

**PARTIAL LIST OF DISEASES CAUSED BY UNTREATED SEWAGE**

**Note: Cells in blue represent most common and high-frequency**

Disease and Transmission pathway	Microbial Agent	Sources of Agent in Water Supply	General Symptoms
<b>PARASITIC INFECTIONS (KINGDOM ANIMALIA)</b>			
<i>A parasite is a disease-causing organism that lives on or in a human or another animal and derives its nourishment from its host.</i>			
Schistosomiasis (immersion)	Members of the genus <i>Schistosoma</i>	Fresh water contaminated with certain types of snails that carry schistosomes	Rash or itchy skin. Fever, chills, cough, and muscle aches
Dracunculiasis (Guinea Worm Disease)	<i>Dracunculus medinensis</i>	Stagnant water containing larvae	Allergic reaction, urticaria rash, nausea, vomiting, diarrhea, asthmatic attack.
Taeniasis	Tapeworms of the genus <i>Taenia</i>	Drinking water contaminated with eggs	Intestinal disturbances, neurologic manifestations, loss of weight, cysticercosis
Fasciolopsiasis	<i>Fasciolopsis buski</i>	Drinking water contaminated with encysted metacercaria	GIT disturbance, diarrhea, liver enlargement, cholangitis, cholecystitis, obstructive jaundice.
Hymenolepiasis (Dwarf Tapeworm Infection)	<i>Hymenolepis nana</i>	Drinking water contaminated with eggs	Abdominal pain, severe weight loss, itching around the anus, nervous manifestation
Onchocerciasis (River blindness)	<i>Onchocerca volvulus</i> and <i>Wolbachia</i>	Black fly bites (insects breed in fast-moving water)	Skin papules, swollen lymph nodes, itching, swelling of face, skin changes. Destruction of eye tissue leading to blindness
Echinococcosis (Hydatid disease)	<i>Echinococcus granulosus</i>	Drinking water contaminated with feces (usually canid) containing eggs	Liver enlargement, hydatid cysts press on bile duct and blood vessels; if cysts rupture they can cause anaphylactic shock
Coenurosis	<i>Multiceps multiceps</i>	contaminated drinking water with eggs	Increases intracranial tension
Ascariasis	<i>Ascaris lumbricoides</i>	Drinking water contaminated with feces (usually canid) containing eggs	Mostly, disease is asymptomatic or accompanied by inflammation, fever, and diarrhea. Severe cases involve Löffler's syndrome in lungs, nausea, vomiting, malnutrition, and underdevelopment.
Enterobiasis	<i>Enterobius vermicularis</i>	Drinking water contaminated with eggs	Peri-anal itch, nervous irritability, hyperactivity and insomnia
<b>BACTERIAL INFECTIONS</b>			
Botulism	<i>Clostridium botulinum</i>	Bacteria can enter an open wound from contaminated water sources. Can enter the gastrointestinal tract by consuming contaminated drinking water or (more commonly) food	Dry mouth, blurred and/or double vision, difficulty swallowing, muscle weakness, difficulty breathing, slurred speech, vomiting and sometimes diarrhea. Death is usually caused by respiratory failure.
Campylobacteriosis	Most commonly caused by <i>Campylobacter jejuni</i>	Drinking water contaminated with feces	Produces dysentery like symptoms along with a high fever. Usually lasts 2–10 days.
Cholera	Spread by the bacterium <i>Vibrio cholerae</i>	Drinking water contaminated with the bacterium	In severe forms it is known to be one of the most rapidly fatal illnesses known. Symptoms include very watery diarrhea, nausea, cramps, nosebleed, rapid pulse, vomiting, and hypovolemic shock (in severe cases), at which point death can occur in 12–18 hours.
E. coli Infection	Certain strains of <i>Escherichia coli</i> (commonly <i>E. coli</i> )	Water contaminated with the bacteria	Mostly diarrhea. Can cause death in immunocompromised individuals, the very young, and the elderly due to dehydration from prolonged illness.
M. marinum infection	<i>Mycobacterium marinum</i>	Naturally occurs in water, most cases from exposure in swimming pools or more frequently aquariums; rare infection since it mostly infects immunocompromised individuals	Symptoms include lesions typically located on the elbows, knees, and feet (from swimming pools) or lesions on the hands (aquariums). Lesions may be painless or painful.
Dysentery	Caused by a number of species in the genera <i>Shigella</i> and <i>Salmonella</i> with the most common being <i>Shigella dysenteriae</i>	Water contaminated with the bacterium	Frequent passage of feces with blood and/or mucus and in some cases vomiting of blood.
Legionellosis (two distinct forms: Legionnaires' disease and Pontiac fever)	Caused by bacteria belonging to genus <i>Legionella</i> (90% of cases caused by <i>Legionella pneumophila</i> )	Contaminated water: the organism thrives in warm aquatic environments.	Pontiac fever produces milder symptoms resembling acute influenza without pneumonia. Legionnaires' disease has severe symptoms such as fever, chills, pneumonia (with cough that sometimes produces sputum), ataxia, anorexia, muscle aches, malaise and occasionally diarrhea and vomiting
Leptospirosis	Caused by bacterium of genus <i>Leptospira</i>	Water contaminated by the animal urine carrying the bacteria	Begins with flu-like symptoms then resolves. The second phase then occurs involving meningitis, liver damage (causes jaundice), and renal failure
Otitis Externa (swimmer's ear)	Caused by a number of bacterial and fungal species.	Swimming in water contaminated by the responsible pathogens	Ear canal swells causing pain and tenderness to the touch
Salmonellosis	Caused by many bacteria of genus <i>Salmonella</i>	Drinking water contaminated with the bacteria. More common as a food borne illness.	Symptoms include diarrhea, fever, vomiting, and abdominal cramps
Vibrio Illness	<i>Vibrio vulnificus</i> , <i>Vibrio alginolyticus</i> , and <i>Vibrio parahaemolyticus</i>	Can enter wounds from contaminated water. Also got by drinking contaminated water or eating undercooked oysters.	Symptoms include explosive, watery diarrhea, nausea, vomiting, abdominal cramps, and occasionally fever.

Disease and Transmission pathway	Microbial Agent	Sources of Agent in Water Supply	General Symptoms
<b>VIRAL INFECTIONS</b>			
Adenovirus infection	Adenovirus	Manifests itself in improperly treated water	Symptoms include common cold symptoms, pneumonia, croup, and bronchitis.
Gastroenteritis	Astrovirus, Calicivirus, Enteric Adenovirus, and Parvovirus	Manifests itself in improperly treated water	Symptoms include diarrhea, nausea, vomiting, fever, malaise, and abdominal pain.
SARS (Severe Acute Respiratory Syndrome)	Coronavirus	Manifests itself in improperly treated water	Symptoms include fever, myalgia, lethargy, gastrointestinal symptoms, cough, and sore throat.
Hepatitis A	Hepatitis A virus (HAV)	Can manifest itself in water (and food)	Symptoms are only acute (no chronic stage to the virus) and include Fatigue, fever, abdominal pain, nausea, diarrhea, weight loss, itching, jaundice and depression.
Poliomyelitis (Polio)	Poliovirus	Enters water through the feces of infected individuals	90-95% of patients show no symptoms, 4-8% have minor symptoms (comparatively) with delirium, headache, fever, and occasional seizures, and spastic paralysis, 1% have symptoms of non-paralytic aseptic meningitis. The rest have serious symptoms resulting in paralysis or death.
Polyomavirus infection	Two of Polyomavirus: JC virus and BK virus	Very widespread, can manifest itself in water, ~80% of the population has antibodies to Polyomavirus	BK virus produces a mild respiratory infection and can infect the kidneys of immunosuppressed transplant patients. JC virus infects the respiratory system, kidneys or can cause progressive multifocal leukoencephalopathy in the brain (which is fatal).
<b>PROTOZOAL INFECTIONS</b>			
Amoebiasis (hand-to-mouth)	Protozoan (Entamoeba histolytica) (Cyst-like appearance)	Sewage, non-treated drinking water, flies in water supply	Abdominal discomfort, fatigue, weight loss, diarrhea, bloating, fever.
Cryptosporidiosis (oral)	Protozoan (Cryptosporidium parvum)	Collects on water filters and membranes that cannot be disinfected, animal manure, seasonal runoff of water.	Flu-like symptoms, watery diarrhea, loss of appetite, substantial loss of weight, bloating, increased gas, nausea.
Cyclosporiasis	Protozoan parasite (Cyclospora cayetanensis)	Sewage, non-treated drinking water	cramps, nausea, vomiting, muscle aches, fever, and fatigue.
Giardiasis (oral-fecal) (hand-to-mouth)	Protozoan (Giardia lamblia) Most common intestinal parasite	Untreated water, poor disinfection, pipe breaks, leaks, groundwater contamination, campgrounds where humans and wildlife use same source of water. Beavers and muskrats create ponds that act as reservoirs for Giardia.	Diarrhea, abdominal discomfort, bloating, and flatulence
Microsporidiosis	Protozoan phylum (Microsporidia), but closely related to fungi	The genera of Encephalitozoon intestinalis has been detected in groundwater, the origin of drinking water [3]	Diarrhea and wasting in immunocompromised individuals..

**CLASSIFICATION OF RISK (SOURCE: SHUVAL ET AL. 1986)**

<p><b>High Risk</b></p> <p>Helminths (worms) (Ancylostoma, Ascaris, Trichuris and Taenia)</p>
<p><b>Medium Risk</b></p> <p>Enteric Bacteria (Cholera vibrio, Salmonella typhosa, Shigella etc.)</p>
<p><b>Low Risk</b></p> <p>Enteric viruses</p>