

Exercise walk-through

8.7

Infection prevention and control

University Medicine

Prevention: match the level to the physics

- 1 Levels** Standard (every patient) + contact / droplet / airborne; droplets $> 5 \mu\text{m}$ fall within $\sim 1\text{-}2 \text{ m}$; $\leq 5 \mu\text{m}$ drift for hours.
- 2 Ladder** Cleaning $\rightarrow$ disinfection (vegetative cells only) $\rightarrow$ **sterilisation** (steam $121\text{-}134^\circ\text{C}$ or chemical).
- 3 Clocks** Staff flu vaccination $40\% \rightarrow 90\%$ cuts the susceptible-staff fraction $60\% \rightarrow 10\%$ (six-fold); a surgical-site cluster on days 5-7 dates the breach.

The precaution levels and their transmission routes

level	route physics	what you add	examples
airborne	$\leq 5 \mu\text{m}$, suspended for hours, rides air	fitted respirator + negative-pressure room	<i>measles, TB</i>
droplet	$> 5 \mu\text{m}$, falls within ~1-2 m of the source	surgical mask within 1-2 m	<i>influenza (mainly)</i>
contact	hands, surfaces, fomites, wounds	gloves, gown, single room	<i>C. difficile, MRSA</i>
STANDARD PRECAUTIONS — every patient: hand hygiene, gloves for anticipated exposure			
<div> <div>soaps and mechanics</div> <div>cleaning</div> <div>→</div> <div>kills vegetative cells, not spores</div> <div>disinfection</div> <div>→</div> <div>steam 121-134 °C or chemical sterilants</div> <div>sterilisation</div> </div>			

Standard for everyone; add the level that matches the route - contact, droplet or airborne.

Check yourself

- Gram-positive stains purple because...? (Thick **peptidoglycan** traps the crystal violet-iodine complex.)
- A 20-minute doubler in 10 h gives...? (30 generations, $\sim 10^9$ cells.)
- Tertian fever periodicity is...? (48-hour synchronous erythrocytic bursting.)
- Two independent resistance mutations multiply to...? ($\sim 10^{-14}$ - 10^{-18} .)

Exercises 2.1-2.3

2.1 Why does a surgical mask within 1–2 m suffice for droplet spread? [3]

2.2 Measles vs influenza: which needs airborne precautions? [3]

2.3 What survives disinfection but not sterilisation? [3]

Exercises 2.1-2.3

2.1 Why does a surgical mask within 1–2 m suffice for droplet spread? [3]

2.1

- Droplets exceed 5 μm and fall within ~1–2 m of the source – the mask breaks the chain at that range ✓.
-

2.2 Measles vs influenza: which needs airborne precautions? [3]

2.2

- Measles (and tuberculosis) – airborne; influenza is primarily droplet ✓.
-

2.3 What survives disinfection but not sterilisation? [3]

2.3

- Spores ✓.

Exercise 3.1

3.1 A fictional clinic raises staff influenza vaccination from 40 % to 90 % uptake.

Calculate the fall in the susceptible-staff fraction (60 % $\rightarrow$ 10 %, six-fold). Explain why the ward effect exceeds the sum of individual protections (each vaccinated staff member is also a blocked link between patients). State which chain link vaccination breaks. [7]

Exercise 3.1

3.1 A fictional clinic raises staff influenza vaccination from 40 % to 90 % uptake.

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3.1

- Susceptible fraction: $1 - 0.40 = 60\% \rightarrow 1 - 0.90 = 10\%$; $60/10 = 6\text{-fold}$ ✓.
- Each vaccinated worker also stops patient $\rightarrow$ worker $\rightarrow$ patient chains – blocked links multiply ✓.
- Vaccination breaks the SUSCEPTIBLE-HOST link ✓.

Exercise 3.2

3.2 A fictional surgical unit reports a cluster of surgical-site infections presenting on post-operative days 5–7.

Use incubation arithmetic to date the acquisition window (the theatre or the first 48 h of aftercare). Map the investigation onto the chain (reservoir: cases/environment; route: contact; entry: the wound) and name one intervention per link. [7]

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3.2

- Days 5–7 post-operation date the breach to the theatre or the first 48 h of aftercare ✓.
- Reservoir (ill staff/environment) → route (hands, instruments) → entry (the wound) ✓.
- Interventions: screen/isolate carriers (reservoir), theatre hygiene and instrument sterilisation (route), wound care protocols (entry) ✓.