

Pathogen Transmission Routes

What is the difference between surface, direct contact and air transmission?

Pathogens transmit from person to person in different ways. Knowing how pathogens spread is essential for developing an effective infection prevention program.

Surface transmission:

Surface transmission refers to indirect transmission by an infectious agent. Surface transmission may occur through:

- ▶ Food or water
- ▶ Objects (e.g. handkerchiefs or door handles)

Real World Examples:

- ▶ Food or water contaminated with Hepatitis A
- ▶ Improperly canned foods supporting the growth of *Clostridium botulinum*



Direct contact and droplet spread transmission:

Direct contact transmission occurs through:

- ▶ Contact with large droplets spread from sneezes and coughs
- ▶ Skin-to-skin contact
- ▶ Contact with soil or plants harboring infectious organisms

Real World Examples:

- ▶ Pertussis (whooping cough)
- ▶ Hookworm spread by direct contact with contaminated soil



Airborne transmission:

Airborne transmission occurs when pathogens are carried by very small droplets suspended in the air.

Airborne transmission may occur through:

- ▶ Dust suspended in the air by air currents
- ▶ Droplet nuclei that remain suspended in the air for minutes to hours

Real World Examples:

- ▶ Measles virus that remains in the air several hours after the infected patient leaves the room



Modes of Transmission¹

Pathogen	Surfaces*	Air†	Direct Contact‡	Disease caused by pathogen	Survival ¹⁻⁸
VIRUSES					
SARS-CoV-2	X	X	X	COVID-19	Minutes to hours in air 4 hrs – 8 days on surfaces [§]
Norovirus	X		X	Stomach flu, gastroenteritis	Days to weeks on surfaces
Measles	X	X	X	Measles	Up to 2 hrs in air and on surfaces
Rhinovirus	X		X	Common cold	4 – 25 hrs on surfaces [§]
Influenza A and B Viruses	X		X	Flu	2 hrs – 2 weeks on surfaces [§]
Adenovirus	X		X	Fevers, upper respiratory tract symptoms, and conjunctivitis (pink eye)	1 hr – 3 months [§]
Cytomegalovirus			X	Usually no symptoms, mild illness in healthy people	1 – 8 hrs [§]
Human Immunodeficiency Virus (HIV)	X		X	AIDS	5 – > 7 days [§]
Hepatitis B virus (Hep B)	X		X	Jaundice, liver disease	> 2 weeks [§]
Hepatitis C virus (Hep C)	X		X	Chronic liver disease	5 days – 6 weeks [§]
Varicella Zoster		X	X	Chicken Pox, Shingles	A few hours in air
Poliovirus			X	Polio	4 hrs – 8 weeks [§]
Respiratory Syncytial Virus (RSV)	X		X	Bronchiolitis, pneumonia	5 – 7 hrs on surfaces [§]
BACTERIA					
<i>Staphylococcus aureus</i> and Methicillin resistant <i>Staphylococcus aureus</i> (MRSA)	X		X	Skin infection	30 mins – 3 yrs on surfaces [§]
<i>Clostridioides difficile</i>	X		X	Severe diarrhea and colitis	15 mins – > 6 weeks on surfaces [§]
<i>Candida auris</i>	X		X	Bloodstream infections	> 14 days [§]
<i>Klebsiella pneumoniae</i>	X		X	Pneumonia	9 days – 6 weeks [§]
<i>Pseudomonas aeruginosa</i>	X		X	Pneumonia, blood infections	1 hr – 8 weeks [§]
<i>Salmonella enterica</i>	X		X	Salmonellosis, food poisoning	< 1 day – > 300 days [§]
<i>Escherichia coli</i>	X		X	Food poisoning	1 hr – > 300 days [§]
<i>Listeria monocytogenes</i>	X		X	Listeriosis, food poisoning	2 hrs – 91 days [§]
<i>Mycobacterium tuberculosis</i>		X		Tuberculosis	6 hours in air
<i>Streptococcus pyogenes</i>	X		X	Strep throat, scarlet fever, necrotizing fasciitis	2 hrs – 4 months [§]
<i>Legionella pneumophila</i>	X			Legionnaires' disease, pneumonia	Up to 2 hrs in air Several months in water
<i>Enterococcus faecium</i>	X		X	Urinary tract infections, surgical wound infection	1 – 16 weeks [§]
FUNGI					
<i>Aspergillus niger</i>		X*		Aspergillosis	2 – 30 days on surfaces [§]
<i>Trichophyton interdigitale</i>	X		X	Athlete's foot	12 – 20 months

* Refers to vehicle transmission including food, water, and fomites (surfaces) † Refers to smaller airborne droplets that may linger in the air for longer periods ‡ Refers to skin-to-skin contact, kissing, sexual intercourse or large respiratory droplet transmission § On hard, nonporous surfaces ¶ *Aspergillus niger* is ubiquitous in the environment in household dust, decomposing plant matter, soil, building materials, plants, food and water

- Centers for Disease Control and Prevention. <https://www.cdc.gov>
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- World Health Organization https://www.who.int/healthacademy/WHO_TB.pdf.
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