Approach to fever in children

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What I want to tell you:

- What is fever?
- Diagnostic approach
- Management
- Sepsis as the most deadly bacterial infection
- Conclusions

Fever in a child under 5

- The most common reason for medical visits
- Diagnoses range from minor to life-threatening
- Conflict recommendations & approaches
- The vast majority: benign viral infections

Why do we pay special attention to fever?

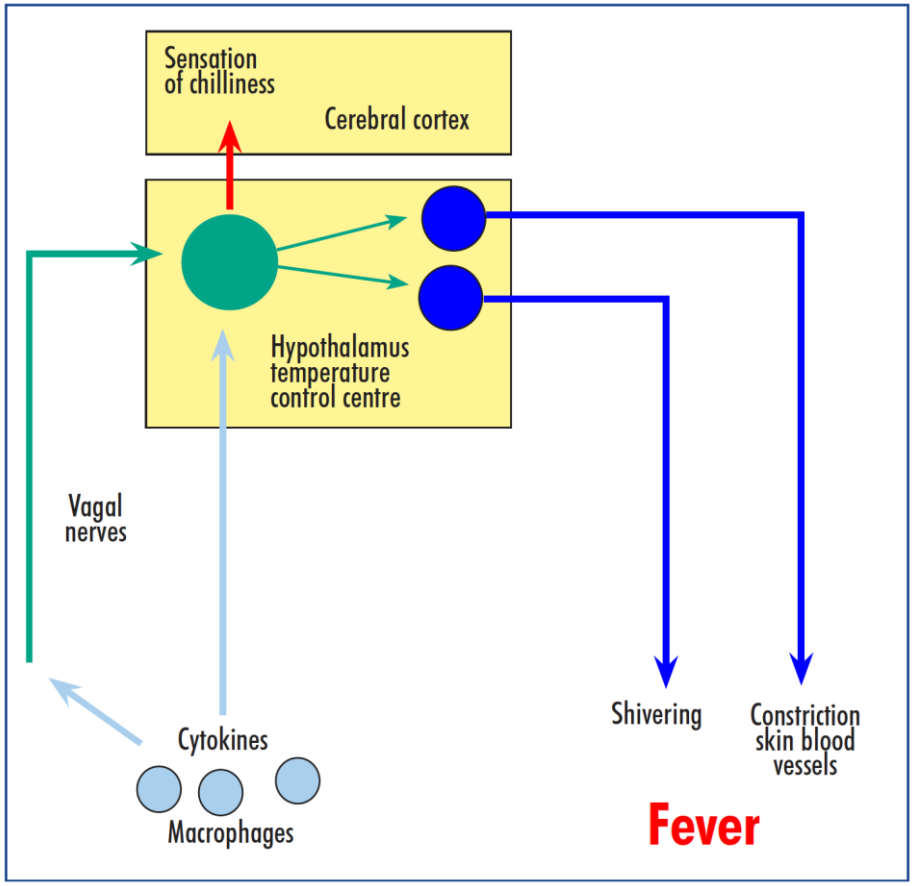
- The most common complaint in pediatric visits
- Parental concern: “fever phobia”
- Some of these kids are sick, but most do well without intervention
- **Clinician concern: we don’t want to miss a life-threatening infection**
- Need an approach to sort them out

WHAT IS FEVER?

Fever

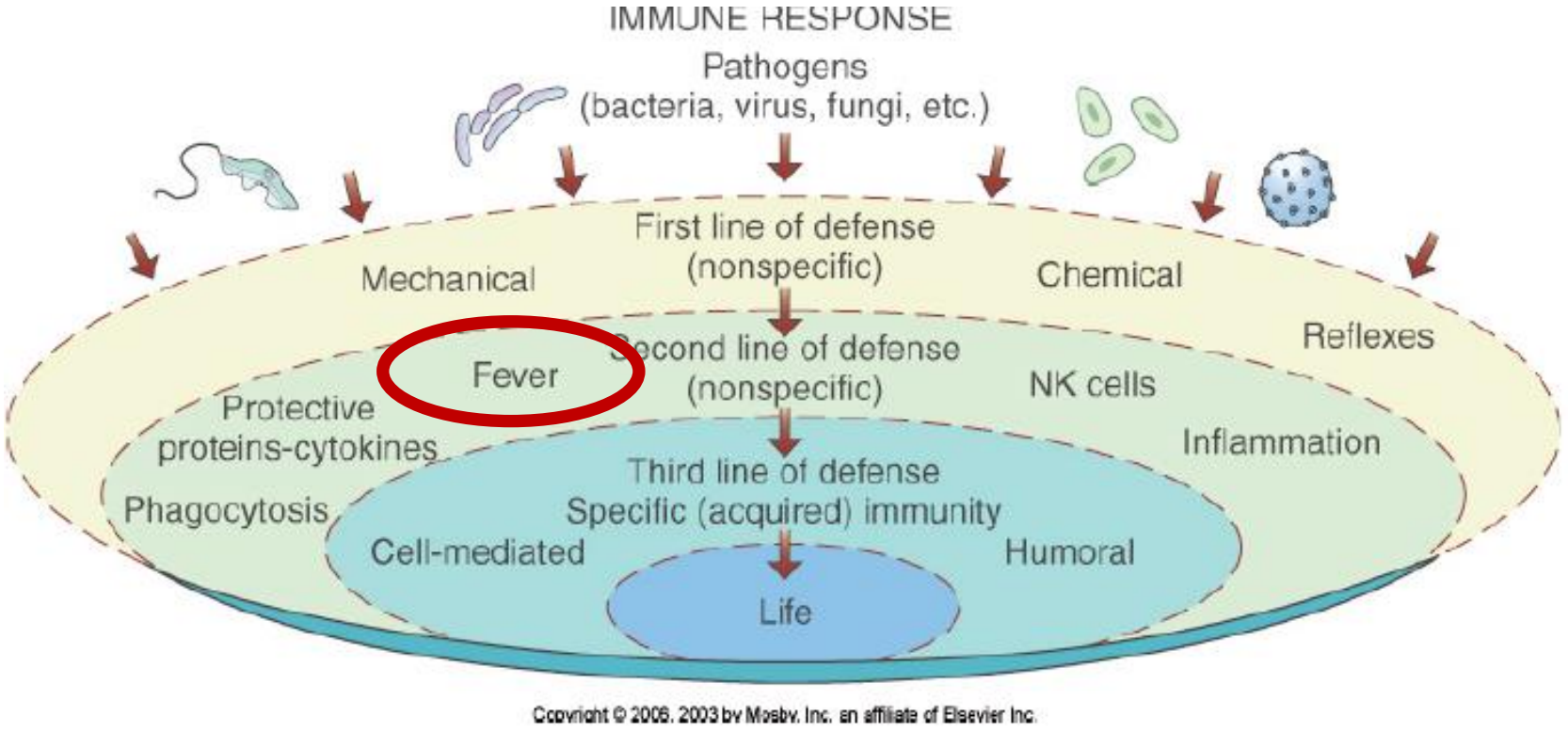
- Temperature > 38,0^{0}C (mouth)
- Stressfull situation for both parents and doctors
  - Problems with data collection from the small child

Regulation of the temperature



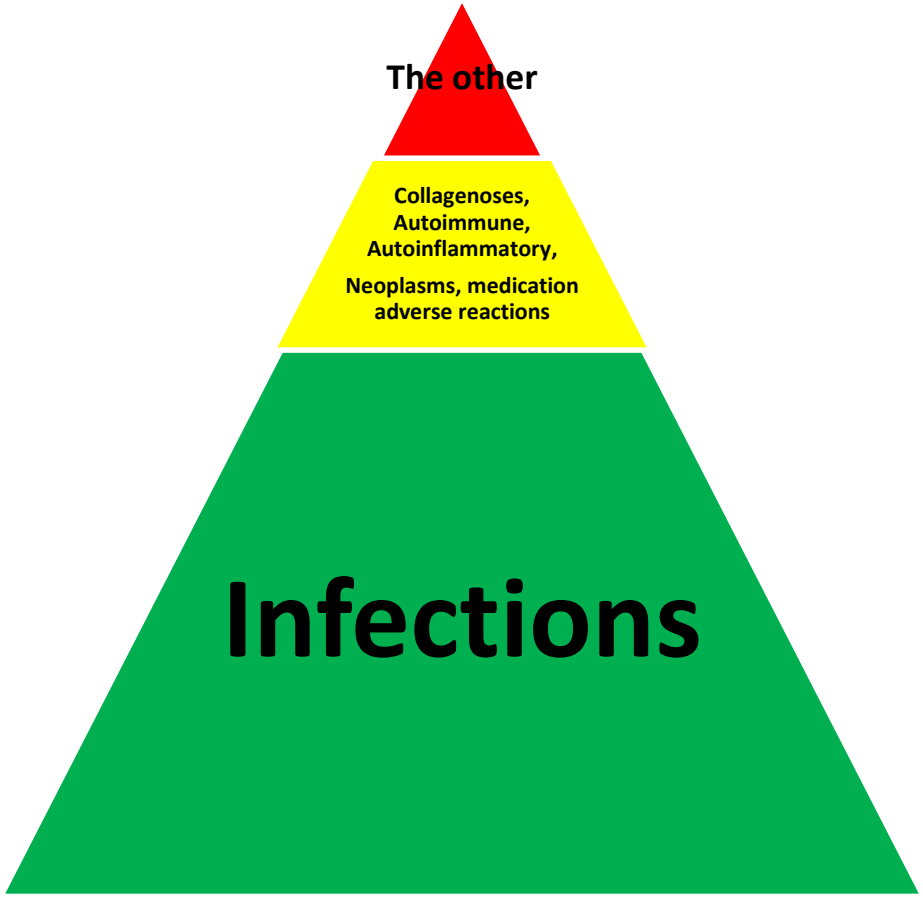
Eccles, Ron (2007). *Mechanisms of symptoms of the common cold and influenza. British Journal of Hospital Medicine, 68(2), 71–75.* doi:10.12968/hmed.2007.68.2.22824

Mechanisms of defense to infection



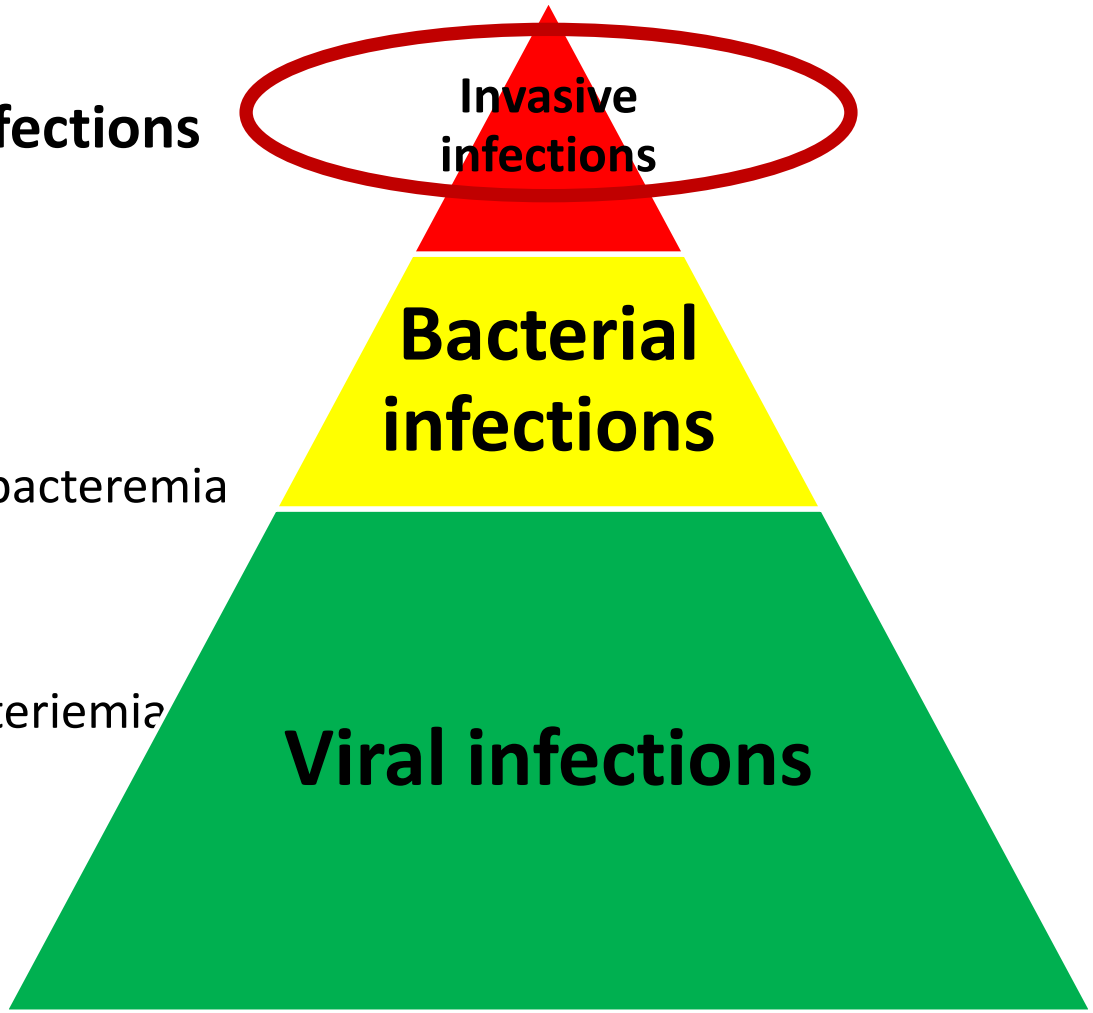
Fever ≈ infection

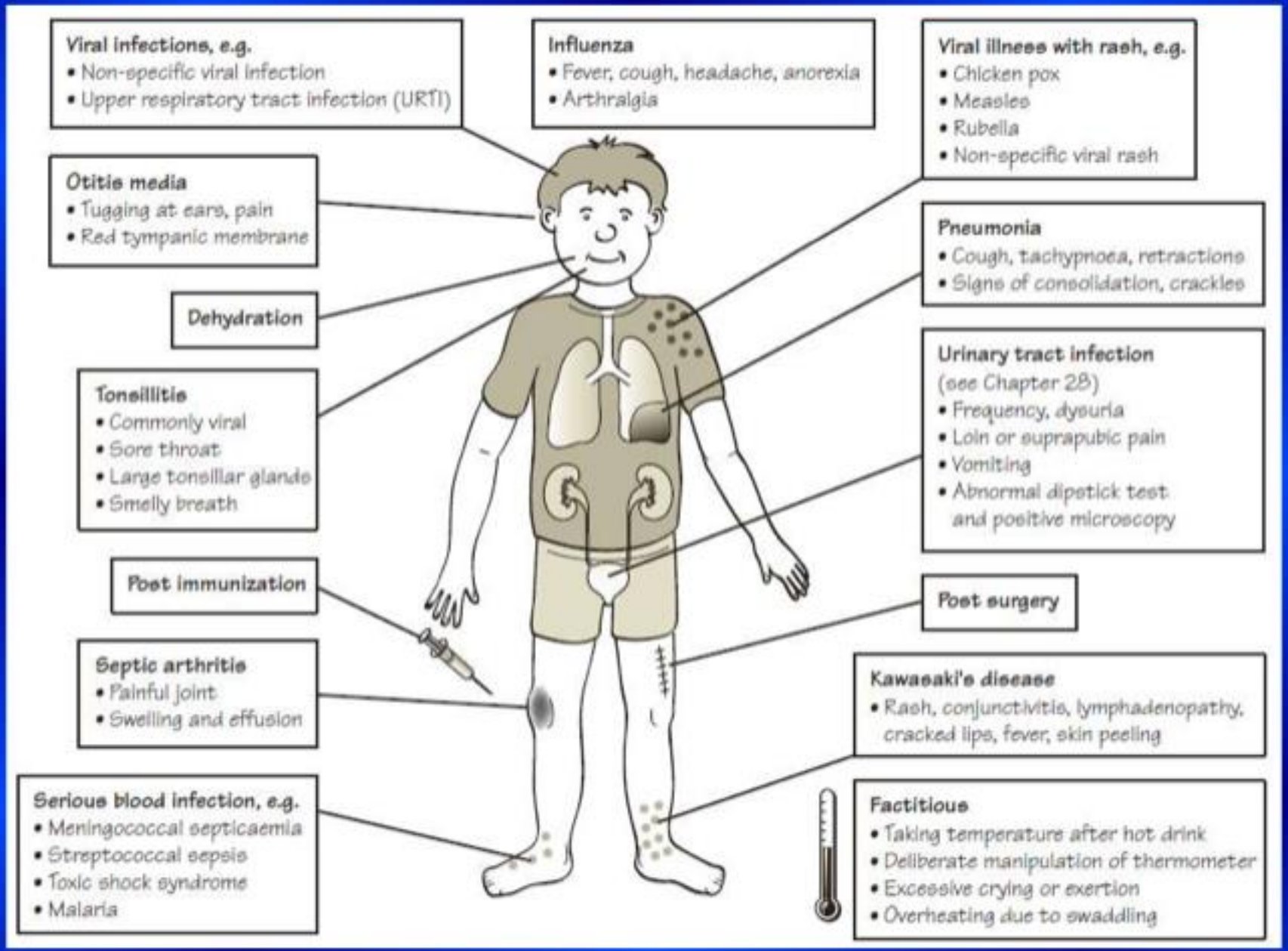
- **Infections**
- Collagenoses & autoimmne disordes
- Auto-inflammatory diseases (periodic fevers)
- Neoplasms
- Allergies
  - Serum sickness
- Drug-induced fever
- Hormonal disturbances
- Regulatory disorders (thalamus)



Infections in a febrile child

- **Viral infection**
- **Bacterial mucosal infections**
  - Otitis media
  - Pharyngitis
  - Sinusitis
  - UTI
  - Pneumonia without bacteremia
- **Invasive infections**
  - Occult bacteremia
  - Pneumonia with bacteriemia
  - Sepsis
  - Meningitis
  - Osteomyelitis
  - Abscess



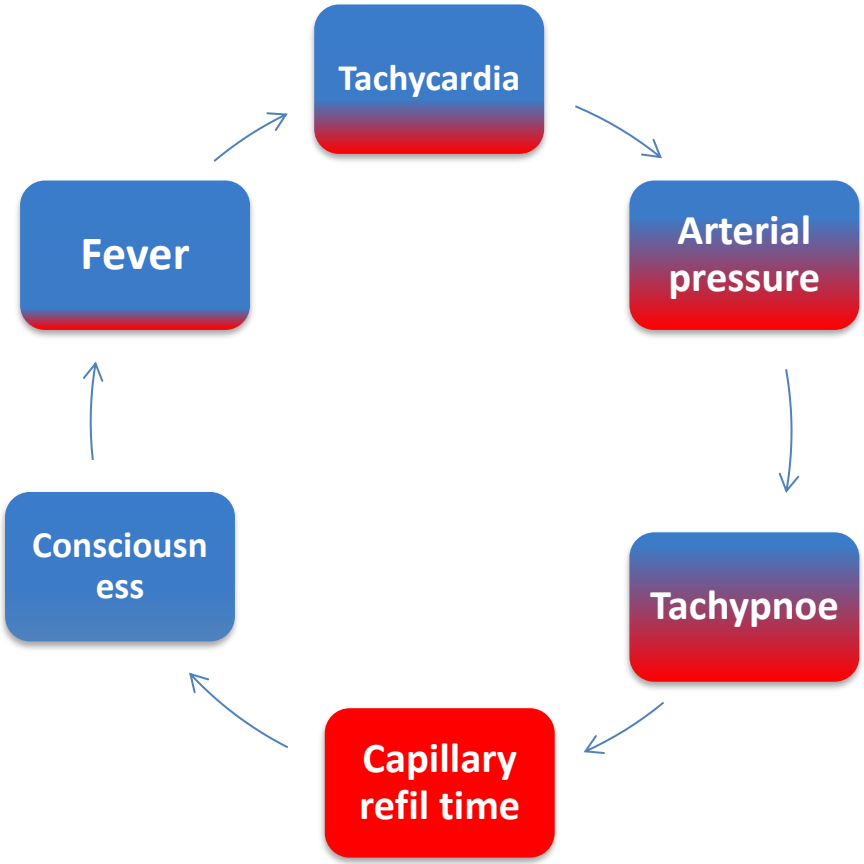

Viral infections, e.g.
• Non-specific viral infection
• Upper respiratory tract infection (URTI)
Influenza
• Fever, cough, headache, anorexia
• Arthralgia
Viral illness with rash, e.g.
• Chicken pox
• Measles
• Rubella
• Non-specific viral rash
Otitis media
• Tugging at ears, pain
• Red tympanic membrane
Pneumonia
• Cough, tachypnoea, retractions
• Signs of consolidation, crackles
Dehydration
Urinary tract infection
(see Chapter 28)
• Frequency, dysuria
• Loin or suprapubic pain
• Vomiting
• Abnormal dipstick test and positive microscopy
Tonsillitis
• Commonly viral
• Sore throat
• Large tonsillar glands
• Smelly breath
Post immunization
Post surgery
Septic arthritis
• Painful joint
• Swelling and effusion
Kawasaki's disease
• Rash, conjunctivitis, lymphadenopathy, cracked lips, fever, skin peeling
Serious blood infection, e.g.
• Meningococcal septicaemia
• Streptococcal sepsis
• Toxic shock syndrome
• Malaria
Factitious
• Taking temperature after hot drink
• Deliberate manipulation of thermometer
• Excessive crying or exertion
• Overheating due to swaddling

Approach to the fever

- **The primary aim: identification of the cause**
  - At least exclusion of the disease that needs immediate therapy e.g. antibiotics or IVIG
- **The secondary aim: symptomatic treatment**
  - Lowering of the fever = relief of symptoms

„Don't put the cart before the horse”

Vital signs


Tachycardia
Arterial pressure
Tachypnoe
Capillary refil time
Consciousn ess
Fever

„Traffic lights system”

- Febrile children < years

https://www.nice.org.uk/guidance/ng143/resources/fever-in-under-5s-assessment-and-initial-management-pdf-66141778137541

	Green – low risk	Amber – intermediate risk	Red – high risk
Colour (of skin, lips or tongue)	• Normal colour	• Pallor reported by parent/carer	• Pale/mottled/ashen/blue
Activity	• Responds normally to social cues • Content/smiles • Stays awake or awakens quickly • Strong normal cry/not crying	• Not responding normally to social cues • No smile • Wakes only with prolonged stimulation • Decreased activity	• No response to social cues • Appears ill to a healthcare professional • Does not wake or if roused does not stay awake • Weak, high-pitched or continuous cry
Respiratory		• Nasal flaring • Tachypnoea: RR > 50 breaths/minute, age 6–12 months RR > 40 breaths/minute, age > 12 months • Oxygen saturation ≤ 95% in air • Crackles in the chest	• Grunting • Tachypnoea: RR > 60 breaths/minute • Moderate or severe chest indrawing
Circulation and hydration	• Normal skin and eyes • Moist mucous membranes	• Tachycardia: > 160 beats/minute, age < 1 year > 150 beats/minute, age 1–2 years > 140 beats/minute, age 2–5 years • CRT ≥ 3 seconds • Dry mucous membranes • Poor feeding in infants • Reduced urine output	• Reduced skin turgor
Other	• None of the amber or red symptoms or signs	• Age 3–6 months, temperature ≥ 39°C • Fever for ≥ 5 days • Rigors • Swelling of a limb or joint • Non-weight bearing limb/not using an extremity	• Age < 3 months, temperature ≥ 38°C • Non-blanching rash • Bulging fontanelle • Neck stiffness • Status epilepticus • Focal neurological signs • Focal seizures

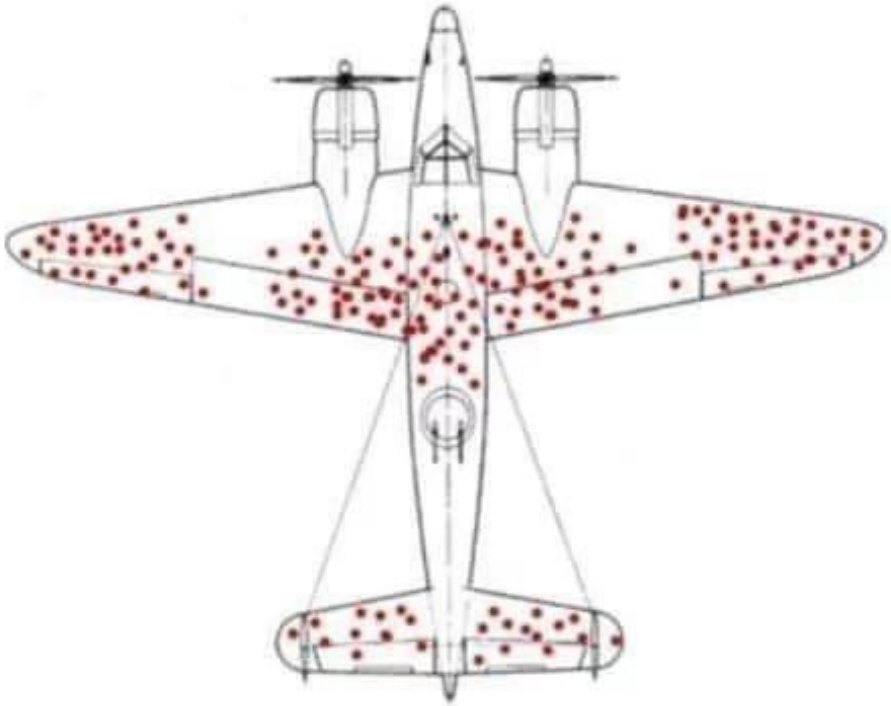
NICE National Institute for Health and Care Excellence

Fever: a common problem in Pediatrics

- Filogenetically old defensive reaction for infections
  - Upregulates natural immunity
  - Each 1^0C up increases lymphocyte production by 10%
- Favouring factors:
  - Age < 3 years
    - Common respiratory infections: to 12/year
    - Tendency to response with high fever to infections

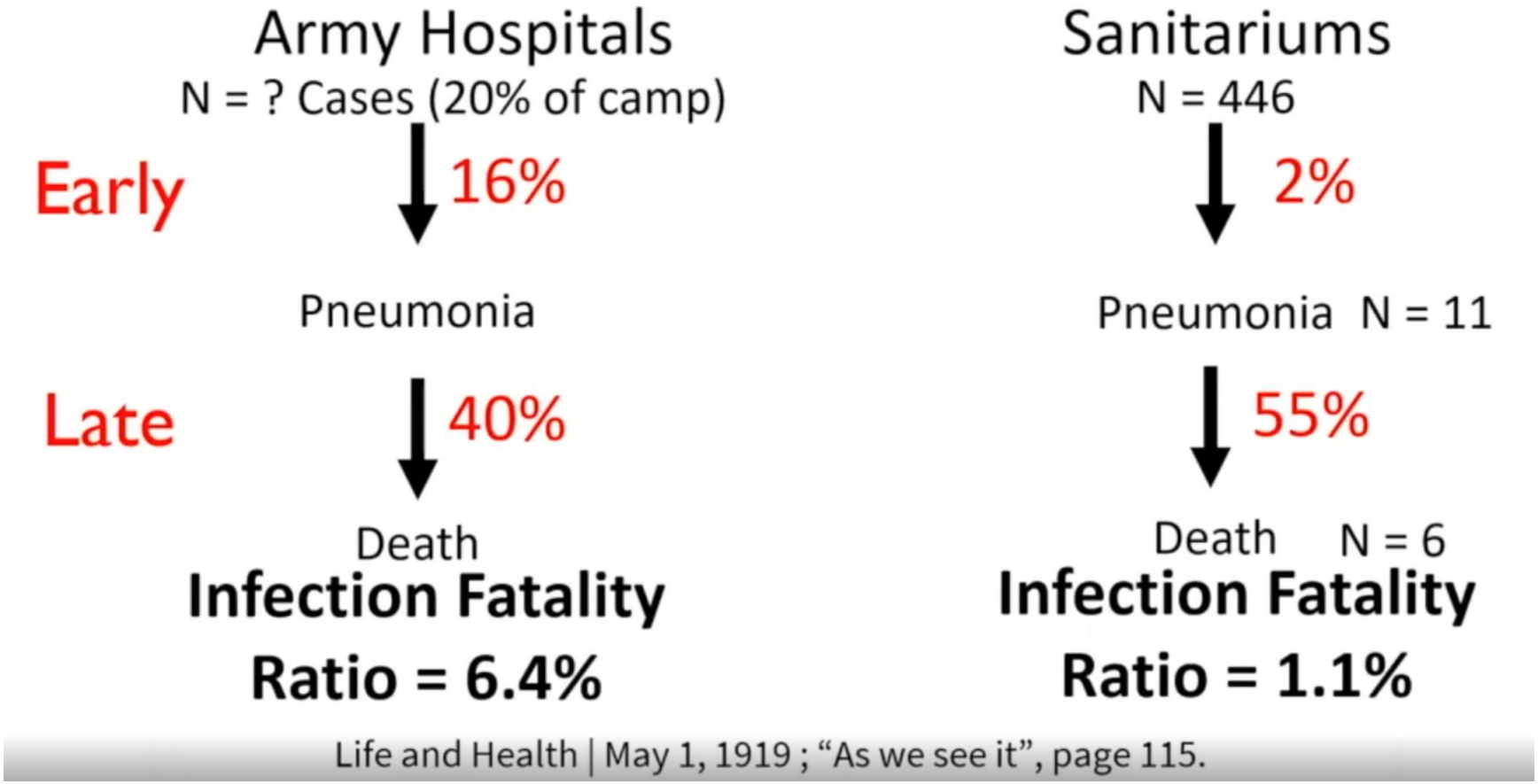
Drawing conclusions, we often make mistakes

This is a picture tracking bullet holes on Allied planes that encountered Nazi anti-aircraft fire in WW2.



many aircraft were shot down, so it was decided to reinforce critical parts of the aircraft. The places where bullets were most likely to hit

Fever increases the production of interoferon gamma



https://northernlightshealtheducation.com/media_download/Life%20and%20Health%20Spanish%20Flu.pdf

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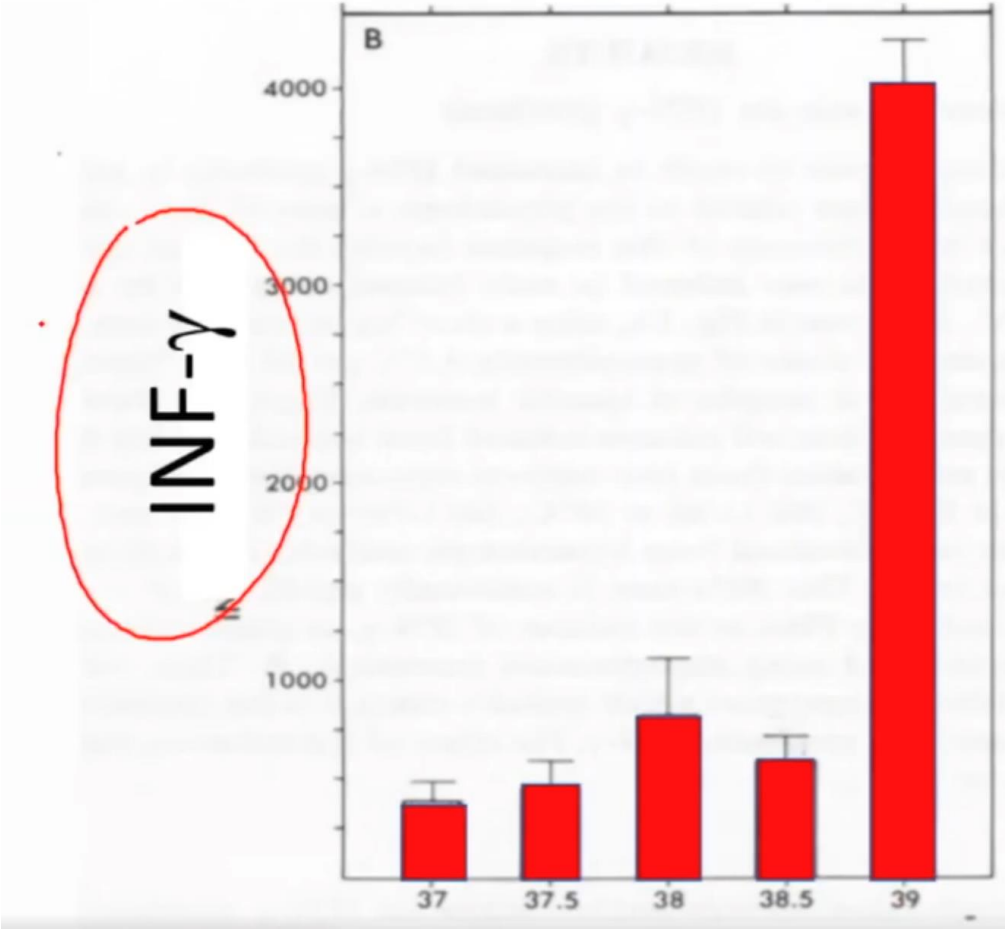
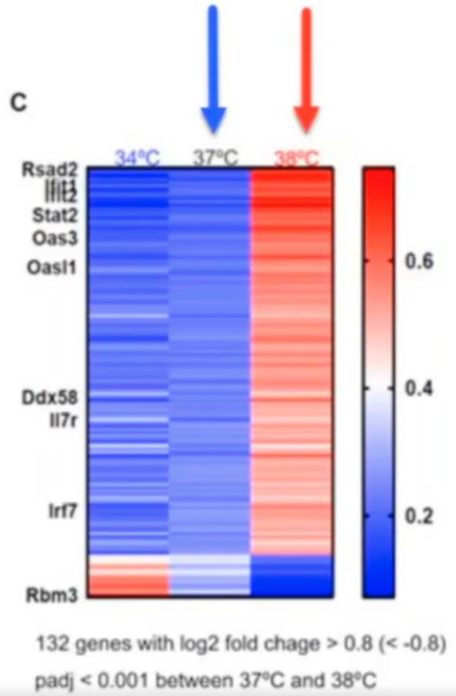


About 38,0 C is suffcient

A subtle temperature increase strongly increases the expression of antiviral response genes

"Remarkably, when comparing genes with altered expression between 37 and 38°C, the majority of genes showed increased expression at the higher temperature and the strongest changes were observed for genes related to innate immunity, interferon response and antiviral response (Figure 1C). These genes did not show a change in expression between 34 and 37°C, suggesting a specific activation of innate immunity and antiviral pathways at elevated temperature (Figure 1C)"



Interpretation of the fever

- The physician's clinical judgment is usually based on the temperature and the general appearance at the time of the examination, not the temperature taken at home.
- This applies to all children except those younger than three months.
- **In the case of normal temperature at the time of the examination but a history of fever, a sepsis examination is indicated for neonates and possibly some infants between the ages of one and three months or if there is the slightest appearance of toxicity**
- The degree of temperature is an important but misleading indicator.
- Bacteremia is more frequent in children with a temperature of 39°C or higher.
- **The absence of fever or the presence of a low-grade fever does not preclude the possibility of a serious infection**

Temperature pitfalls

- Antipyretics:
  - There is no correlation between disease etiology/severity and response to antipyretics (Baker, 1987; numerous others)
- Tactile temperatures
  - Sensitivity 83%
    - Specificity 76% (Hooker, 1996; Graneto, 1996)
- Afebrile on presentation:
  - 6 of 63 infants 0-3 months with bacteremia/meningitis afebrile in the clinic after being febrile at home (Pantell, 2004)

The importance of age

- Bacteremia appears at all ages; however, it is more frequent in infants between the ages of three and 36 months
- Before the age of three months, the incidence of bacterial disease in febrile infants is about 10%, and that of bacteremia is between 2% and 3%
- **As a rule, bacterial infections are more serious and insidious in infants less than three months**
- This group, particularly the neonates, is more vulnerable and is exposed to a greater variety of causal agents, group B streptococcus and E coli being the two main ones
- The main danger during the neonatal period is UTI or meningitis

Take home message

- Fever is sign not a disease
- Response of the fever to treatment has a limited prognostic value
- The primary aim: identification of the cause
  - Fever usually, but not always indicates infection
- We treat symptomatically fever to relieve symptoms not to normalize temperature
- There are no sufficiently reliable markers of bacterial infection

References

1. NICE guideline: Fever in under 5s
2. Management of Fever in Children: Summary of the Italian Pediatric Society