Answers to data response and decision making exercises

1. Diarrhoea is the second leading killer of babies and young children in the world. The United Nations Children's Emergency Fund (UNICEF) estimates that this water-borne disease accounted for 9 per cent of all deaths among children under the age of five worldwide in 2015. This equates to over 1400 young children dying each day or about 530 000 children in a year. Most deaths from diarrhoea occur among children less than two years old.

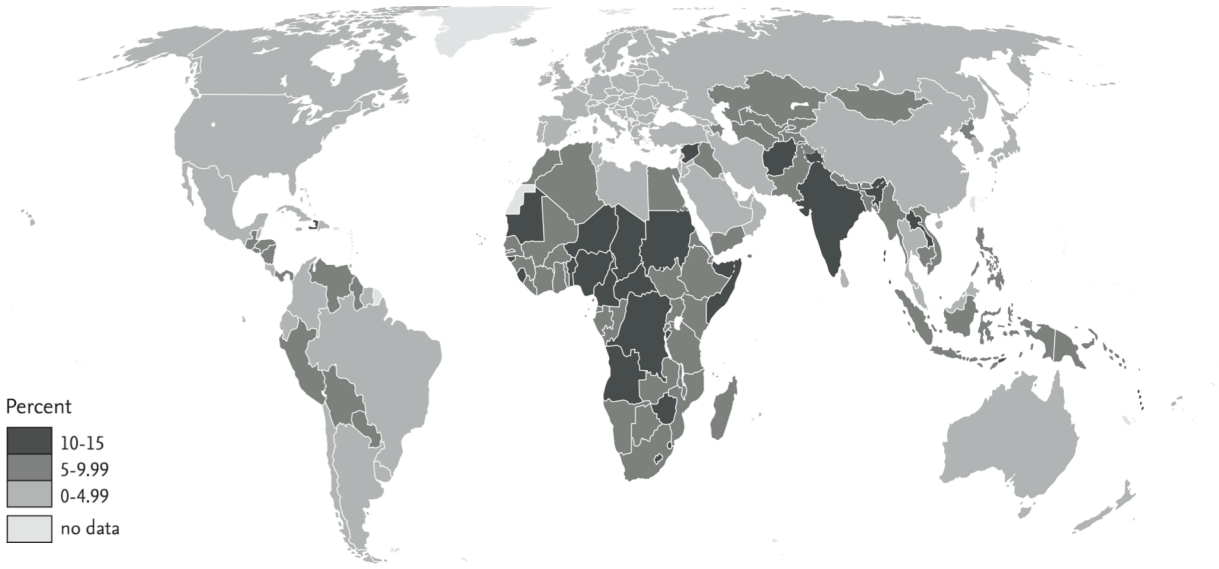


Fig. 4.26 Percentage of deaths among children under 5 years of age, attributable to diarrhoea, by country.

a) Describe the general distribution of countries in the world where diarrhoea accounts for 10 per cent or more of childhood deaths.
A total of twenty-four countries worldwide are in this category with seventeen being located in the continent of Africa, one in North America, one in Australia and five in Asia. There are none in any other continent. It is not surprising that most are in Africa or Asia since it is in these two continents that the majority of the world's poorest countries, known as LEDCs, are found.

b) The most severe threat to life posed by diarrhoea is dehydration. Explain what dehydration is and why you think it presents such a threat to babies and young children.
Dehydration is the excessive loss of water from the human body at a rate faster than it is replaced by fluid intake. It is most commonly caused by viral infections such as the rotavirus and symptoms include sweating, vomiting and diarrhoea. Babies and young children under the age of five years are particularly at risk from the effects of dehydration because they have a low body weight. Even small amounts of fluid loss at this age can become life threatening.

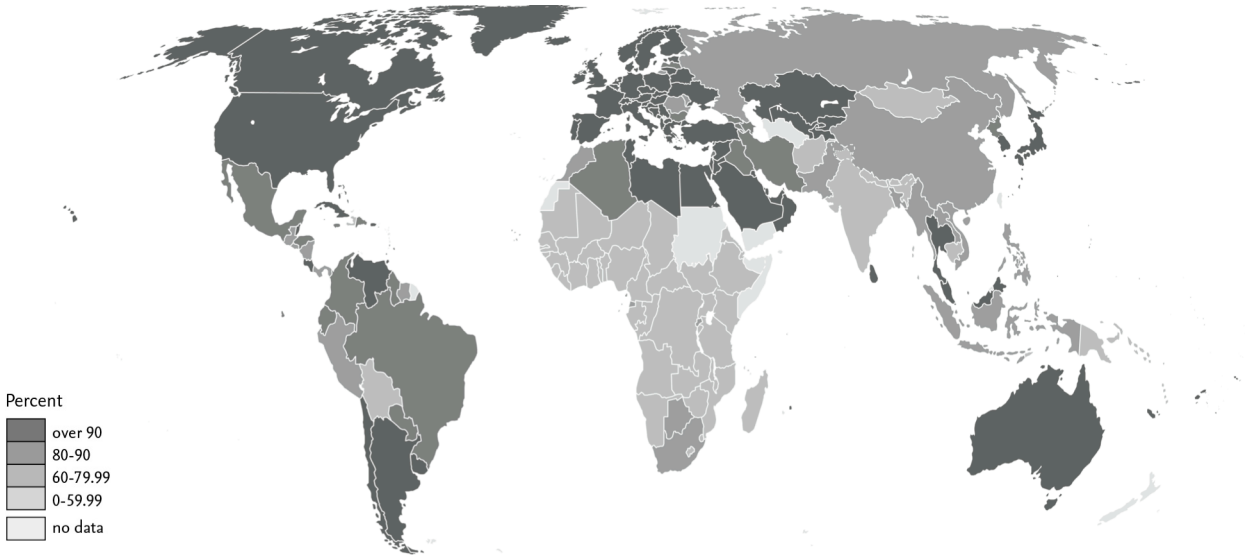


Fig. 4.27 Percentage of population with improved sanitation by country.

c) The map in Figure 4.27 shows the proportion of the population using improved sanitation facilities. Explain what you understand by the term 'improved sanitation'.
Examples of improved sanitation include flush toilets linked to piped sewage networks which are in turn connected to processing works. The term refers to any system which effectively removes human waste and ensures that it never has contact with drinking sources.

d) How does the information in Figure 4.27 help to explain the distribution of deaths as a result of diarrhoea in Figure 4.26 that you described earlier?
There is a strong correlation between those regions of the world with the lowest levels of improved sanitation and those with the highest child mortality levels linked to diarrhoea. This is not surprising since poor sanitation will result inevitably in human water supplies such as rivers or wells becoming contaminated by faeces and causing infections such as diarrhoea.

2. The country of Cambodia in Southeast Asia has one of the highest incidences of diarrhoea amongst children of any country in the world. Diarrhoea accounts for 20 per cent of all deaths of children aged under five, which translates to 10 000 overall deaths each year.

Fig. 4.28 Location of Cambodia.

Fig. 4.29 Cambodia.

a) UNICEF is working with the government of Cambodia and other partners in the country to reduce childhood deaths caused by diarrohea. One important part of its work is educating children about the importance of handwashing using soap. Suggest why this simple and inexpensive change could reduce childhood deaths from diarrhoea in Cambodia by up to 40 per cent.
Diarrohea is caused by the ingestion of disease carrying bacteria, parasites and viruses including rotavirus. Pathogens are most commonly passed from person to person through contaminated hands. Pathogens are easily ingested either when infected hands come into direct contact with the mouth or with water that may be used for drinking. Careful handwashing with antibacterial soap immediately after defecating is a low cost and sustainable method of reducing child deaths. Access to an improved water supply (potable water) is also required to achieve this, otherwise, although children will be washing their hands with soap, they will be using contaminated water.

Another focus of UNICEF's work in Cambodia is to provide every home with a toilet. The cost of doing this is a challenge in Cambodia, which is one of the poorest countries in Asia. Over two million people survive here on less than US$1.20 a day.

Fig. 4.30 Pumping raw sewage out of a gutter on a city street in Phnom Penh, Cambodia.

b) Using examples of improved sanitation that you have studied in other countries of the world, describe what UNICEF could do in Cambodia that would be cheap and effective.
It will be necessary to develop less expensive and more sustainable sanitation systems than in MEDCs which rely on local resources and expertise rather than advanced technology and high capital costs. An example is the joint Kenyan government – Oxfam project in Nairobi where millions of cheap, plastic and portable *Fresh Life* toilets have been distributed to homes. These are located in the home, are odour free and separate human solid and liquid waste. The waste is collected daily by local companies and processed into bio-fuel briquettes and fertiliser which are sold to residents. This is a good example of sustainable development – something which improves people's quality of life, involves a cost which is manageable and enhances the environment.

3. UNICEF estimates that 7 million out of 15 million Cambodians are unable to access safe drinking water – most of them poor and living in rural areas. Improving the quality of rural water would make a huge contribution to reducing child deaths resulting from diarrhoea in the country. Water for Cambodia is a non-government organisation (NGO) working in Cambodia, which since 2006 has been building and installing biosand water filters in rural homes that produce clean drinking water directly from contaminated sources. Each filter is constructed of a concrete case about a metre tall and a 10 centimetre square within which there are layers of sand and gravel.

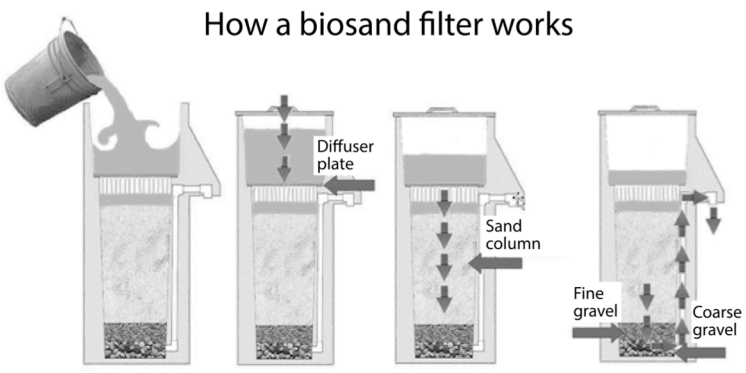


Fig. 4.31 A biosand filter.

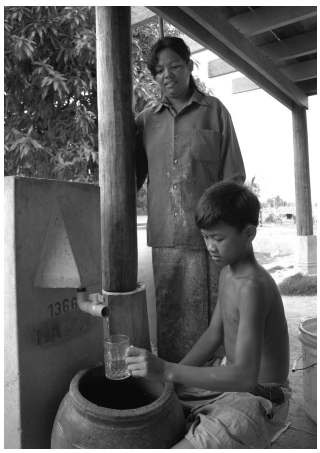


Fig. 4.32 A boy in Cambodia taking safe drinking water from a sand filtration device.

a) Suggest how the sand filter removes up to 98.5 per cent of bacteria from contaminated water.
Large organic particles settle in the top layers and smaller particles are eaten by harmless organisms attached to the sand particles. If the grain size is around 0.1 mm in diameter, a sand filter can remove all faecal coliforms (bacteria that originate from faeces) and virtually all viruses.

Read the following information about biosand filters from Water for Cambodia:

"A family receiving a biosand filter pays a nominal fee and is actively involved in the installation, giving them a vested interest in maintaining the filter. Also, instruction in filter operation and maintenance, as well as basic education in hygiene and sanitation, is provided. Biosand filters in general require very little maintenance (occasional stirring up of the top few inches of sand and scooping the suspended sediment) and are still functioning effectively at other sites more than 10 years after installation. Filters are manufactured locally using local materials. After passing through the sand and gravel, the now clean water travels through the copper pipe and out the spout using the force of gravity alone. There are no moving or mechanical parts to break. One filter can produce enough clean water for a family of 6–8 for many years."

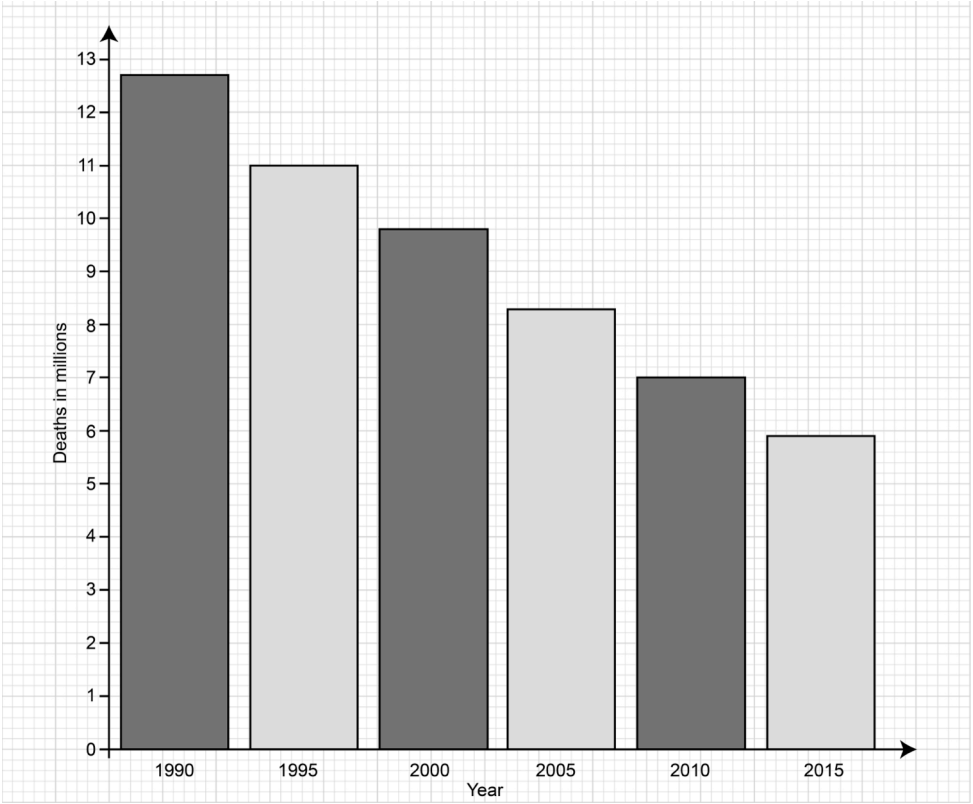
b) Explain why installing biosand filters is a good example of sustainable development for people in rural Cambodia.
Because they are cheap to construct using local resources, do not require expensive servicing, last for a long time and improve the quality of people's lives and the environment.

4. The figures in Table 4.1 show changes in the total number of deaths of children aged under five years in the world since 1990 calculated by UNICEF.

Year	Deaths in millions
1990	12.7
1995	11.0
2000	9.8
2005	8.3
2010	7.0
2015	5.9

Table 4.1: Deaths of children under five years, 1990–2015.

a) On the grid below, draw a simple bar graph to show these figures.



b) By how many million did deaths fall between 1990 and 2015?
6.8 million

c) Which five-year interval showed the greatest decline in deaths?
1990–1995

During this period, the total annual number of deaths in children under five years from diarrhoea decreased by more than 50 per cent from over 1.2 million to half a million. This is because of education programmes to improve hygiene such as hand washing, installing improved toilet systems and improving the quality of drinking water, particularly in rural areas. Another factor has also contributed to this dramatic decline in deaths. Children with diarrhoea can be treated easily with a simple and cheap oral rehydration solution (ORS) that involves drinking water with small amounts of salt, sugar and zinc added.

Fig. 4.33 A woman gives a boy some of the oral rehydration solution, Benin, Africa.

Fig. 4.34 Packets of oral rehydration solution from Nepal (left) and Peru (right).

d) Thousands of lives are now being saved across the world through the use of ORS. Suggest why even though cheap ORS has been available since the 1950s, they have not had a major lifesaving effect on children until fairly recently.
This is because ORS treatments will not have had any effect until the solution could be mixed in water which was not contaminated with faecal matter (potable water). So the advances of potable water access combined with improved sanitation had to be well progressed before ORS began to have an effect on controlling diarrhoea and saving children's lives.

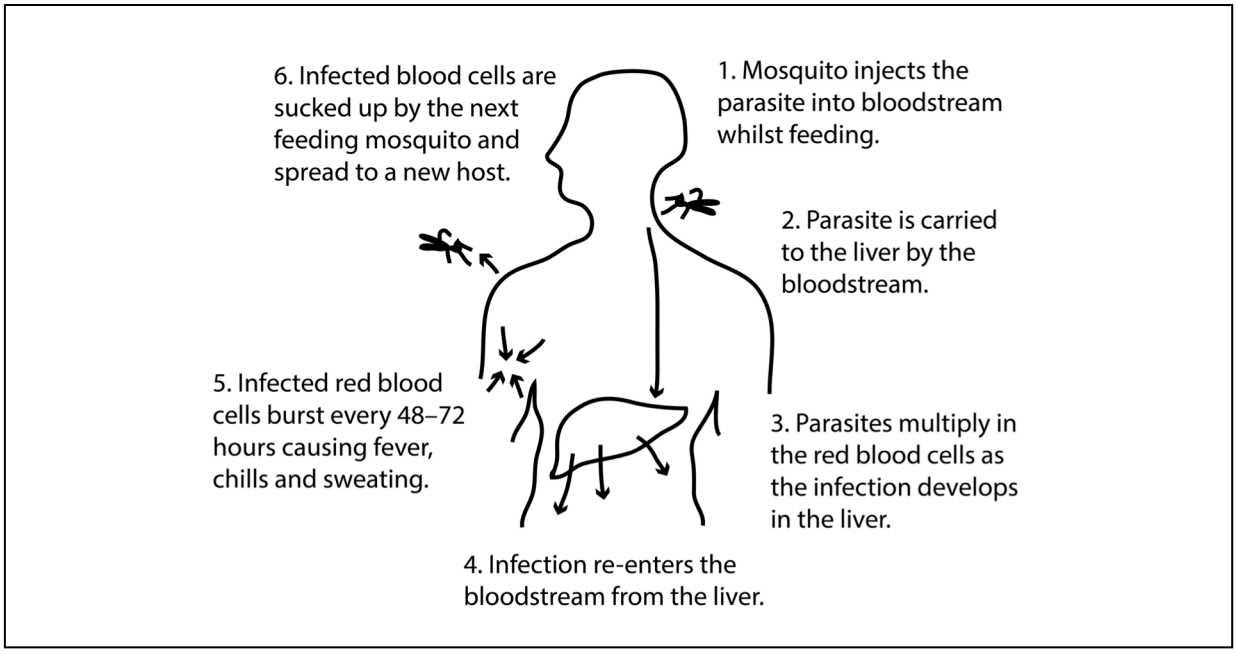
5. Rotavirus is the leading cause of diarrhoea in children and it cannot be treated with antibiotics or other drugs. Rotavirus and the deadly diarrhoea it causes can, however, be prevented through vaccinating children. For example, Ghana introduced rotavirus vaccination in 2012. By 2014, the number of children aged 0-11 months admitted to hospital with severe diarrhoea dropped from 4817 cases to 2711.

Fig. 4.35 Vaccinating a baby against rotavirus.


Fig. 4.36 Anopheles mosquito.

While progress is being made in Ghana in reducing child deaths from diarrhoea, the country is finding controlling malaria, another water-borne disease spread by the anopheles mosquito, a much greater challenge. In Ghana, approximately 20 000 children still die from malaria every year (25 per cent of all deaths of children under the age of five). Even if a child survives, the consequences from severe malaria such as convulsions or brain dysfunction can hamper long-term development and schooling. The economic burden of malaria is estimated to cost Ghana at least US$2 billion a year.

a) Using a diagram, show how anopheles mosquitoes spread malaria.



b) Explain why malaria is proving to be a very difficult disease to fight and conquer.

The parasite can lie dormant for many years. Infected people can therefore move long distances, including overseas, before they develop symptoms. Diagnosing malaria quickly, which is essential to control its spread, is too expensive for many LEDCs who often lack the trained medical staff to take samples from those living in remote areas, and then to analyse them in modern laboratories. The malaria parasite has also demonstrated that it can quickly build genetic resistance to new insecticides designed to control it. Because malaria mostly occurs in LEDCs, some people argue that pharmaceutical companies have been slow to prioritise identifying an effective vaccine because profit returns would be too low to justify the research costs.