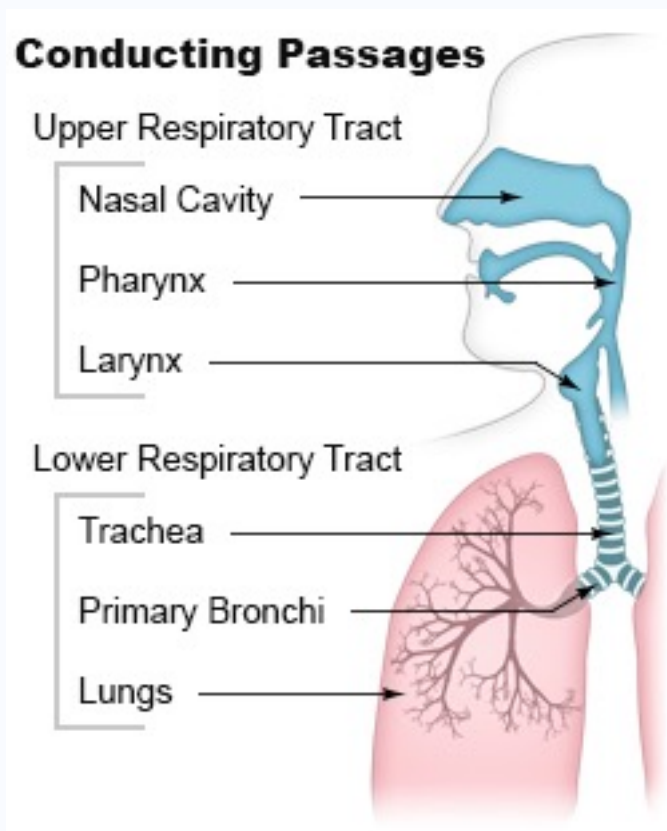


Respiratory Tract Infections: A Clinical Perspective

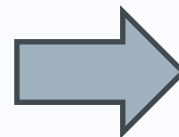
Professor Nick Francis

13 March 2025

Respiratory Tract Infections (RTIs)



- Most common illnesses to affect humans!
- Coughs, colds, sore throat, bronchitis, pneumonia



Societal impact

- Health
 - Symptom burden
 - Mortality
 - Long-term effects
- Healthcare
 - Primary care
 - Emergency departments
 - Hospital admissions (winter bed pressures)
- Economic
 - Lost productivity
 - Cost of treatment
- Education
 - School absenteeism
- Epidemics and pandemics
- Antibiotic use and antimicrobial resistance



Antibiotic use

WHO IS PRESCRIBING?



General practice

11%



Hospital inpatients

7%



Hospital outpatients

5%



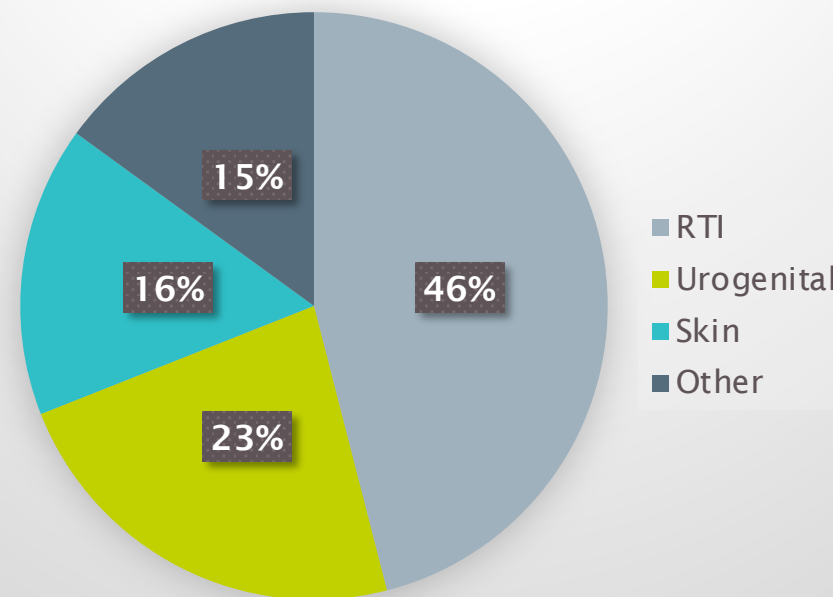
Dental practices

3%



Other community settings

Antibiotic use in primary care



Antimicrobial resistance

GLOBAL A failure to address the problem of antibiotic resistance could result in:



10m
deaths
by 2050

Costing
£66
trillion

EUROPE



25,000

people die each year
as a result of hospital infections caused by

5 key
resistant
bacteria



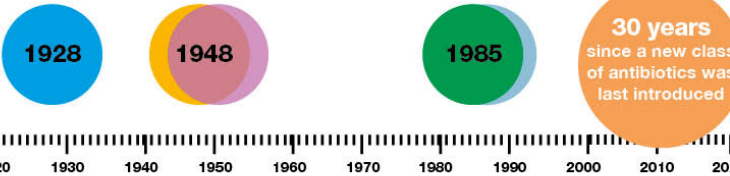
Antibiotic discovery and resistance timeline



Date of
resistance
identified



Date of
discovery



“It is not difficult to make microbes resistant to penicillin in the laboratory by exposing them to concentrations not sufficient to kill them, and the same thing has occasionally happened in the body. The time may come when penicillin can be bought by anyone in the shops. Then there is the danger that the ignorant man may easily underdose himself and by exposing his microbes to non-lethal quantities of the drug make them resistant.”

Alexander Fleming

Increased use of antibiotics leads to increased resistance

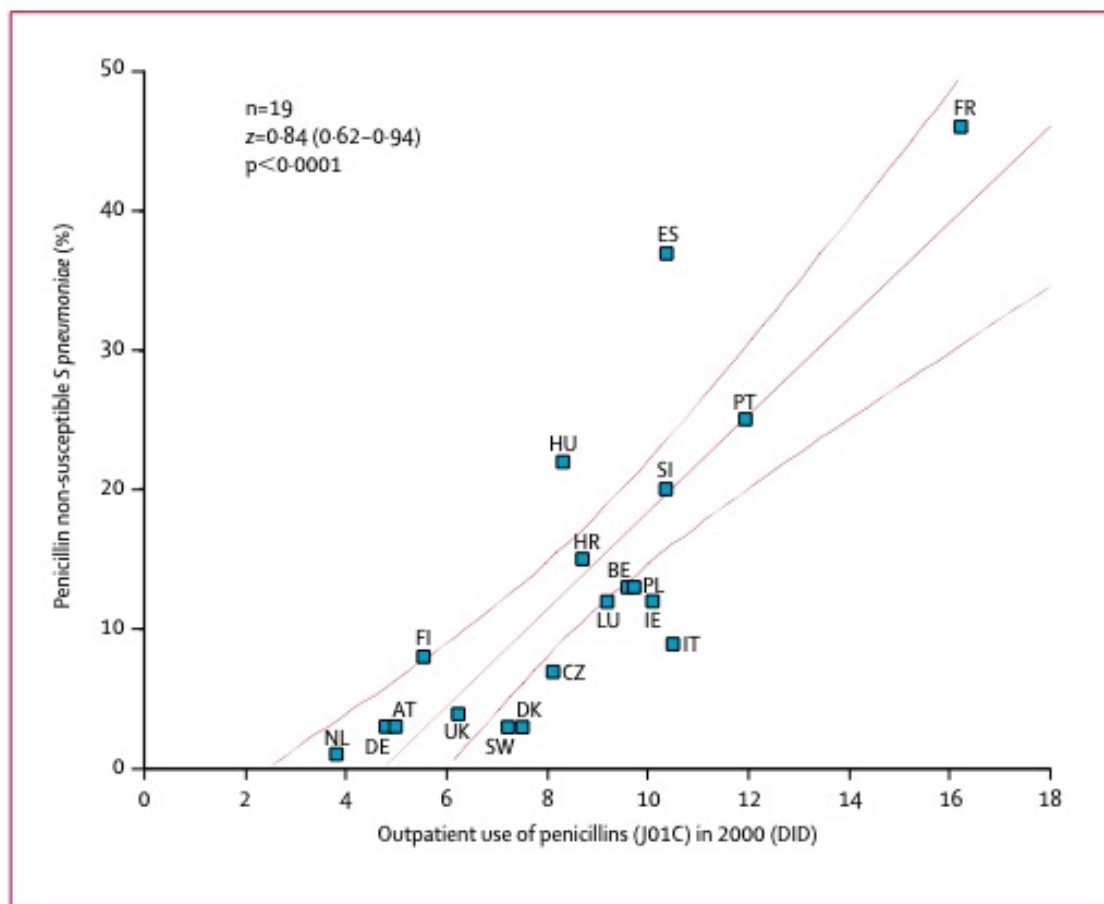
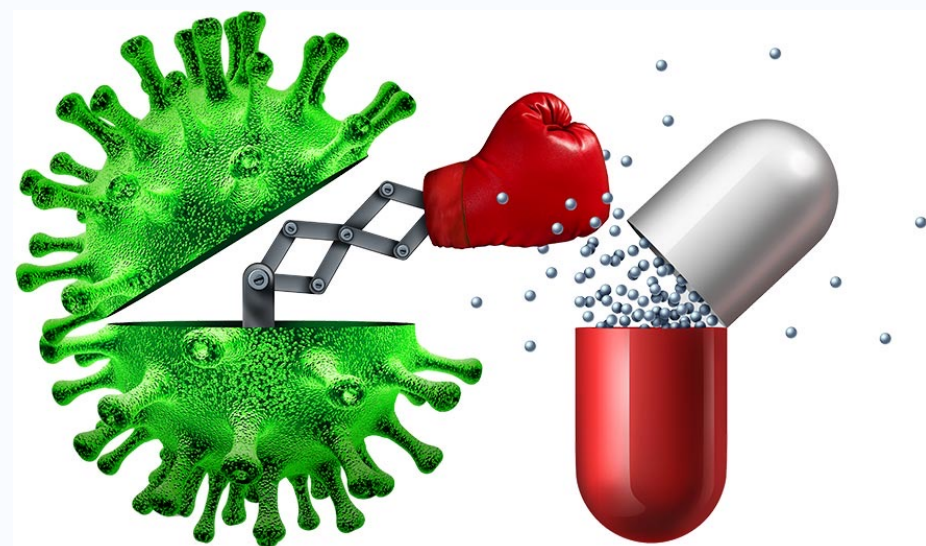


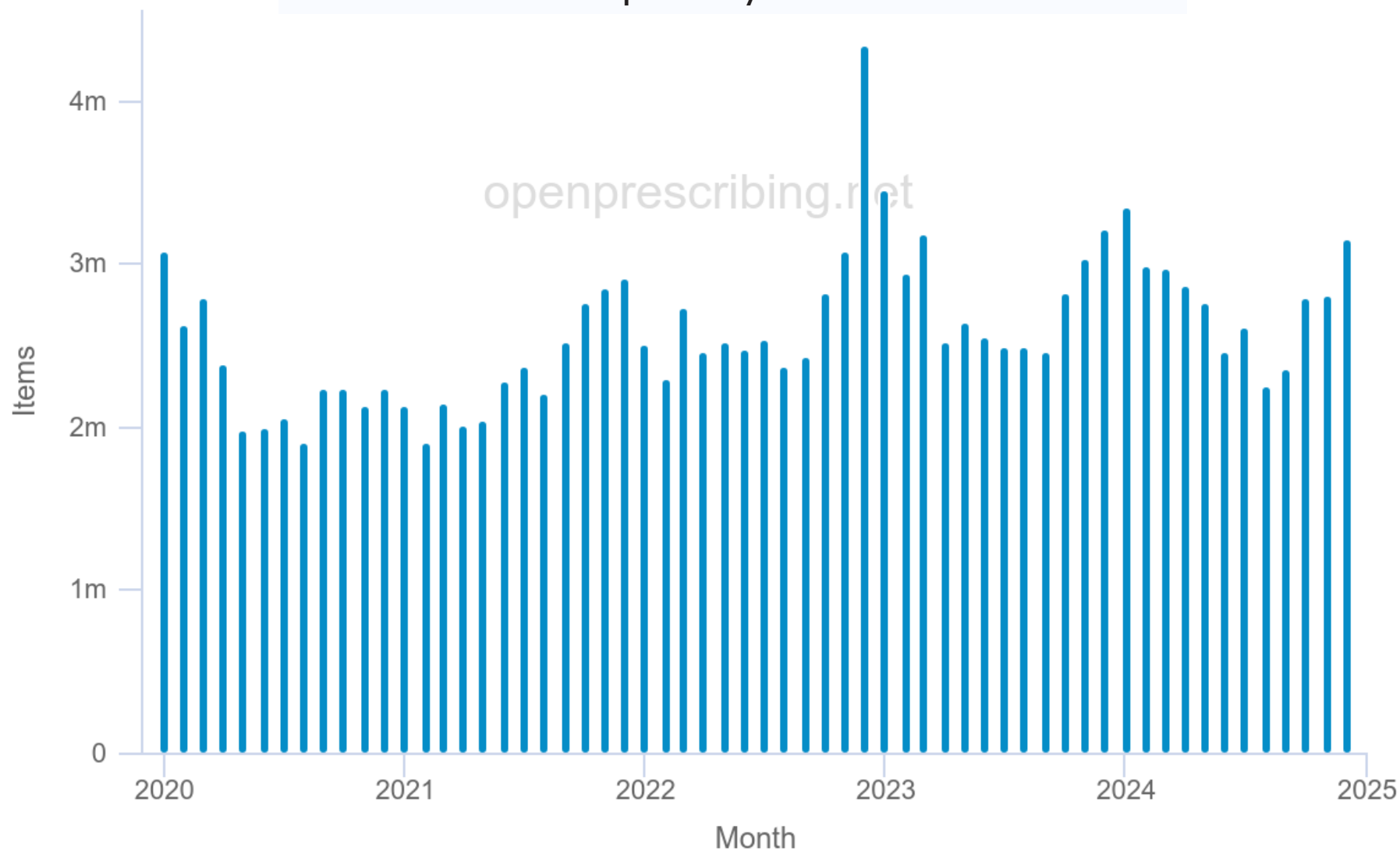
Figure 6: Correlation between penicillin use and prevalence of penicillin non-susceptible *S pneumoniae*
AT, Austria; BE, Belgium; HR, Croatia; CZ, Czech Republic; DK, Denmark; FI, Finland; FR, France; DE, Germany; HU, Hungary; IE, Ireland; IT, Italy; LU, Luxembourg; NL, The Netherlands; PL, Poland; PT, Portugal; SI, Slovenia; ES, Spain; UK, England only.

Antibiotic use for an RTI increases the risk of a subsequent resistant infection: OR = 2.4 (1.3 to 4.5)

Costello et al. BMJ, 2010.

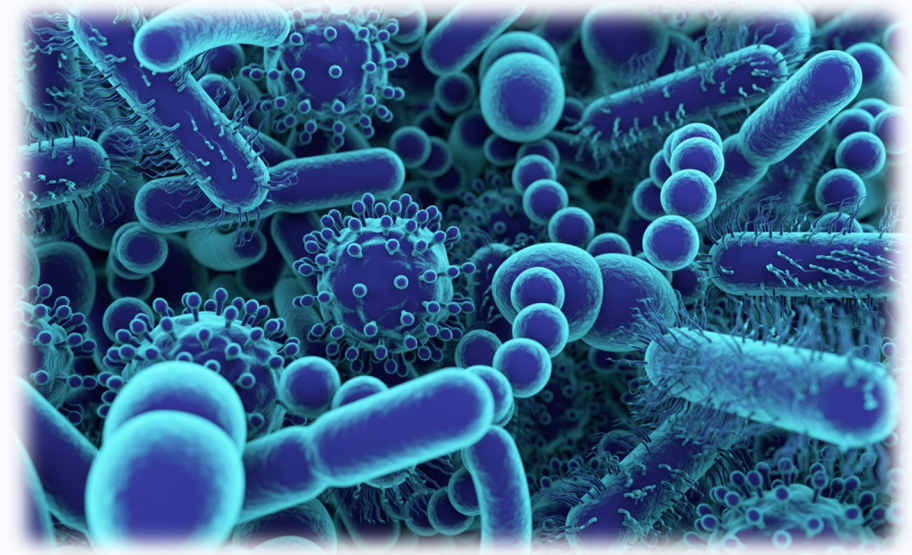


Antibiotics use in primary care: 2020 - 2025



Causes of RTIs

- Most RTIs are caused by viruses, but they can also be caused by bacteria and fungi
- Other conditions, such as allergies, can cause symptoms that can be confused with RTIs
- Depending on the type of RTI, ~60% - 80% are caused by viruses
 - Rhinoviruses
 - Influenza viruses
 - Coronaviruses
 - RSV
 - Adenoviruses
 - Parainfluenza viruses
 - Human metapneumovirus



Meta-analysis of primary care studies (N=13964)

- 33% virus detected
- 18% bacteria detected
- 20% both virus and bacteria detected
- 30% no pathogen detected

Assessing the diagnosis and prognosis of RTIs

- Diagnosis
 - The process of identifying the illness along with its causes and symptoms
- Prognosis
 - The process of predicting the progression of an illness

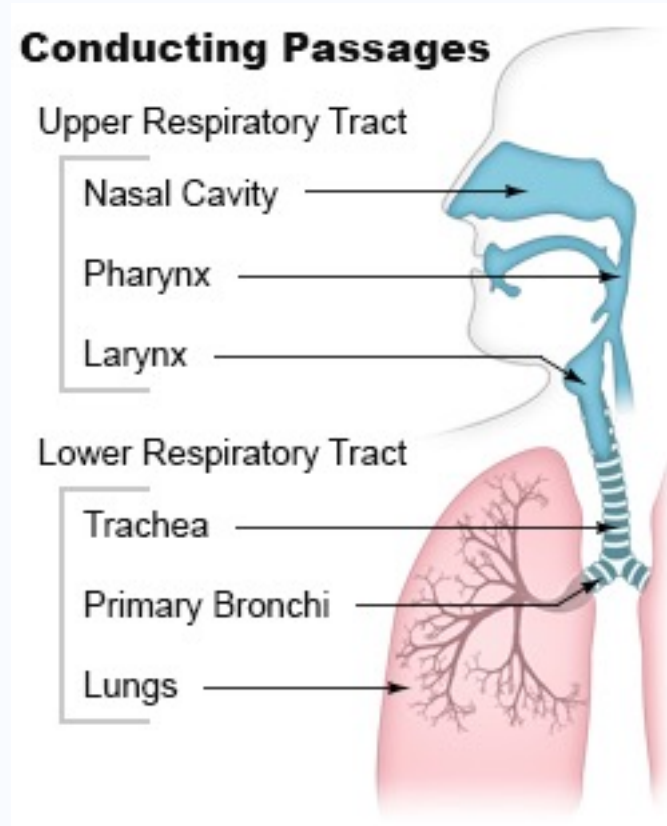


Diagnostic and prognostic tools



- Clinical assessment – symptoms, risk factors, vital signs, examination
- Clinical decision rules
- Point of care tests
 - Biomarkers
 - Pathogen tests
- Laboratory tests and imaging

Respiratory sounds



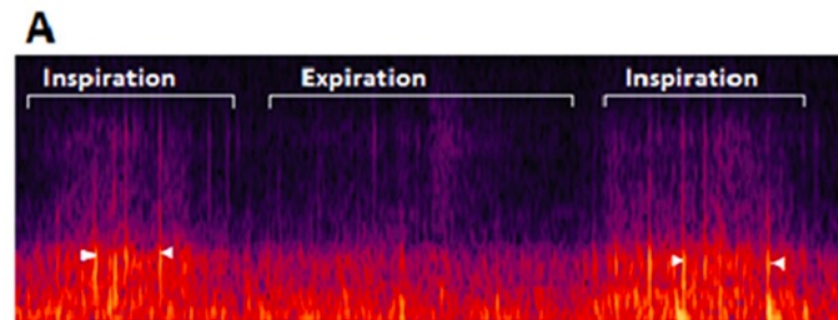
- RTIs often result in cough, which produces sound
- Breathing sounds may be affected by RTI
- RTIs cause increased mucous production in the airways, which can create or change breathing sounds
- RTIs cause swelling in the lining of the airways, voice box and throat, and therefore can change the way someone speaks or makes sounds

Auscultation

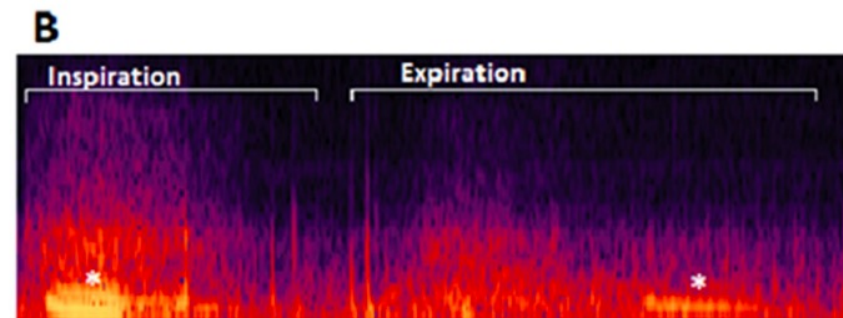
- Chest auscultation using a stethoscope has been a key part of the assessment of patients with RTI since the technique was first described by Laennec in 1816
- The stethoscope has become a hallmark of the medical profession



Crackles



Wheezes



Type	Description	Mechanism	Possible causes
Crackles	Discontinuous, popping sounds (fine or coarse)	Caused by air moving through fluid, mucus, or collapsed alveoli reopening .	Pneumonia, Bronchitis, Bronchiolitis
Rhonchi	Low-pitched, snoring or gurgling sound	Due to airflow through mucus-filled large airways	Bronchitis, COPD
Wheeze	High-pitched, musical sound (mainly on expiration)	Due to narrowed airways from inflammation, bronchospasm, or mucus plugging	Viral Bronchiolitis, Asthma, COPD, Pneumonia
Stridor	Harsh, high-pitched sound (mainly on inspiration)	Caused by narrowing of the upper airway (trachea, larynx, epiglottis) due to inflammation or obstruction	Croup, Epiglottitis
Pleural Rub	Grating, leathery sound heard with respiration	Caused by inflammation of the pleural surfaces rubbing against each other	Pleurisy
Diminished Breath Sounds	Reduced or absent air movement sounds	Suggests reduced airflow, lung collapse, or fluid in the pleural space	Severe Pneumonia, Pleural Effusion
Bronchial Breath Sounds	Harsh, tubular sounds	Occurs due to increased sound transmission through fluid-filled alveoli (consolidation)	Consolidation in Pneumonia

Do auscultation findings predict adverse outcome?

- Cohort study of 28,846 patients with acute LRTI
- Risk Factors at first consultation for severe adverse outcomes (death or hospitalisation from LRTI complications or pneumonia or reconsultation)

Feature	aRR
Crackles	1.39 (1.01-1.90)
Bronchial breathing	1.07 (0.71-1.60)
Wheezing	0.89 (0.67-1.18)
Age > 65	2.15 (1.72-2.67)
Any comorbidity	1.57 (1.24-1.99)
No coryza (runny nose)	1.60 (1.27-2.02)
Sats < 95%	2.76 (2.08-3.65)

Value of auscultation

- Influenced by obesity, clothing, movement, ambient noise
- Several causes of each sound
- Wide variation in the use and interpretation of terms
- Inter-rater agreement:
 - Crackles - kappa = 0.49 (moderate)
 - Wheeze - kappa = 0.62 (substantial)

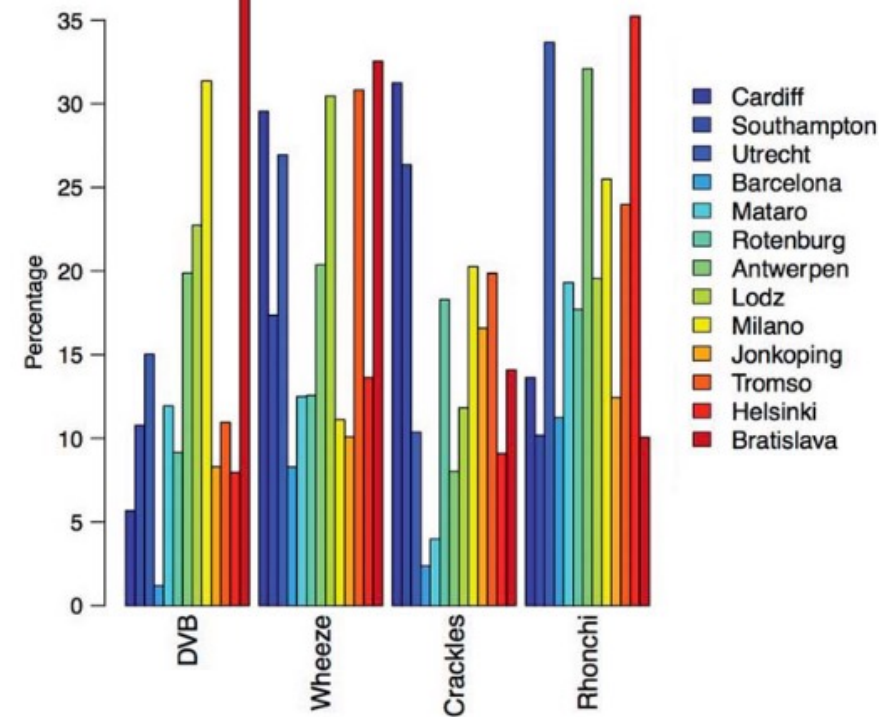


Figure 2. Proportion of patients in each network with each of four auscultation abnormalities.

Why develop a self-assessment tool to inform prognosis?

- A tool that could reliably predict whether an infection was likely to get better or worse may help patients feel that they do not need to see a healthcare professional about their RTI.
- This could reduce anxiety, unnecessary consulting, and unnecessary use of antibiotics.
- Algorithms are likely to be better at interpreting sounds than humans