Game: How Does It Spread?

Lesson
Pathogens spread disease in different ways, and some pathogens spread in more than one manner. Play a game to learn about the different ways that pathogens spread and match specific pathogens to their transmission mechanism.

Materials
- Pathogen/disease card sets (pp. 4-13)
- "Modes of Transmission" game boards, one mode on each board: Airborne, Direct Contact, Contaminated Surfaces, Contaminated Food/ Water, Insects or Animals (Vectors), Mother to Child (pp 14-19)

Instructions
- In this game, players match pathogens with their mode(s) of transmission.
- In each round, players will try to match the pathogen/disease card in their hand to its primary mode of transmission.
- Set up the table with the "Modes of Transmission" game boards.
- Place the pre-sorted sets of pathogen/disease cards near the game board. Use one set at a time.
- Gameplay:
    - Up to 6-8 players at a time.
    - Players may play individually, in pairs/teams, or as one group. Individual play is recommended for smaller groups, pairs/teams/one group for larger groups.
    - Ensure that the players are familiar with each mode of transmission by showing the game boards and discussing the associated image.
    - Players look at the first card in their set.
    - Players decide which mode of transmission applies to each pathogen and place the card onto the correct board.
        - Let players know it is OK to not know all the routes of transmission and it is fine to simply guess.
        - Some diseases are transmitted in multiple ways. In this game, players are attempting to match their pathogen/disease card to its most common/primary mode of transmission, however, additional modes of transmission are noted on the Game Key and should be acknowledged as a correct response if a player places a card on one of its secondary modes.
    - Players continue to play cards until all cards are placed on the game boards.
    - When all cards have been placed, check the game key (on page 2) to note the correct methods of transmission for each and foster a conversation of what the players were familiar with and what information was new to them. Reference the "Reflection" section for discussion prompts.
    - If there is time and the players would like to continue, repeat the game with a different set of cards.

Reflection
- Note which pathogens/diseases had transmission methods that surprised the players, those with multiple modes of transmission that they did not expect, etc.
- Prompt players to consider ways that spread could be limited for the different modes of transmission.

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GAME KEY

SET 1	Ebola virus **DIRECT CONTACT** CONTAMINATED SURFACES MOTHER TO CHILD	*Borrelia burgdorferi* bacteria (Lyme disease) **INSECTS OR ANIMALS** MOTHER TO CHILD	Varicella virus (Chickenpox) **AIRBORNE** DIRECT CONTACT MOTHER TO CHILD	Rotavirus **DIRECT CONTACT** AIRBORNE CONTAMINATED SURFACES	*Corynebacterium diphtheriae* bacteria (Diphtheria) **AIRBORNE** DIRECT CONTACT
SET 2	Dermatophytes fungi (Ringworm) **DIRECT CONTACT** CONTAMINATED SURFACES	*Vibrio cholerae* bacteria (Cholera) **CONTAMINATED FOOD/WATER**	Japanese encephalitis virus (JEV) **INSECTS OR ANIMALS**	Human papillomavirus (HPV) **DIRECT CONTACT** MOTHER TO CHILD	Influenza virus **AIRBORNE** CONTAMINATED SURFACES DIRECT CONTACT
SET 3	Yellow fever virus **INSECTS OR ANIMALS**	Hepatitis B virus **DIRECT CONTACT** MOTHER TO CHILD CONTAMINATED SURFACES	Poliovirus **DIRECT CONTACT** CONTAMINATED FOOD/WATER AIRBORNE	*Mycobacterium tuberculosis* bacteria (Tuberculosis or TB) **AIRBORNE**	Rabies Virus **INSECTS OR ANIMALS**
SET 4	*Plasmodium* unicellular protozoan parasite (Malaria) **INSECTS OR ANIMALS**	Rhinovirus* (Common Cold) **AIRBORNE** DIRECT CONTACT CONTAMINATED SURFACES	Measles virus **AIRBORNE** CONTAMINATED SURFACES	*Salmonella Typhi* bacteria (Typhoid) **CONTAMINATED FOOD/WATER**	*Neisseria meningitidis* bacteria (Meningococcus) **DIRECT CONTACT** AIRBORNE
SET 5	Zika virus **INSECTS OR ANIMALS** MOTHER TO CHILD DIRECT CONTACT	Epstein-Barr virus (Mononucleosis) **DIRECT CONTACT** CONTAMINATED SURFACES	Hepatitis A virus **CONTAMINATED FOOD/WATER** DIRECT CONTACT MOTHER TO CHILD	*Bordetella pertussis* bacteria (Whooping cough) **AIRBORNE**	Rubella virus **AIRBORNE** MOTHER TO CHILD

Airborne: 8 Primary: 2 Secondary
Direct Contact: 8 Primary: 6 Secondary
Contaminated Food/Water: 3 Primary: 1 Secondary

Insects or Animals: 5 Primary: 0 Secondary
Contaminated Surfaces: 0 Primary: 8 Secondary
Mother to Child: 0 Primary: 7 Secondary

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Additional information

NON-COMMUNICABLE DISEASE EXAMPLES

INFECTIOUS DISEASE EXAMPLES – These are examples of infectious diseases caused by a pathogen but considered non-communicable as they do not easily spread between people. Why are some vector-borne diseases considered communicable and others are not? This is due to ease of spread between people. For example, diseases like malaria, yellow fever, and dengue live well in both human blood and mosquito salivary glands so a person can infect a mosquito that can go on to infect another person. In contrast, West Nile Virus can infect a person from a mosquito bite, but it does not reproduce well enough in the human body to infect other mosquitoes or people. In this case, people are considered to be "dead-end hosts" because they can't spread the infection. Tick-borne encephalitis (TBE) is another example in which people are dead-end hosts.

Tetanus – caused by *Clostridium tetani* bacteria that enter the body through a wound.
Rabies – caused by rabies virus (RABV), enters the body through a wound exposed to the saliva of an infected mammal. Theoretically it is possible to transmit between people via a bite wound, but no case has ever been recorded. However, people have gotten rabies following organ or tissue transplants from people with undiagnosed infections. Rabies is another disease in which people are generally considered to be dead-end hosts.
Botulism – caused by *Clostridium botulinum* bacteria. The bacteria produce a toxin that can be introduced in foods that have fermented because of improper preparation or storage. The spores can be introduced into a wound or through ingestion and cause disease.
Legionnaires' Disease (Legionellosis) – caused by *Legionella pneumophila* bacteria, spreads by breathing tiny droplets of water that contain the bacteria. Because the bacteria survive in warm stagnant water, outbreaks are often associated with plumbing or HVAC systems as well as hot tubs or saunas. Because the bacteria reproduce in immune cells deep in the lungs, this infection does not spread between people.
West Nile Virus – caused by the West Nile virus (WNV); related to the Japanese encephalitis virus; transmitted by the bite of *Culex* mosquitoes which are infected by birds; the virus doesn't reproduce well enough in people, making them "dead-end hosts." Can rarely be spread from a mother to her baby during pregnancy.
Lyme Disease – caused by *Borrelia burgdorferi* bacteria, spread to people by the bite of blacklegged ticks (deer ticks). Ticks must be attached for more than 24-36 hours to cause disease. Can rarely spread from a woman to her baby during pregnancy.

NON-INFECTIOUS DISEASE EXAMPLES – These are examples of diseases that cannot be transmitted from person to person and are not typically caused by a pathogen, with some exceptions- e.g., some cancers are known to be caused by viruses, such as cervical cancer (HPV) and liver cancer (hep B). Scientists continue to research possible links between pathogens and other diseases; for example, multiple sclerosis (MS) and a connection to Epstein-Barr virus (EBV), and Alzheimer's disease and herpes simplex virus, but the connections are currently inconclusive.

Diabetes
Cardiovascular disease
Asthma
Chronic obstructive pulmonary disease (COPD)
Parkinson's disease
Epilepsy
Chronic Traumatic Encephalopathy (CTE)
Environmental exposures (like Coal Worker's pneumoconiosis (CWP/ Black Lung) or asbestosis)
Multiple sclerosis (MS) **Possible** link to Epstein-Barr virus (EBV)
Cancer – some caused by viral infections, such as HPV and hepatitis B
Alzheimer's disease **Possible** link to herpes simplex virus

SET 1

Ebola virus	***Borrelia burgdorferi* bacteria (Lyme disease)**	**Varicella virus (Chickenpox)**
Rotavirus	***Corynebacterium diphtheriae* bacteria (Diphtheria)**	


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SET 2

Dermatophytes fungi **(Ringworm)**	***Vibrio cholerae* bacteria** **(Cholera)**	**Japanese encephalitis virus** **(JEV)**
Human papillomavirus **(HPV)**	**Influenza virus**	


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SET 3

Yellow fever virus

Hepatitis B virus

Poliovirus

***Mycobacterium tuberculosis* bacteria**

(Tuberculosis or TB)

Rabies virus


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SET 4

Plasmodium
unicellular protozoan parasite

(Malaria)

Rhinovirus

(Common Cold)

Measles virus

Salmonella Typhi
bacteria

(Typhoid)

Neisseria meningitidis
bacteria

(Meningococcus)


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SET 5

Zika virus	**Epstein-Barr virus (Mononucleosis)**	**Hepatitis A virus**
***Bordetella pertussis* bacteria (Whooping cough)**	**Rubella virus**	


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Airborne



Direct Contact



Contaminated Surfaces



Contaminated Food/Water



Insects or Animals



Mother to Child

