Waterborne or vector-borne?

Trace the pathogen from its source to its point of entry. Cholera usually enters through swallowing contaminated material; malaria usually enters through an infected mosquito bite.

1. CHOLERA: THE FAECAL-ORAL ROUTE

Faeces contain bacteria → **Food or water** contaminated → **New host** swallows bacteria

Vibrio cholerae from infected people can contaminate water or food through faeces. Another person may become infected after consuming it. Poor sewage disposal or food hygiene can connect the source to the next host.

The bacterium is the agent; water is the vehicle. People without obvious symptoms can still shed bacteria. Cholera is not normally an airborne infection.

2. MALARIA: TRANSMISSION THROUGH A VECTOR

Infected human parasites in blood → **Female mosquito** acquires parasites → **Another human** infected by a bite

A female *Anopheles* mosquito takes up *Plasmodium* while feeding on an infected person. After development in the mosquito, parasites can be passed in its saliva during a later bite. The diagram summarises transmission, not the full parasite life cycle.

Plasmodium is the pathogen; the mosquito is the vector. Malaria does not normally spread through casual contact. Less common routes include infected blood and contaminated needles.

Faecal contamination and cholera spread: WHO, Cholera fact sheet.
Mosquito vector and other malaria routes: WHO, Malaria fact sheet.

Scope: Cambridge Biology 9700 syllabus, section 10.1, outcome 3, p. 30.

TB: inhaling infectious particles

Pulmonary TB caused by *Mycobacterium tuberculosis* can spread through air. Explain release, suspension and inhalation rather than simply writing "close contact".

1. AIR LINKS THE SOURCE TO THE NEXT HOST

1	**Release**	A person with infectious TB in the lungs or throat releases bacteria-containing particles when coughing, speaking or singing.
2	**Remain airborne**	Fine aerosols or droplet nuclei can stay suspended. Poorly ventilated indoor spaces make exposure more likely.
3	**Inhalation**	Another person breathes in the particles. Bacteria may reach the lungs and establish infection.

2. INFECTION DOES NOT ALWAYS MEAN INFECTIOUSNESS

People with latent (inactive) TB are infected but do not spread TB bacteria. Active TB in the lungs or throat can be infectious. Ordinary handshakes or touching objects are not the usual route of person-to-person TB transmission.

3. REMEMBER THE OTHER NAMED TB BACTERIUM

Mycobacterium bovis can pass from infected cattle to people, particularly through unpasteurised milk or dairy products. It can also spread through close exposure to infected animals or people with infectious lung disease. This differs from the main *M. tuberculosis* airborne route.

Route summary: inhaled particles explain typical human-to-human TB spread; contaminated dairy is an important additional route for *M. bovis*.

Airborne spread and latent versus active TB: CDC, TB Causes and How It Spreads.
Animal-to-human and dairy transmission: CDC, Bovine Tuberculosis in Humans.

Scope: Cambridge Biology 9700 syllabus, section 10.1, outcome 3, p. 30.

HIV: specific fluids and entry routes

HIV can pass in blood, semen (including pre-seminal fluid), vaginal and rectal fluids, and breast milk. These must reach susceptible tissue or enter the bloodstream; ordinary touch is not enough.

1. CONNECT THE FLUID TO THE EXPOSURE

Sexual contact	During anal or vaginal sex, virus-containing fluids can contact mucous membranes or damaged tissue.
Shared equipment	Contaminated needles, syringes or injection equipment can transfer blood directly.
Blood products	Transfusion of infected blood can transmit HIV. Screening makes this very rare where effective safeguards operate.
Parent to infant	Transmission may occur during pregnancy, childbirth or breastfeeding; it is not inevitable.

2. DO NOT ASSIGN HIV THE WRONG ROUTE

HIV is not spread through air, water, mosquito bites, hugs or sharing food. Saliva, sweat and tears alone do not transmit HIV. A person does not need to have AIDS to have HIV; the virus, not the syndrome, is transmitted.

3. TRANSMISSION IS NOT UNAVOIDABLE

Effective HIV treatment can reduce the amount of virus in blood. People who maintain an undetectable viral load on treatment do not transmit HIV through sex (U=U). This statement concerns sexual transmission; do not automatically apply it to every exposure route.

Fluids, entry routes and exposures: CDC, How HIV Spreads.
Non-transmission routes and undetectable viral load: WHO, HIV and AIDS.

Scope: Cambridge Biology 9700 syllabus, section 10.1, outcome 3, p. 30.