

Preventing the transmission of faecal-oral diseases

Poor hygiene practices, lack of adequate sanitation and unsafe or limited water supplies can contribute to the spread of preventable diseases such as cholera or typhoid. Understanding how pathogens (organisms that cause disease) are transmitted allows engineers and public health workers to intervene in appropriate ways to break the transmission cycle, saving lives and reducing unnecessary suffering. This guide examines these crucial issues.

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Infectious dose, ID50, is defined as the number of pathogens ingested per person needed to infect 50% of the population.

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About the diagram

The movement of pathogens (disease-causing organisms) from the faeces of a sick person to where they are ingested by somebody else can take many pathways, some direct and some indirect.

This diagram illustrates the main pathways. They are easily memorized as they all begin with the letter 'f': fluids (drinking water) food, flies, fields (crops and soil), floors, fingers and floods (and surface water generally).

The diagram is a summary of pathways: other associated routes may be important. Drinking water may be contaminated by a dirty water container, for example, or food may be infected by dirty cooking utensils.

References and further information

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Summary

The 'f' diagram is a useful and easy to remember diagnostic tool for engineers and public health workers trying to prevent the spread of widespread, but preventable, diseases transmitted via the faecal-oral route.

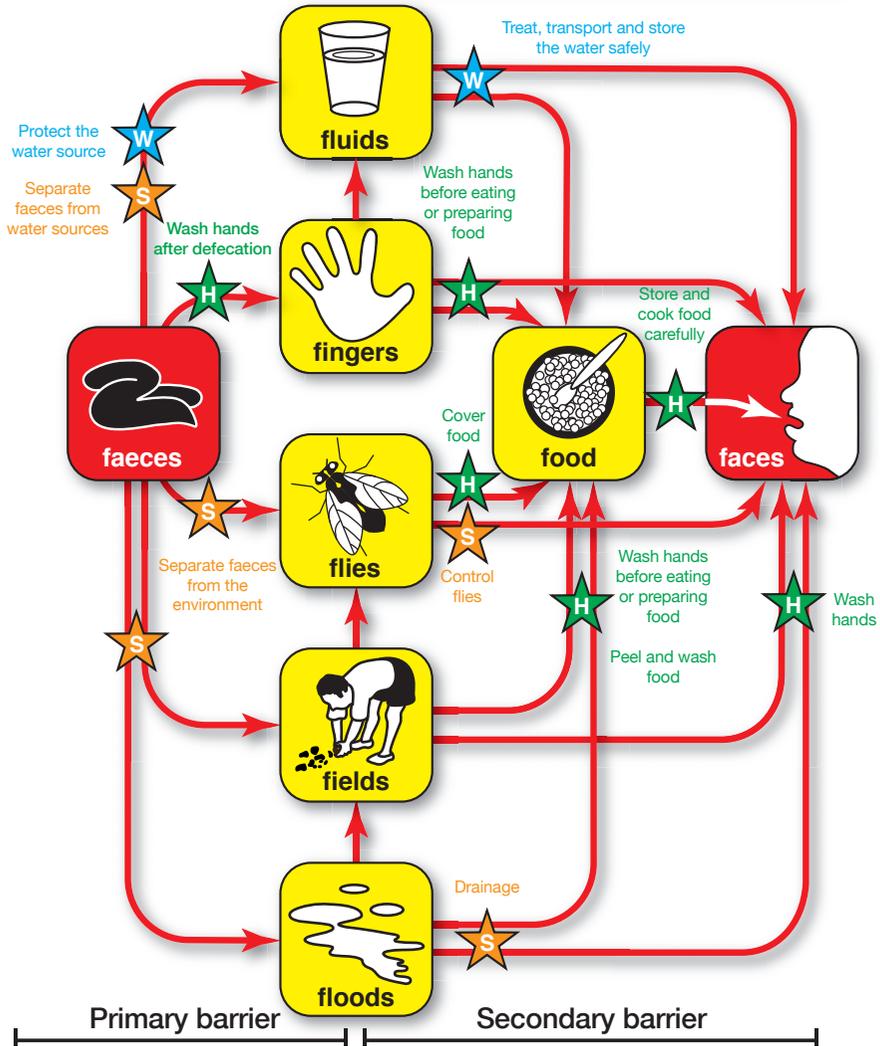
Decisions about the extent to which water supply staff and community members should be involved should be made locally.

The 'f' diagram

WATER (blue star icon) Barriers can stop the transmission of disease; these can be primary (preventing the initial contact with the faeces) or secondary (preventing it being ingested by a new person). They can be controlled by water, sanitation and hygiene interventions.

SANITATION (orange star icon)

HYGIENE (green star icon)



Introduction

Infectious faecal-oral diseases are spread when a susceptible person (or in some cases, an animal) ingests a pathogen that gives them the disease. The pathogen multiplies inside them and is subsequently found in their faeces.

Excreta-related water-borne diseases can be transmitted by any route which allows faecal matter to enter the mouth; the faecal-oral route. In 1958, Wagner and Lanoix identified the major means of transmission and produced what is now known as the 'f' diagram'.

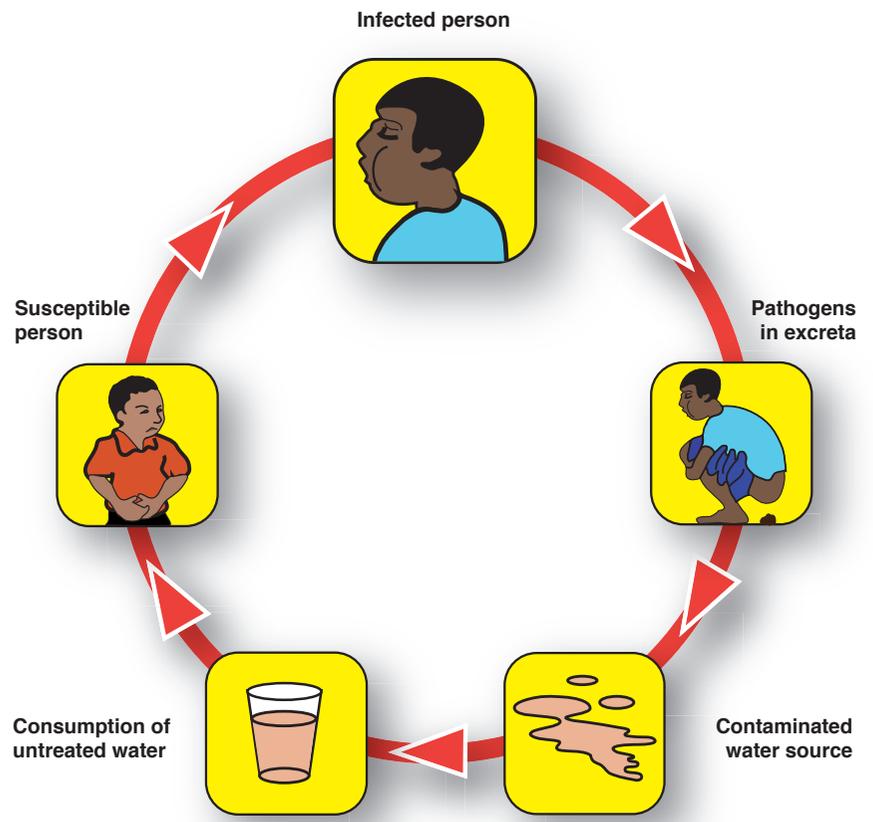


Figure 1. An example of a transmission route is through contaminated drinking water

Table 1. Visual components and attributes

Disease	Pathogen	Infectious dose	Annual burden	Asymptomatic carriers
Cholera (severe diarrhoea and vomiting)	<i>Vibrio cholera</i>	10 ³ to 10 ⁸	3 – 5 million cases 120,000 deaths	1 in 30 – 50 infected people develops illness
Giardiasis (diarrhoea and stomach cramps)	<i>Giardia intestinalis</i> (or <i>G.lamblia</i>)	10 to 100	200 million cases death rare	1 in 2 – 4 infected people develops illness
Typhoid (fever)	<i>Salmonella typhi</i> and <i>S paratyphi</i>	10 ³ to 10 ⁹	6 – 33 million cases 216,000 deaths	Asymptomatic carriers: Very common
Hepatitis A and E (liver inflammation, jaundice)	<i>Hepatitis A and E viruses</i>	low	1.4 million cases of hep A mortality rate > 1%	1 in 2 – 13 infected people develops illness
Bacillary dysentery (bloody diarrhoea)	<i>Shigella dysenteriae</i>	10 to 100	120 million cases, 1.1 million deaths	Asymptomatic carriers: Common

Types of faecal-oral disease

The diseases spread by faecal-oral routes can be categorized as:

- Water-borne diseases, where pathogens are ingested via contaminated drinking water or food. This is addressed by improving water quality.
- Water-washed or water-scarce diseases, where the disease is spread due to poor hygiene practices, such as a lack of hand washing after defecation and before preparing and eating food. This is addressed by improving water quantity
- Excreta-related diseases, where poor sanitation contributes to its spread.

Susceptible people

Healthy people usually require a high infectious dose before they contract the disease. If people are already ill (e.g. suffer from HIV/AIDS), if they are malnourished, elderly or very young, then they are more susceptible to the disease and will succumb to a lower than average dose.

Some people can contract the disease but not show any adverse symptoms (asymptomatic). They become carriers of the disease and can still spread it.

Epidemics

These diseases are of particular concern in emergency situations where lack of safe water and adequate excreta disposal, coupled with more susceptible people often living in crowded conditions, make the rapid spread of the disease possible.

Breaking the transmission

The spread of the disease can be halted by curing everybody carrying the disease, so it is no longer in their faeces, but this leaves them vulnerable to new sources of infection.

Vaccination has been very successful in reducing the spread of polio by reducing the number of susceptible people in the population. Once about 80% of the population are immune, the cycle of transmission is effectively broken, but vaccines are not available for every faecal-oral disease.

Generally a more sustainable solution is to break the transmission routes. This can be carried out at several stages, taking a multiple barrier approach. So, if one barrier does not stop the transmission, another may. Safe water, adequate excreta disposal or handwashing may each only reduce the disease by about 30%. Together, the impact is much higher, but wider environmental sanitation measures and improved general health (nutrition, for example) also contribute to the reduction of disease.

A complex pattern

The 'f' diagram is complex, featuring many possible transmission routes and barriers. Its role as a way of directly promoting good hygiene practices to the public is not always advisable, as it can be confusing. It is better to concentrate on one or two clear messages rather than trying to address every possible transmission route at the same time. These messages should be based on an assessment of the higher risk practices current in the local population and which of these can be identified and changed easily.

Print out a poster!

A poster of the 'f' diagram pictured overleaf is available from:

<http://wedc.lboro.ac.uk/resources/booklets/f-diagram.pdf>