Respiratory Health

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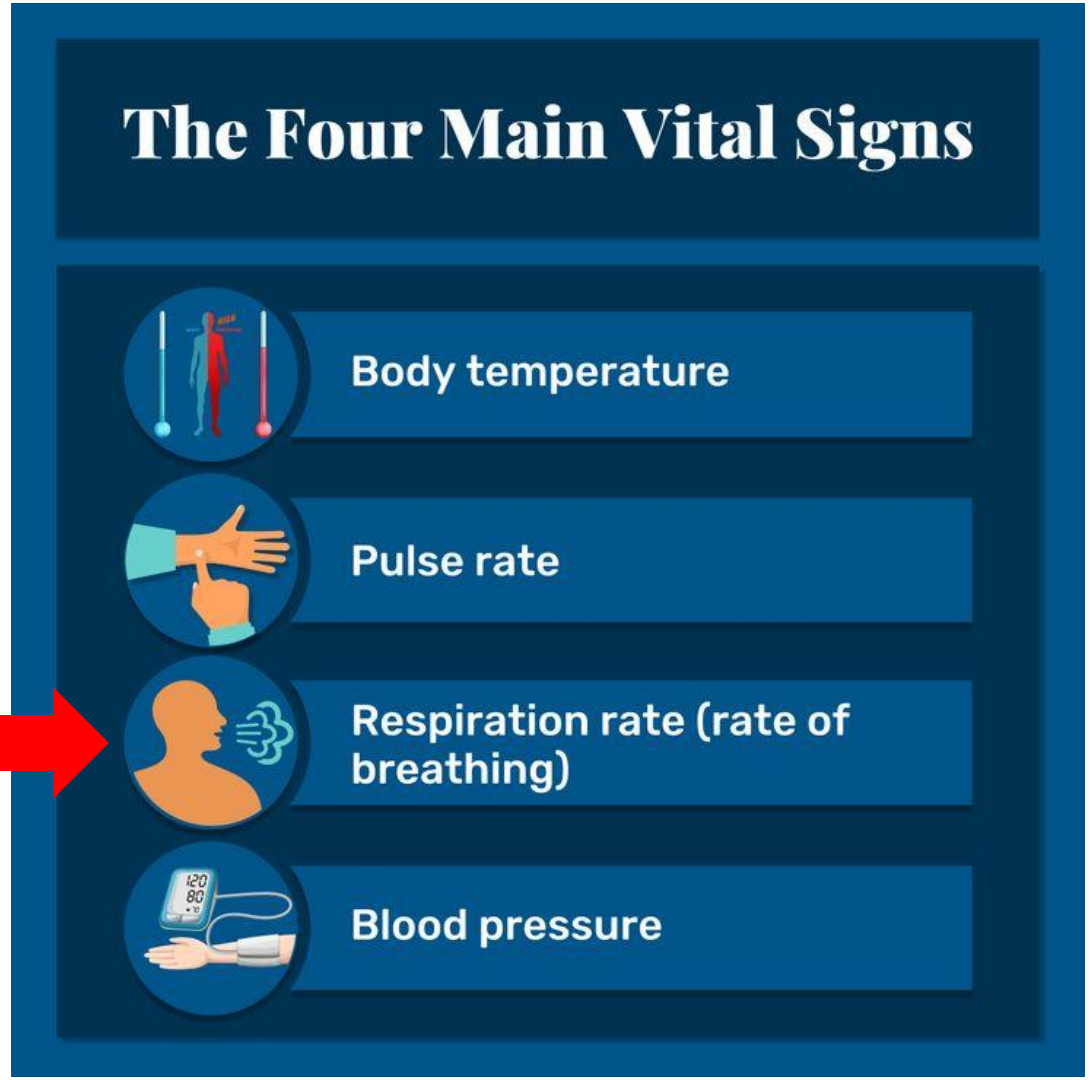
What Are Vital Signs?

Vital signs are measurements of physiological functioning that indicate the overall health status
of a person

There are four “main” vital signs, but some have suggested extending the list:

- 5th: Pain
- 6th: Gait speed

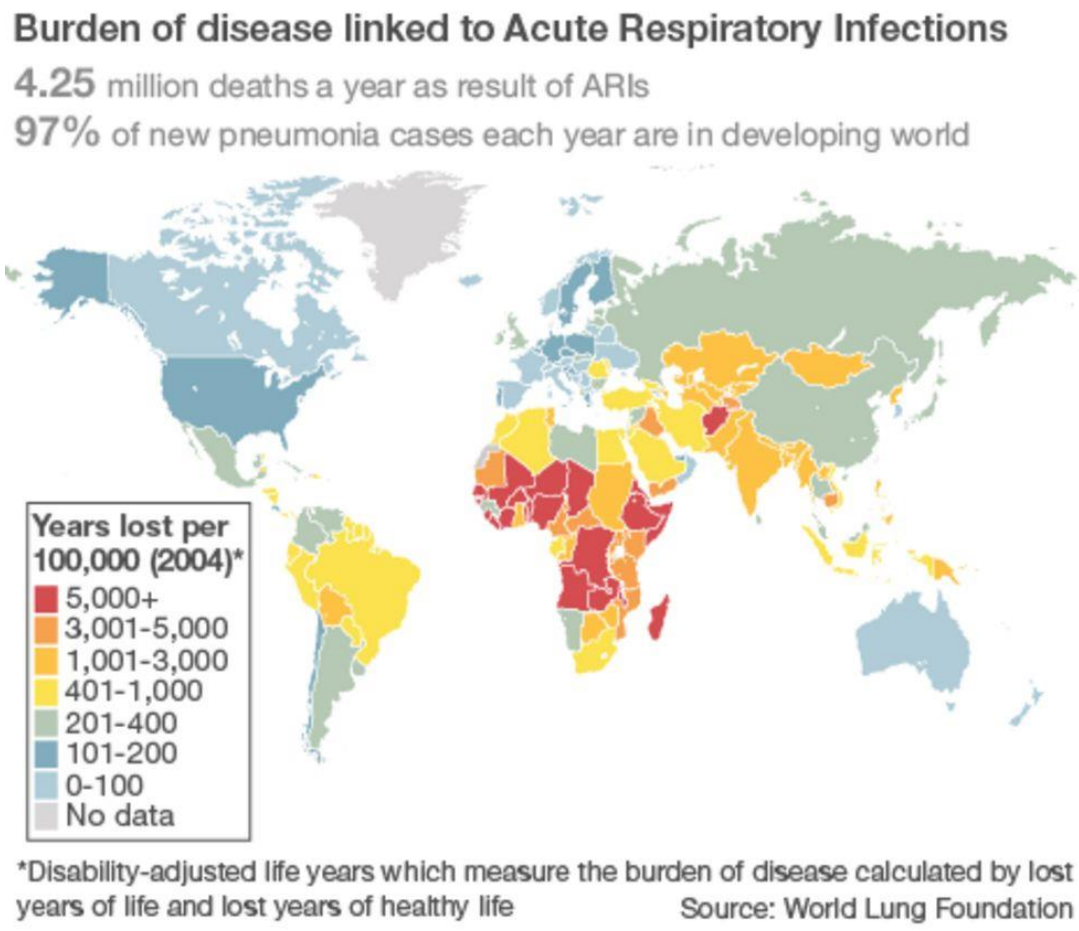


Why Else Do We Care About Respiratory Health?

Before the pandemic, three respiratory diseases accounted for the top ten causes of death worldwide

1. **Chronic obstructive pulmonary disease (COPD):** Kills 3.2 million people every year
2. **Pneumonia:** A leading cause of death among children < 5 years old and adults > 65 years old
3. **Lung cancer:** One of the deadliest forms of cancer (10–20% survival rate)

Other respiratory diseases include asthma, tuberculosis, whooping cough (pertussis), and COVID-19



What Can We Measure About Respiratory Health?

Measure	Traditional Sensor	Relevant Features
Respiration rate	Chest strap	Breaths per minute
Cough characteristics	Microphone	Cough rate, productive (wet) vs. unproductive (dry)
Speech characteristics	Microphone	Speaking rate, pitch, loudness
Spirometry	Spirometer	Flow-volume curve, FEV1, FVC, PEF

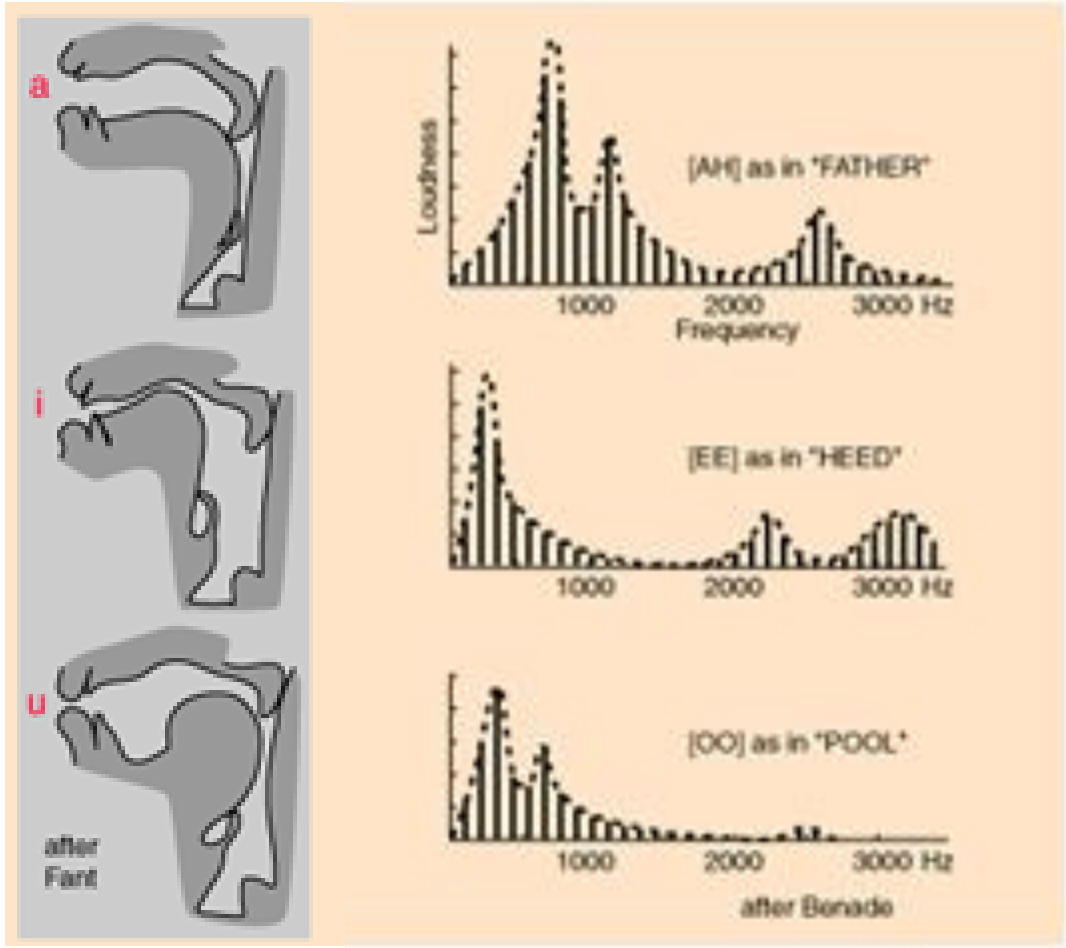
Speech In More Detail

Respiratory illnesses influence our airways, and we use our airways to produce speech

Lots of different categories and terms used to describe speech features

- **Time domain:** Speaking rate, loudness
- **Frequency domain:** Pitch, formant frequencies, MFCCs

- **Prosodic:** Speaking rate, loudness, pitch
- **Spectral:** Formant frequencies, MFCCs



MFCCs: Mel-frequency cepstral coefficients

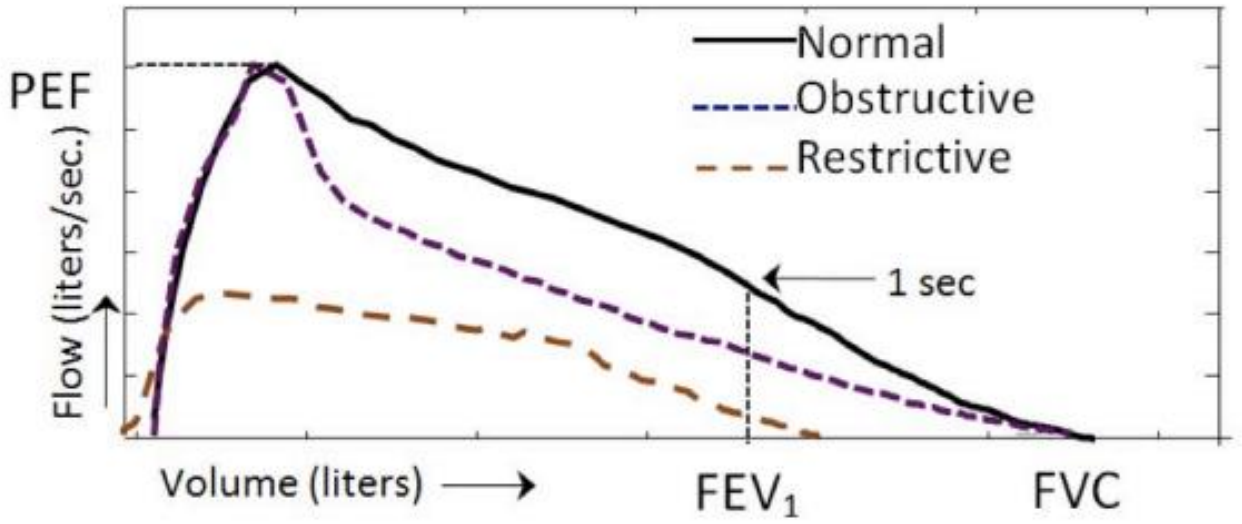
Spirometry In More Detail

Requires a patient to exhale as much air out as quickly as possible through a tube

- This effort is non-trivial and often requires coaching

Flow-volume curve provides lots of useful information

- **PEF:** Peak expiratory flow
- **FEV1:** Forced expiratory volume in 1 second
- **FVC:** Forced vital capacity
- **FEV1/FVC**



Resources

Global Impact of Respiratory Disease
(Levine and Marciniuk ‘22)