Break transmission chains

A vaccination programme coordinates protection across a population. Its benefits can extend beyond the people who receive the vaccine.

1. FROM INDIVIDUAL TO COMMUNITY

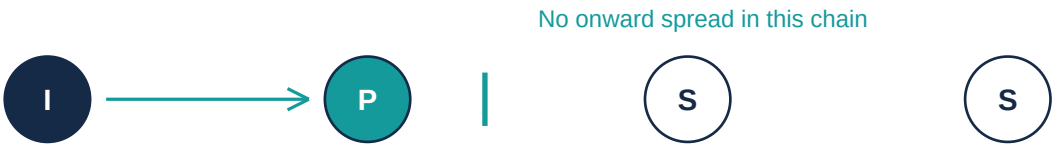
Vaccination generates active immunity. When vaccination reduces infection or onward transmission, widespread protection leaves fewer susceptible hosts for a pathogen to reach. Chains of person-to-person spread become less likely.

2. FOLLOW TWO POSSIBLE CHAINS

Many susceptible contacts



A protected contact interrupts this chain



I = infectious person; S = susceptible; P = protected against infection.

3. INDIRECT PROTECTION: HERD IMMUNITY

Reduced circulation lowers exposure risk for people who remain susceptible, including some who cannot receive a particular vaccine. They do not acquire memory cells from vaccinated neighbours: their protection is indirect.

This is a simplified example, not a guarantee for every contact. Vaccination is not always completely protective, and effects on transmission differ among vaccines and diseases.

Community protection and its limits: WHO, How do vaccines work?
Active protection and vaccine effects: CDC, Explaining How Vaccines Work.

Scope: Cambridge Biology 9700 syllabus, section 11.2, outcome 6, p. 31.

Make a programme effective

High uptake requires reliable services as well as an effective vaccine. Each link in delivery affects how much protection a population develops.

1. REACH THE TARGET POPULATION

Accessible vaccination services help people receive the required doses. Outreach and catch-up activity address missed vaccinations. Coverage must be checked locally: a high national average can hide communities with many susceptible people.

2. KEEP THE VACCINE EFFECTIVE

Maintain the required temperature-controlled supply chain during storage and transport: the cold chain. Incorrect temperatures can compromise vaccine potency. Appropriate equipment, temperature monitoring and trained staff help protect vaccine quality.

3. SUPPORT UPTAKE AND COMPLETION

Clear communication and public trust support participation. Reliable supplies, trained staff and records help people complete vaccination courses. Additional doses or boosters are used where needed; one dose does not provide lifelong protection for every vaccine.

4. MONITOR AND RESPOND

Surveillance tracks disease cases and outbreaks. Coverage records identify under-vaccinated groups. These data guide targeted action and allow programmes to check whether disease incidence is falling. Incidence means new cases in a population during a defined time.

Uptake is the proportion vaccinated, not a direct measurement of the proportion immune.

Access, coverage gaps and monitoring: WHO, Immunization coverage.
Cold chain, equipment and staff training: CDC, Vaccine Storage and Handling.

Scope: Cambridge Biology 9700 syllabus, section 11.2, outcome 6, p. 31.

Sustain the protection

A successful programme can reduce cases and outbreaks. Lasting success depends on maintaining immunity and detecting gaps before transmission expands.

1. DISTINGUISH THREE OUTCOMES

CONTROL	Disease occurrence is reduced to an acceptable level; continued measures are needed.
ELIMINATION	Transmission of a specified infection is reduced to zero in a defined area; measures are still needed to prevent re-establishment.
ERADICATION	Worldwide incidence of infection is permanently reduced to zero through deliberate efforts.

2. A HISTORICAL EXAMPLE: SMALLPOX

Vaccination, case detection and containment helped end smallpox transmission. WHO declared smallpox eradicated in 1980. Elimination in one country is not the same as eradication worldwide.

3. WHY OUTBREAKS CAN RETURN

Missed doses and uneven access leave susceptible groups. New unvaccinated cohorts and waning protection can enlarge those gaps. If an infectious person introduces the pathogen, transmission may restart where protection is insufficient.

Core link: sustained uptake + effective delivery + surveillance can reduce spread. Low case numbers alone are not a reason to assume the pathogen has disappeared worldwide.

Control, elimination and eradication: CDC, The Principles of Disease Elimination.
Eradication example: WHO, Smallpox.
Coverage gaps and imported infection: WHO, Immunization coverage.

Scope: Cambridge Biology 9700 syllabus, section 11.2, outcome 6, p. 31.