Introduction - What is Tuberculosis (TB)?

- An infection caused by the bacterium Mycobacterium tuberculosis
- Spreads through inhaling tiny droplets from
- coughs/sneezes of an infected person
- Commonly affects the lungs and can cause many holes in them, though it can also damage other organs
- According to Public Health England, the UK has the second highest mortality rate from TB in Western Europe, which is also 5 times higher than in the US.

## The Severity of TB

- One major symptom is a persistent cough that lasts more than 3 weeks, which is what our product aims to use for
- Other symptoms- bloody phlegm coughed up, intense breathlessness and night sweats
- Research by the Australian National University has shown that as a result of TB, disabilities such as mental health illnesses and musculoskeletal disorders can occur

**Current Treatment** 

Pulmonary TB is treated by an antibiotic regime

There are some problems with the current treatment

• Consists of 2 antibiotics- isoniazid and rifampicin, with an additional

Treatment for MDR-TB is much longer (20-24 months), and involves

• This is the reason why TB is still a major health problem worldwide

Allows scope for immediate isolation and early access to treatment

• Patient compliance will increase as they are not as badly affected by

• The spread of TB and time for antibiotic regime will be lowered.

the disease and will need to take drugs for less time.

This will reduce to likelihood of MDR-TB developing.

2 drugs (pyrazinamide and ethambutol) for the first 2 months

The potential for Multi-Drug Resistant TB (MDR-TB) to occur

• The conventional treatment last for 6 months

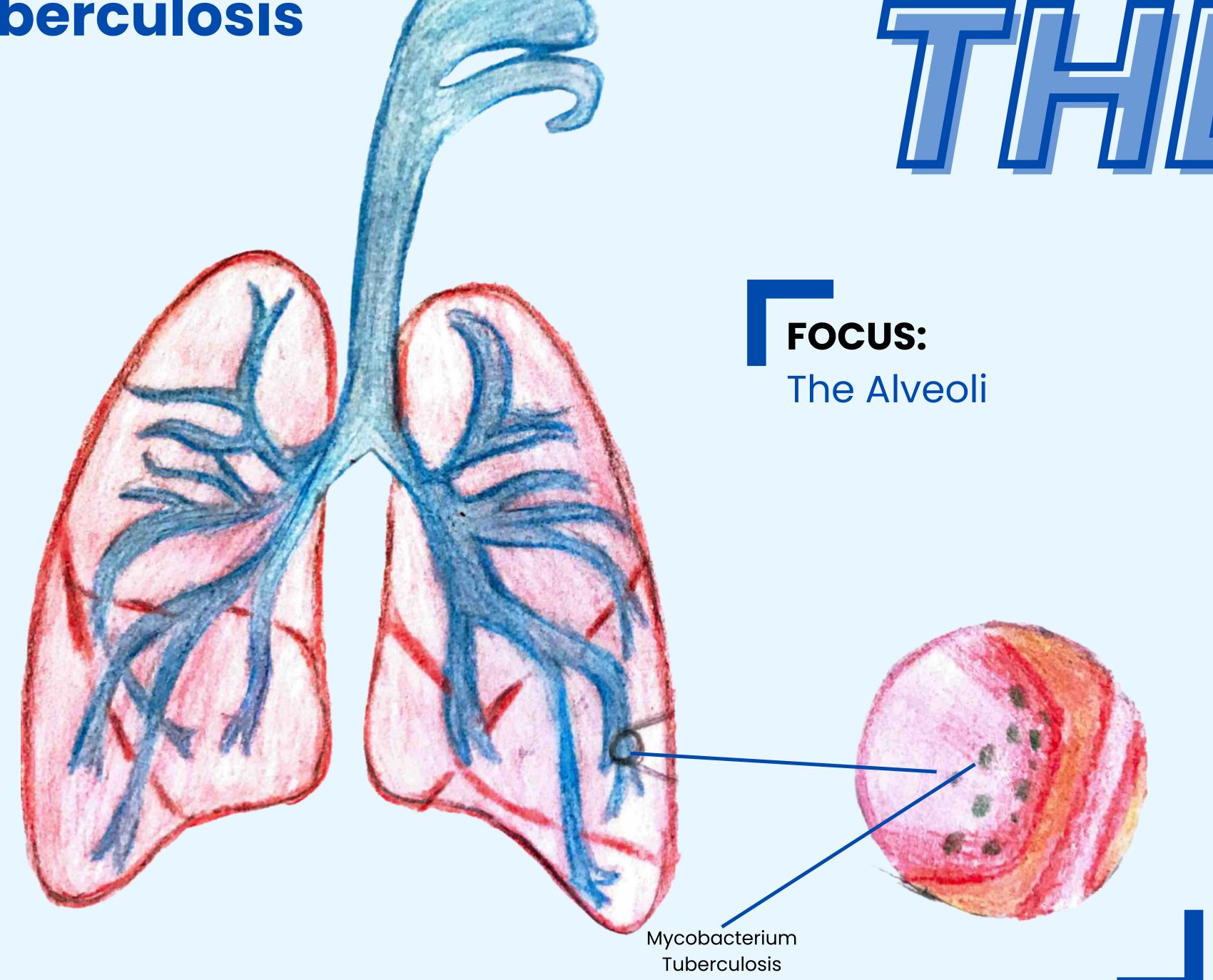
use of toxic drugs, such as Linezolid

and in large cities such as London

Our product aims to **solve these issues** 

Designed to detect TB early in patients

• If untreated, it can be **fatal** 



### <u>Urbanisation</u>

- The incidence of TB in some parts of east London is comparable to that in India.
- These areas tend to be overpopulated, which as an issue due to the communicable nature of TB

- Can increase in future as more people migrate to the UK due to international crises and globalisation, which we have seen recently
- with high rates

from high-risk countries in overpopulated areas

# and TB

- TB mortality is high in urban areas, particularly London
- One big risk factor for the spread of TB is time spent in a country

# Links Between Modern Issues

### <u>Immigration</u>

- Multidrug-resistant TB is more common in London, which is likely to be due to immigration from Eastern Europe.

There is a clear link between the two, as there is more immigration

### FOCUS: The occurrence of MDR-TB via Natural Selection Pros of the Firstly, non-compliance has to take place amongst patients (often due to the length of the treatment) **TB Tester**

Cons of the **TB Tester** 

### √Non-invasive

Casing, which is subject t

a change of colour/ the

children are the target

shape of animals if

group

Low cost of the raspberry pi inside the computer √Device is small and portable, so can be hand-held or

√Quicker diagnosis time than alternatives, such as X-Rays √Available for repeated use in public areas, so less devices

A 'Disease of the Past'?

Not only affects all countries but also all age groups.

women and 11% were children aged 0-14.

• 1882- Dr. Robert Koch announced the discovery of Mycobacterium tuberculosis

• One common misconception is that this bacteria that causes TB has been eradicated

• Globally, tuberculosis (TB) is still the **leading cause of death** by an infectious disease

being an **emergency** concerning the respiratory system, which we hope to prevent

2020-56% of notifications were of reports of TB in adult males, 33% were adult

In the UK, people are still being admitted to hospitals, with the usual circumstance

Image of a TB Tester at a bus stop

need to be manufactured

Stand for stability and to prevent theft

### X Possibility of inaccurate results if the device isn't cleaned properly

X Confidentiality may be compromised.

# Trialling

LEDS to indicate result of test

participants who have risk factors/symptoms of TB (excluding direct contact) and another with participants without risk factors/symptoms

2 participant groups: one of

Microphone output attached for

user to cough into

Separate cohort studies for adults and children with a sample size of 12 participants

Participants complete health history questionnaires and use the TB Tester alongside a TB blood test, ensuring that there's a negative result

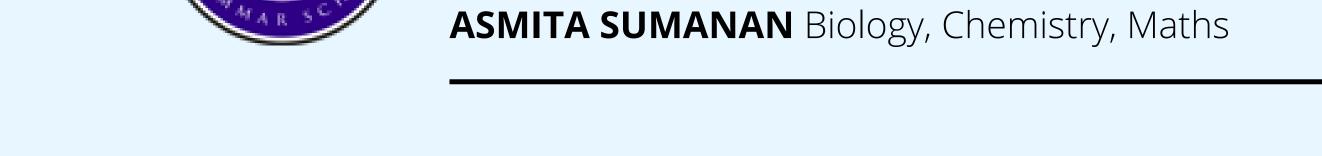
All participants are then

continuosly exposed to TB

After a week, there's a followup where the participants complete a questionnaire ticking off what symptoms they are currently experiencing

### Participants are then de a TB blood test and use the product

If the blood test result is positive the time taken (days) for Tb tester to give a positive result is recorded. The follow-ups are done every week for a year. Data collected is then used to calculate the efficacy and accuracy of our product



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# Our Proposal: Early and Easy Detection of TB

### **Our Objectives:**

- To detect TB in its early stages to prevent further spreading endemically/epidemically/globally.
- To detect TB through latest innovative technology

### Possible Locations for TB Tester:

- Airports, train stations, bus stops, community centres
- This is because these places are epicentres for the transfer of disease
- Hospitals

### The Basic Process:

- 1. Patient coughs into the microphone
- 2. The cough recording is interpreted by the device
- 3. The LED on the device will flash red if the user is TB positive and flash green if they do not have TB

## FOCUS:

### The technology behind the TB Tester

The sound of the cough will be interpreted via machine learning in a computer with a raspberry-pi device

- 1. Information will be taken from a database of cough audio recordings and used as statistical classifiers,
- Demographics, i.e age/sex of patients who had TB and those who did not will be considered Other respiratory diseases and their 'signature' coughs will be taken into account
- 2. The data will be compared to find matches between short term spectral information, such as frequency
- 3. Automatic analysis of the cough sounds will take place
- 4. There will be a final decision of a +ve/-ve result

### Our product has potential, as...

- In two separate experiments, there has been a 78% and 85% accuracy in differentiating TB positive people from controls
- With advancements in technology and further sensitivity in AI, the success will be more likely to increase

# Practicalities

- The device will be distributed to community centres in the UK- promoted by GPs during consultation with
- In low-income countries, the device will be found in transport areas such as bus stops, train stations etc.
- implementation will also occur in airports alongside security checks.
- Volunteers and people involved in community service can be involved in monitoring and cleaning the device before and after use to prevent the possibility of inaccurate results.



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Bacteria resistant to the drug are more likely survive

Bacteria multiply and prolong the infection