

Health protection, immunisations and screening in a nutshell

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What is “health protection”?

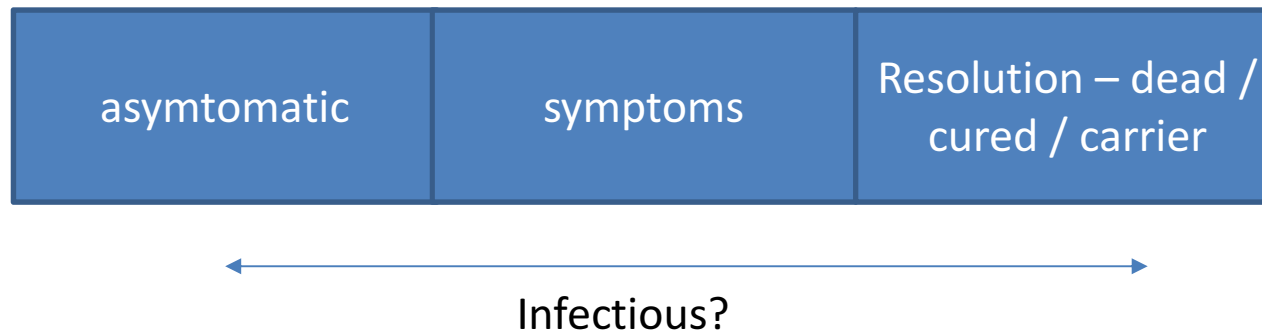
- Protecting the public from threats to their health
 - Who are “the public”
 - What do we consider as a threat
 - How do we define “health”
 - Physical
 - Psychological
 - Spiritual
 - According to potential

What is health protection?

- Preventing and controlling **Infection** / outbreaks of infectious disease
 - Main sources
 - Food / water
 - People (esp children and medical professionals...)
 - Animals
- Reducing exposure to **Hazards** in the environment
 - Chemical, radiological, poisonous
 - Eg asbestos, exhaust fumes, climate change
- Mitigating and responding to **Emergencies**
 - Fires, floods, pandemics etc

How do we prevent infection?

Aim is to stop **transmission**

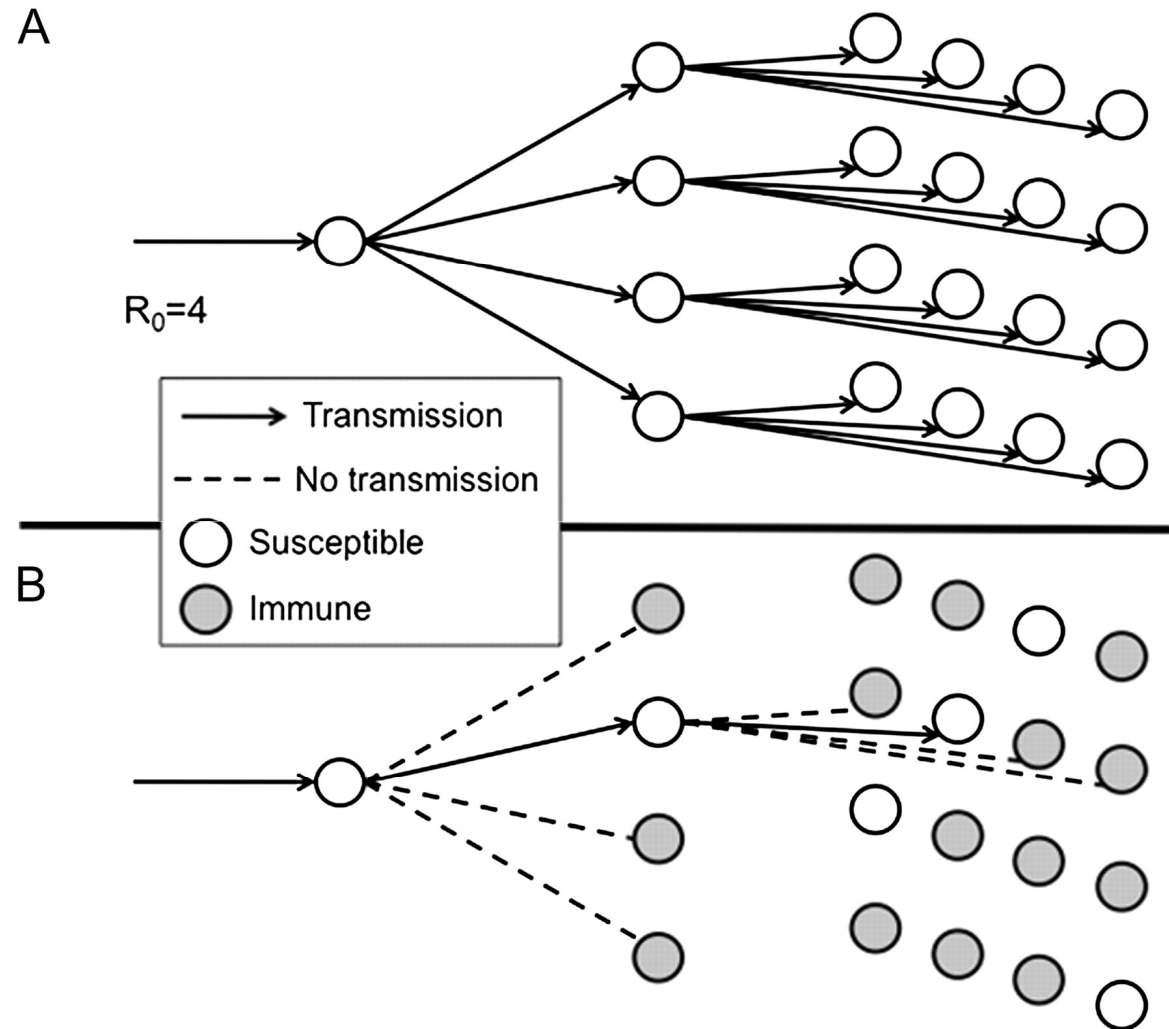


- **Spread = how infectious the disease is x how many vulnerable people the source comes into contact with**
 - **Recognise outbreaks (routine data collection, notification, soft intelligence)**
 - **Reduce sources**
 - Isolate cases / exclude from work / school
 - Dispose of infected material (bed linen, needles) / handwashing
 - Control “vectors” (eg mosquitos in malaria)
 - **Treat disease early before it has chance to spread**
 - Screening (esp for disease with long asymptomatic phase eg HIV, TB)
 - Contact tracing
 - **Reduce vulnerability in pop (vaccination, antibiotics, physical barriers / masks / condoms)**

Vaccination

- Prevents transmission (usually by “training” immune system to intercept infection before it causes disease)
- No vaccine is 100% effective (some probably worse than 50%)
- Aim is usually to achieve “herd immunity”

Diagram illustrating transmission of an infection with a basic reproduction number $R_0 = 4$ (see Table 1).



Fine P et al. Clin Infect Dis. 2011;52:911-916

Herd Immunity

- Threshold at which ongoing transmission of disease is controlled
- Proportion of population that need vaccination depends on how infectious the disease is

Some maths and definitions

- R_0 = how many people one case would infect in a totally vulnerable population
 - Eg R_0 for measles = ~ 20 !
- V_c = proportion of pop who need to be vaccinated to have progressive reduction in deases
- E = effectiveness of the vaccine (%who it works for)

Maths for immunity

- $V_C = \frac{(1 - \frac{1}{R_0})}{E}$
- So for measles where the vaccine is really good ($E \sim 1$), and the disease is very infectious ($R_0 = 20$)

$$V_C = \frac{(1 - \frac{1}{20})}{1} = 0.95$$

So to control measles we need to keep vaccination rate above 95%

- Caveat = assumes random mixing and random vaccination, and populations are not randomly mixed

Screening

- What it is
 - Organised effort to detect and treat/control disease in a symptom free person / population

What should we screen for? – Wilson and Junger criteria

- The disease
 - The disease is a big enough problem to make it worthwhile
 - It has a latent / asymptomatic phase
 - We know its natural history
- The treatment
 - We have general agreement on how the disease should be treated
 - We have resources to treat the disease
- The test
 - The screening test is acceptable to the population
 - We have resources to test the whole population at risk
 - The test is (relatively?) safe

Tests vs a Screening Programme

- NO TEST IS PERFECT
 - False positives = people the test says has disease when they don't
 - False negatives = people the test says don't have the disease when they do
- Many tests have subjective interpretation
 - Cancer cytology, x-rays etc all rely on people being adequately trained
- Screening programme = providing the test, quality assuring the testing and how its offered, assuring access to treatment, monitoring equality etc etc etc

Doing harm by screening

- Physical
 - Test causes harm
 - False positive results = unnecessary investigations / treatment
 - False negatives = inappropriate reassurance, increase transmission etc
- Psychological
 - Anxiety about a disease I probably don't have
 - Waiting for tests
 - Labelling
 - Cultural insensitivity
- Financial
 - Can't get insurance etc

Benefits vs Harms

- Who should we screen and how often should we screen?
 - Benefits suffer diminishing returns whereas harms are constant
 - Therefore you have to find a “break even” point

Whose job is it?

- Managing screening programmes = NHS England with input / advice from Public Health England
- Vaccination programmes = As above
- Health protection = complicated
 - PHE taken over most of the HPA roles
 - Expert advice
 - Surveillance
 - Emergency planning and response

BUT

- Most of the legal powers rest with the LA
 - Forcing people to close / clean up / get treated etc
- And in an “emergency” there are statutory obligations for all NHS organisations to cooperate

Want more?

- Screening
 - <http://www.healthknowledge.org.uk/interactive-learning/screening>
 - <http://www.patient.co.uk/doctor/screening-programmes-in-the-uk>