The Institute for Research in Schools
Lesson plan: It takes a community

Overview and resources

This lesson has been produced by the Institute for Research in Schools (IRIS) in partnership with the MRC Integrative Epidemiology Unit at the University of Bristol. To find out more visit: www.researchinschools.org or email info@researchinschools.org.

The lesson is designed to take around 2 hours 30 minutes to 3 hours and can be delivered as one session or split over several sessions. It has been produced for students aged between 14 and 18 years old.

The following resources should be downloaded from the IRIS website in preparation for delivering this lesson:

- Lesson PowerPoint It takes a community
- Task Force briefing
- Task Force information pack
- Task Force Additional background
- Task Force Blank report.

The following videos will also be required:

- Pandemic Hunters BBC News Clip: BBC news: https://www.bbc.co.uk/news/science-environment-52775386
- I'm an epidemiologist YouTube video:
  Long version - https://youtu.be/Qmt_k36TDzM or
  Short version - https://youtu.be/lhdFlf2E5Ag

Disclaimer: This lesson along with the associated resources are based on a fictional illness called 'Exan'. All organisations, people and data mentioned in this activity are fictional.

Lesson instructions

Lesson outcomes

[Slide 3]

By the end of this activity students will:

- an understanding of the diverse STEM roles that play an important part in managing a public health emergency.
- To appreciate the critical role of data, its use, and its interpretation during a public health emergency.
- To recognise the importance of collaboration between scientists.

Extended Starter Activity (15 minutes)

[Slide 5 to 7]

Students will carry out a think, pair, share activity to answer the following question:

- Can you identify at least three global public health emergencies that have happened since 2000?

Students should spend one minute thinking about their answer independently. They will then have a minute to discuss their ideas with the person next to them and finally, the whole class will come together through teacher Q&A to share their ideas (3 minutes).

[Slide 8]

Possible answers:

Show students the possible answers and ask them to explain the difference between the two sets –

Communicable diseases

- 2000-2001 Central American dengue epidemic
- 2002-2004 SARS pandemic
- 2009-2010 H1N1 Influenza Swine Flu pandemic
- 2014-2016 West African Ebola epidemic
- 2015-present Zika virus epidemic
- 2019 – present Covid-19 pandemic

Non-communicable diseases

- Diabetes
- Cancer
- Heart disease
- Stroke
- Obesity

[Slide 9]

Explain the difference between communicable and non-communicable diseases:

- **Noncommunicable disease** – is a non-infectious diseases that cannot spread from one person to another or from one organism to another. These are usually caused by genetic, environmental and behavioural factors.
- **Communicable diseases** – can be transferred from one person to another, or from one organism to another. These are caused by pathogens such as viruses, bacteria or fungi.

[Slide 10]

The teacher should explain that:

1. An **outbreak** is when cases of a disease are in excess of what we would normally expect to see. An **epidemic** is when a community or region experiences an excess of an illness in excess of what we would normally expect to see. A **pandemic** is defined as a "an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people".
2. Although Covid-19 is by far the biggest global public health emergency in living memory, it is by no means the only one we have faced in recent years. There have been three worldwide outbreaks of influenza: 1918 (Spanish), 1957 (Asian) and 1968 (Hong Kong). The first influenza pandemic of the 21st century occurred in 2009–2010 and was caused by an influenza (H1N1) virus called Swine Flu. There have been many examples of epidemics that affect large parts of the world including Cholera, Ebola and Virus.

[Slide 11]

The teacher should explain that:

3. A Public Health Emergency of International Concern (PHEIC) is a formal declaration by the World Health Organization (WHO) of "an extraordinary event which is determined to constitute a public health risk to other States through the international spread of disease and to potentially require a **coordinated international response**".

Introduction Activity (10 - 15 minutes)

[Slide 13]

Students should watch this short video clip from the BBC news website:

https://www.bbc.co.uk/news/science-environment-52775386

Optional – read the accompanying article – this will need to be printed or students will need access to the internet.

The video explores a very specific piece of work, which aims to act as a type of early alert system to warn us of future potential pandemics. Like much of the media around coronavirus, this clip constantly refers to 'scientists' which can be a little bit misleading.

Ask students to watch the clip again but this time think about the specific type of scientists or skills needed in order to complete this project.

[Slide 14]

As a group come together to discuss your ideas.

Students will come up with many different roles and it is important to emphasise at this point that is really does take an extremely large community of scientists to help protect us from pathogens.

[Slide 15]

Go through some of the possible answers including:

- Veterinarians, Animal Biologists/Behaviour Expert, Ecologists and Animal Trackers – all of these individuals work directly with animals, not only to take samples (e.g blood, saliva) but also to monitor their behaviour, track their locations and explore their interactions with the human world around them.
- Microbiologists/Virologists/Lab Technicians – This group of experts look at identifying the pathogen, analysing it from the structure right down to the DNA. They aim to understand how it interacts with human cells to ultimately make us sick.
- Epidemiologists – this is a generic term often used to describe a scientist who studies the patterns, causes and effects of diseases in groups of people. For example, an Infection Control Epidemiologist would often work in a clinical setting advising hospitals on how to keep an infection under control whereas an Infection Disease Epidemiologist works to understand the effects of disease on a population.
- Mathematician, Modeller, Coder – This group isn't often associated with public health emergencies, but they play a crucial role in such instances. They collect and use data to predict and model the spread of a pathogen, explore who might become ill and in turn help to identify possible solutions or control methods. In the video example, they use their skill to help write algorithms which will potentially identify future pathogens which could cause a pandemic.

[Slide 16]

Play students the video called 'I'm an epidemiologist'. There are two versions of this video depending on time available:

- Long version - https://youtu.be/Qmt_k36TDzM or
  Short version - https://youtu.be/lhdFlf2E5Ag

[Slide 17]

Explain to students what Epidemiologists do. If students have access to the internet, it is recommended that they spend around 10 minutes looking at the job profile on prospects.ac.uk.

Main Activity (120 minutes)

[Slide 19]

The instructions for the main activity can be found in the **Task Force briefing** document. It is recommended that all students are given a copy of this document and that you read through the document/instructions as a group.

Split the students into smaller groups and provide each group with one copy of the following documents:

- **Task Force information pack**
- **Task Force Additional background information**

Each sub-group must select a leader who will co-ordinate the group's activity and act as a spokesperson.

At this point give the students between 10 and 15 minutes to have an initial read through the materials. We would recommend that during this stage, students annotate the graphs with any patterns or trends they are observing.

After 15 minutes, bring the groups back together and hand out the **Task Force Blank report**. Inform students that in their sub-groups they need to use the information provided to answer each question. We recommend, that students spend between 15 and 20 minutes on each question. To maintain the activities pace we suggest using a stopwatch or timer.

When answering questions students should:

- Look for links across different sources.
- Reference the source they are using to evidence their answers/viewpoints.
- Where appropriate try and explain their answers.

Sub-groups should record their answers in the **Task Force Blank report**.

Once students have had enough time to go through each question bring the class back together.

Go through each question asking the spokesperson for each group *to provide their answer and justify itusing evidence*. This phase of the lesson presents a prime opportunity to get students to discuss their conflicting answers and views. When this is happening, point out to students that sometimes things are not clear cut or obvious and people working in this field often spend a large amount of time collecting data in an attempting to find out what is happening.

Main activity feedback has been provided at the back of this document.

Plenary Activity (10 minutes)

[Slide 21]

Ask students to reflect on the title of this lesson 'It takes a community . . . ', in the context of this lesson and of the Covid-19 pandemic, what does this mean to them? Ask student to discuss and share their ideas.

If required used the following prompts to direct the conversation:

- Collaboration
- STEM (Science, Technology, Engineering and Math)
- Data, Modelling and Coding

[Slide 22]

Go through the outcomes and reflect on what progress students feel they have made.

Main activity feedback

Sweat tends to be one of the main transmission methods. We can see that apart from blood, almost 100% of people infected with Exan will contain viable infectious Exan-21-A in their sweat. Unlike blood, sweat is regularly secreted from the body and appears to be the main route of transmission for Exan-21-A. This is supported by data which suggests that (a) gyms and sport facilities appear to be the main locations of transmission and (b) those that play a team sport or use a communal gym appear to be more likely to catch Exan. Interestingly, hospital admissions appear to increase during the summer months or warmer weather. This is most likely due to increase sweating or could also be linked to how well the virus can survive in colder climates, this will require additional investigation. In addition, people could be more active in the summer verses winter but we do not have any data available to support this view.

Another factor that appears to increase the likely hood of becoming infected with Exan-21-A is using public toilets and possibly hygiene, although we do not have direct evidence to support the latter point. We know that during stage 2 of the infection 95% of people will experience stomach cramps and diarrhoea. Just under 75% of faeces sample contained viable infectious Exan viruses, making it the 2nd most contagious bodily excretion after sweat. People who use public toilets more regularly or who live in shared households appear more likely to catch Exan-21-A. In addition, those who sanitise or wash their hands less also appear more likely to catch Exan-21-A. Data suggests that are you more likely to catch Exan-21-A on public transport modes which have toilets vs transportation without toilets, this could provide indirect evidence to hygiene and shared toilets being a risk factor.

Transmission in the education sector seems to be concentrated in the nursery setting (72% of cases). It is not clear from the data why this is, but it could be linked back to hygiene. It is not unreasonable to assume that very young students have less rigid hygiene routines and therefore are more likely to pass Exan on the through faecal matter. Additionally, it is not unreasonable to assume that smaller children are less likely to maintain social distancing. More data is needed on the effectiveness of social distancing and the importance of hand/toilet hygiene in preventing the spread of Exan. It is well established that young children tend to sweat less, although no data is available, and therefore we need to question if the main transmission routes of Exan are different between adults and children.

Although additional data is needed, we think that Exan-21-A is mainly caught through direct contact, although we suggest that research is carried out to determine if Exan can be caught through airborne particles? We do not think this is likely however, as transmission appears to be low in some environments that are ideal for airborne transmission e.g. universities (lecture halls) and on public transport.

To control the spread of Exan-21-A in the community it appears that we need to reduce activities that involve sweating and coming into contact with other peoples sweat. Recommendations include:

- Closing public gyms
- Banning team sports or group exercise
- Avoiding situations where people are enclosed in warm environments for example night clubs or pubs.

We will also need to reduce the use of public/shared toilet use or where this is not possible enact enhanced cleaning and hygiene procedures.

In a clinical setting it should be far easier to control the spread of Exan-21-A. We would recommend the following:

- Patients should be isolated in a single room or with other patients suffering from Exan-21-A.

In both settings we would recommend that regular handwashing with soap not sanitiser take place.

It is well known that exercise helps maintain positive mental health. Data suggests that a lockdown could have a detrimental impact on mental health and although we are not recommending a national lockdown we would need to consider the impact that banning group/public exercise or team sport could have on mental health. It is not unreasonable to suggest that solo outdoor exercise could continue but we would need to be mindful of sweating and not touching surfaces.

Overall, data suggests that a total closure of all schools is not necessary, particularly when we consider the impact that it could have on the progress of the poorest 20% of students. We would recommend however that nursery settings are closed or that the number of students in nursery at any one time is reduced along with the introduction of enhance cleaning and hygiene measures.

We do not have access to mortality data, but we do have hospital admission data. It is safe to assume that individuals who are admitted to hospital are experiencing more severe symptoms and are therefore at a higher risk than their counterparts. Hospital admission data suggests that very young children and the elderly are at higher risk of Exan-21-A. Data also shows that males are more likely to be admitted into hospital than females. Finally, the higher your BMI, the more likely you are to be admitted into hospital. This is interesting because the elderly and those with high BMIs are overall less likely to catch Exan. We do not have any data on this but it is well established that the very young and very old are more susceptible to dehydration due to diarrhoea and are less able to thermoregulate when they have a fever. Is this why these groups are more likely to be admitted into hospital with Exan? More data and study is required.

Excess mortality data does show that there have been more excess deaths amongst those with a lower level of education. We cannot assume that those excess deaths are due to direct Exan infection or if they are caused by indirect or non-related factors. Data does show that the most deprived have a lower life expectancy than the least deprived and that those on a low income are more likely to be physically inactive than their wealthier counterparts. While we can assume that a lower level of education is positively correlated with income additional research needs to be carried out to investigate why excess deaths in this group is significantly higher than in other groups.