1918 virus have identified numerous features that likely contributed to its robustness and rapid global spread.

Pathogen: Group 5 - Measles

Group Members: Gabrielle Leiker, Aarush Goel, Emma Ottinger, and Marlee Sacksner

Basic Biology

- A virus that belongs to the Paramyxovirus family and is known to grow and attack epithelial cells of the pharynx and lungs.
- Person to person transmission through droplets and remains active and contagious in the air for two hours.
- Cells are infected after binding of hemagglutinin to cell receptors.
- Uses the H glycoprotein to bind to and attach to host cells and first infects lymphocytes and regional lymph nodes and multiplies and spreads rapidly.

Key Historical Events

- Pre-vaccine era, vaccine era, and post-vaccine era
- Demonstrated in 1757 (by Francis Home) that measles is caused by infectious agent in blood of patients (CDC)
- 1912 measles became a nationally notifiable disease in the U.S. and cases were required to be reported (CDC).
- Vaccine became available in 1963 (CDC)
- 1971, measles mumps, and rubella vaccines are combined in the measles-mumps-rubella (MMR) vaccine in the US
 - CDC: <https://www.cdc.gov/measles/about/history.html>
- 2019 Washington state declared local public health emergency after 26 cases of measles

Present-day status/relevance

- Measles was officially eliminated from the United States in 2000 meaning no measles are spread within the country, and new cases are found when they are contracted abroad and return to the US
- 86% of measles cases in 2024 were unvaccinated
- 13 outbreaks were reported in 2024 and a total of 227 cases were reported by 29 jurisdictions
 - CDC: <https://www.cdc.gov/measles/data-research/index.html>

Group 3

Pathogen: **Plague**

Group Members: Esther Shon, Peace Odiase, Lorelai Konen, Sarah Slann, Vivian Janicki

Basic Biology

- [NIH](#): Caused due to infection with the gram-negative bacillus *Yersinia pestis*
 - Plague is a zoonotic infection
 - “Life-cycle of *Y. Pestis* starts within an insect vector followed by transmission to a mammalian host... Humans are only affected as incidental hosts” like the bite of a flea or direct handling of animal tissue with open skin lesions.
- [CDC](#): Transmitted by fleas and cycles among wild rodents
 - Plague bacteria is transmitted to humans through flea bites, contact with contaminated fluid or tissue, or infectious droplets
- Two main forms of plague infection: [bubonic and pneumonic](#)
 - Bubonic: most common and “characterized by painful swollen lymph nodes.” 30% to 60% case-fatality ratio
 - Pneumonic: Always fatal when left untreated. Transmitted by “the inhalation of respiratory droplets/small particles from a patient with pneumonic plague.”

Key Historical Events

- [How the Black Plague spread](#)
 - Terrifyingly contagious, could spread just through touching clothing
- [Timeline, Prognosis, etc.](#)
- Thought to have originated in Asia and then moved into Europe during warfare
- Struck Europe and Asia in the mid-1300s
- 12 ships had docked at the port of Messina and most sailors aboard the ships were either dead or severely ill and covered in black boils
- [Black Plague Timeline](#)
- [History of the Plague](#)

Present-day status/relevance

- Poor sanitation in various regions → unnecessary deaths
- Impacted evolution, [NIH Article on the Black Death and human evolution](#)
- [WHO](#) Now days, plague is easily treated with antibiotics and standard precautions. Untreated pneumonic plague can be rapidly fatal within 18 to 24 hours.
 - Confirmation of the plague requires lab testing— a sample of pus from a bubo, blood or sputum and currently African and South America have been using laboratory validated rapid dipstick tests.
- Endemicity—plague still exists today

Group 2:

Pathogen: Malaria

Group Members: Catherine Hwang, Sam Riordan, Sophie Branham, Shane Roehrig, Caden Mattingly

Basic Biology

- Causal agent are blood parasites of the genus *Plasmodium*. There are approximately 156 named species of *Plasmodium* which infect various species of vertebrates. Four species are considered true parasites of humans, as they utilize humans almost exclusively as a natural intermediate host: *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*.
- The malaria parasite life cycle involves two hosts. During a blood meal, a malaria-infected female Anopheles mosquito inoculates sporozoites into a human host.
 - These sporozoites infect human liver cells where they mature, rupture, replicate, etc., and persist in the liver to cause relapses by invading the bloodstream. Later on, blood stage parasites are responsible for the clinical manifestations of the disease.
- Most frequent symptoms include fever and chills, which can be accompanied by headaches, myalgias, arthralgias, weakness, vomiting, and diarrhea
- Untreated malaria can progress to severe forms that can be rapidly (less than 24 hours) fatal

Key Historical Events

- In 1989, Sir Ronald Ross won a nobel prize after proving malaria is spread by mosquitos
- In 1939, the insecticide DDT was tested which eventually led to the eradication of malaria in the U.S. in 1952
- In 1955, WHO launched a Global Malaria Eradication campaign
 - Based mainly on the spraying of insecticide in designated “malarious areas” of the world
 - The program resulted in the elimination of endemic malaria from Europe, Australia, and other developed areas and in a radical reduction of cases in less-developed countries such as India.
- In 1989, the FDA approved an anti-malaria drug Melfoquine hyrdochloride
- In 1992, the Walter Reed Army Institute of Research entered a malaria vaccination into clinical trial
- In 1996, insecticide-treated bednets were tested in multiple African countries which reduced malaria related childhood mortality by 20%

Present-day status/relevance

- 2022: malaria caused an estimated 249 million clinical episodes and 608,000 deaths
 - Number of deaths has significantly decreased since 2000

- Areas of high burden: Burkina Faso, Cameroon, the Democratic Republic of the Congo, Ghana, India, Mali, Mozambique, Niger, Nigeria, Uganda, and, Tanzania
 - 95% of all malaria cases are in WHO African Region
- Malaria is currently both preventable and curable reducing the number of deaths worldwide
- Risk of infection is higher in some areas than others depending on multiple factors, including the type of local mosquitoes.
- Currently malaria prevention in most countries of the world relies on indoor residual spraying or mass routine distribution of insecticide treated mosquito nets
- Currently it seems like reducing malaria cases has been at a standstill

Infectious Disease Events

- Endemic: in 80 countries (Africa, Latin America, and parts of the Caribbean, Eastern Europe, the South Pacific, and in Asia including South Asia, Southeast Asia, and the Middle East)
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- Epidemic: can become more prevalent past warmer climates where malaria carrying mosquitoes are found because of climate change
- Outbreak: can be influenced by travel to/from an endemic country, higher risk for travelers with lack of education/resources to preventative measures
- Influenced by climate change and drug resistance - cause countries to become more viable places for mosquito life cycle
 - Warmer winters are giving Anopheles mosquitoes an opportunity to start reproducing earlier
 - populations grow to the point where they have a higher probability of biting an infected person who has been to a malaria-endemic area.
- Mosquitoes can travel from containers on ships / on clothes and be introduced to new locations
 - This can cause new anti-malarial resistant strains

<https://www.ncbi.nlm.nih.gov/books/NBK215638/#:~:text=By%201750%2C%20both%20vivax%20and,until%20the%20early%2020th%20century.>