

Whooping Cough

Dr.Yossra K.Al-Robaiaay
Professor
FICMS (FM)



Introduction:

Whooping cough, or **pertussis**, is a highly contagious infectious disease caused by **Bordetella pertussis**.

The disease is **notable** for its characteristic **paroxysmal cough ending in a "whoop,"** which can lead to severe complications or even death in vulnerable groups.

Despite advances in vaccination, it is **endemic disease worldwide** , and remains a significant global public health concern, particularly affecting **infants** and **unvaccinated populations**.

Historical Background :

- The disease first appeared in France in **1414**.
- The first epidemic has been recognized since the **16th century**.
- *B. pertussis* was isolated in **1906** by **Bordet** and **Gengou**.
- Before vaccines, pertussis was a **leading cause of child mortality globally**.

Historical Background



Jules Bordet (1870-1961)
Belgian Immunologist



Octave Gengou (1875-1957)
Belgian Microbiologist

Global Burden of Disease

- The World Health Organization (WHO) reported **151,074** pertussis cases globally. Based on **2008** data WHO estimated that there were **89,000 deaths**.
- A **2014** publication estimated **24.1** million pertussis cases and **160,700 deaths** in children younger than 5 years worldwide

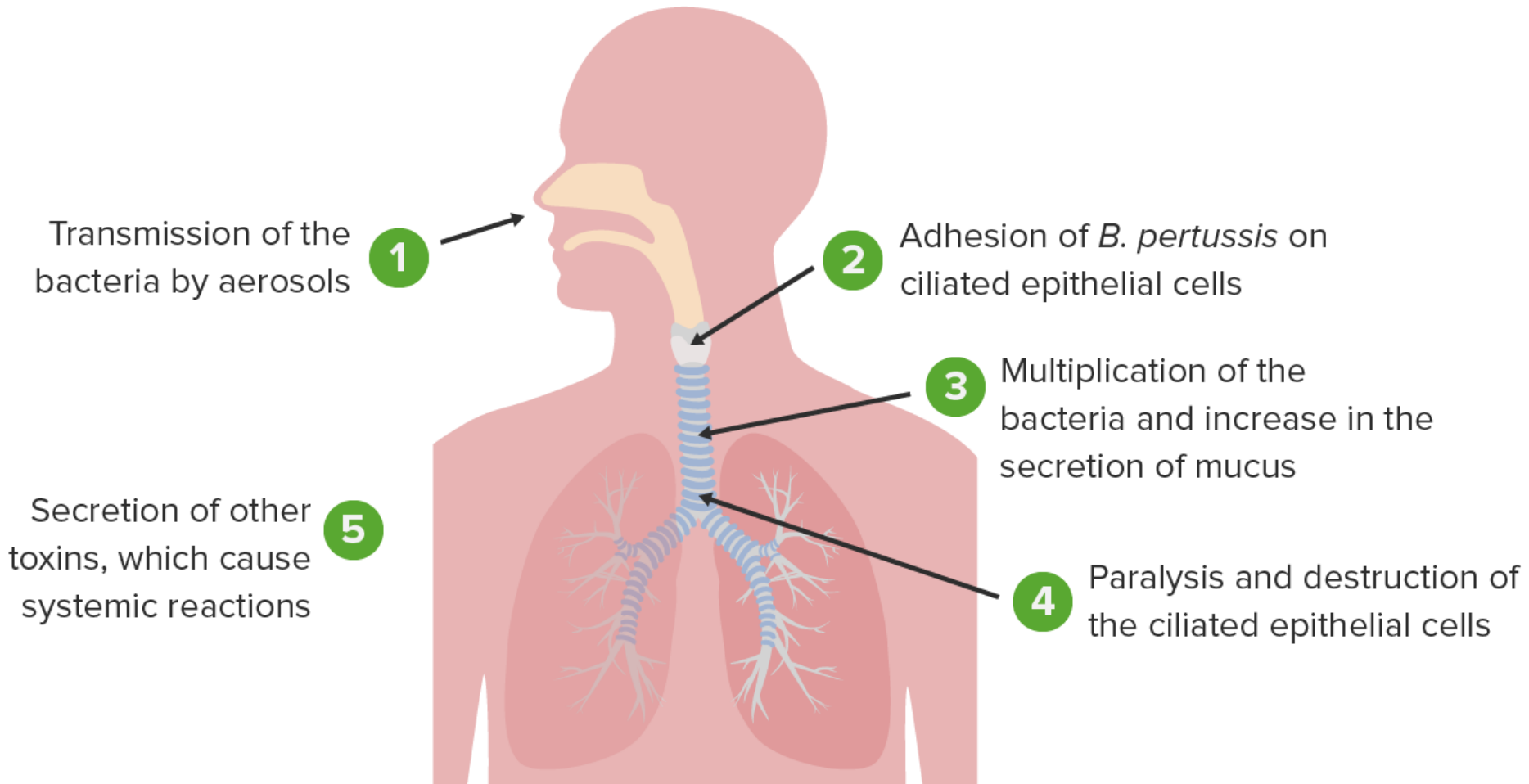
Pathogenesis :

Pertussis is an acute, highly contagious pediatric disease.

- Adults and adolescents are also effected.
- **95%** due to *B. pertussis*
- 5% by *B. parapertussis*
- Only 0.1% by *B. bronchoseptica*

Pathogenesis:

- Primarily whooping cough is **a toxin-mediated disease.**
- Bacteria attach to cilia of respiratory epithelial cells.
- Inflammation occurs which interferes with clearance of pulmonary secretions.
- Pertussis antigens allow evasion of host defenses (**lymphocytosis promoted but impaired chemotaxis**).

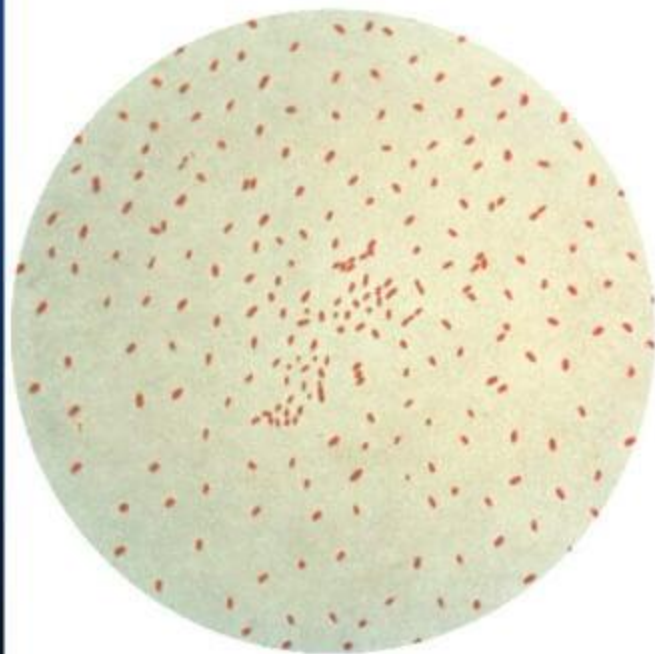


Pathogenesis of Whooping Cough



Epidemiological Determinants

***Bordetella pertussis* - An Overview**



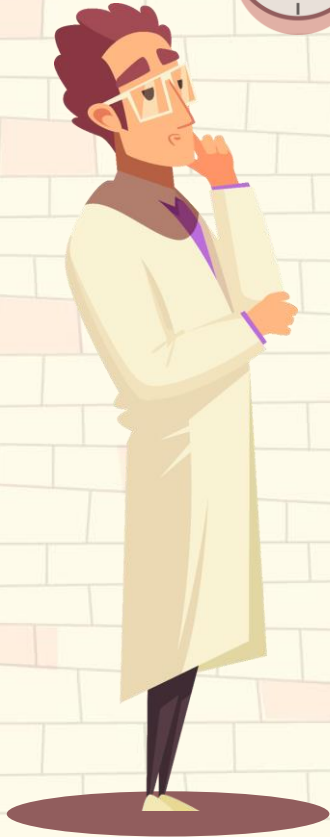


I. Agent Factors

Causative Organism: *Bordetella pertussis*

— is a gram-negative, aerobic bacillus producing toxins **pertussis toxin (PT)** and **tracheal cytotoxin**, responsible for the disease's clinical manifestations.

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I. Agent Factors

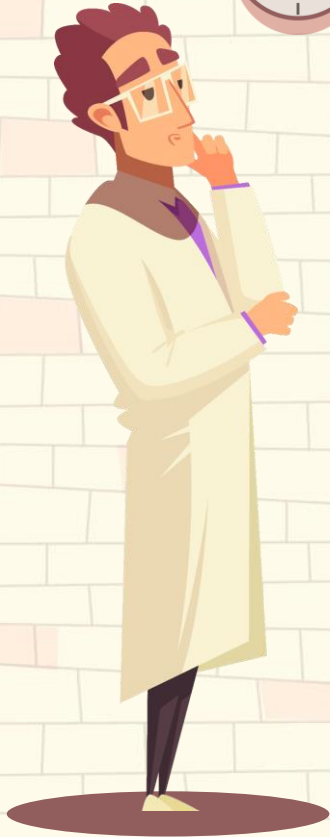
Reservoir of Infection:

The reservoir for *Bordetella pertussis* is humans.

The bacteria do not survive long in the environment outside the human body, making humans the sole reservoir.



I. Agent Factors



Host:

- The **host** of pertussis is also humans, **primarily** children and unvaccinated individuals.
- However, it can infect individuals of **all** ages, especially those who are **unvaccinated** or have **waning immunity** from vaccination or previous infection.

II. Host Factors

- **Age:**
 - **Primarily** affects infants and young children. **Mortality** is highest in those **under six months**.
 - **Adolescents and adults** can develop **milder forms** and act **as reservoirs**, spreading the infection to infants.
- **Sex:** Incidence and fatality rates are slightly higher in **females**

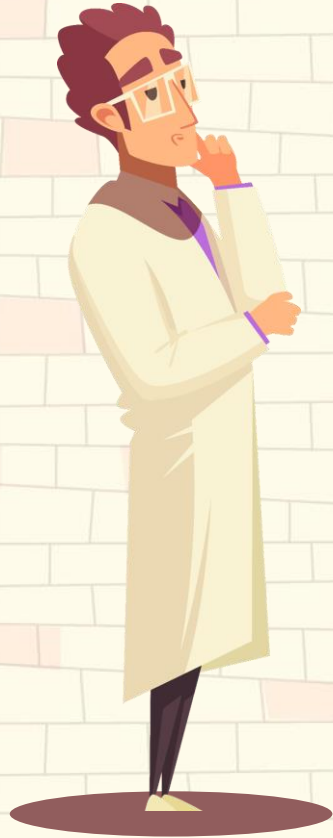


II. Host Factors

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- **Immunity:**
 - Immunity after infection or vaccination is **not lifelong**, necessitating **booster doses**.
 - Maternal antibodies do not provide sufficient protection at birth.





III. Environmental Factors:



Seasonality: While pertussis occurs year-round , so **no** distinct seasonal pattern seen , but cases **may peak during winter and spring.**

Socioeconomic Conditions: Higher risk in lower-income groups living in **overcrowded** settings.



Source Of Infection :



B. pertussis infects only man.

The source of infection is a **case of pertussis**, more often, the source may be mild, missed and unrecognized cases.

- There is **no evidence** that infection is ever **subclinical** .
- A chronic carrier state does not exist.

IV. Modes of Transmission:

Droplet Infection: Primary mode; transmission occurs via respiratory droplets during coughing, sneezing, or close contact. **older siblings** who may be harboring the bacteria in their nose and throat can bring the disease home and **infect an infant in the household.**

Fomites: Plays a **minimal role** unless freshly contaminated.



IV. Disease Dynamics:

Incubation Period

Typically **7-14** days, up to **21** days.

Period of Communicability

Highest during the **catarrhal** stage and the **first three** weeks of the paroxysmal stage

Secondary Attack Rate

As high as **90%** among unimmunized household contacts



- If untreated, a person can transmit pertussis from **onset of symptoms to 3 weeks after the onset of coughing episodes.**
- The period of communicability is reduced to **5 days after treatment with antibiotics.**

V. Trends and Patterns:

Pertussis cases declined dramatically with vaccine introduction in the **1940s**.

Since the **1980s**, there has been a resurgence due to waning vaccine immunity and improved diagnostics.

Adolescents and children aged **7-10** years exhibit increasing incidence due to waning immunity from a **cellular vaccines**.





Clinical Features:

Stages of Illness

- 1. Catarrhal Stage (1–2 weeks):** Similar to a common cold with sneezing, runny nose, and mild cough.
- 2. Paroxysmal Stage (1–6 weeks):** Characterized by severe coughing fits, inspiratory "whoop," cyanosis, and vomiting.
- 3. Convalescent Stage (weeks to months):** Gradual recovery with occasional recurrence of symptoms.



Complications:


- **Common:** Pneumonia, otitis media, dehydration.
- **Severe:** Neurological complications like seizures and encephalopathy



Clinical Management



a. Diagnosis:

- Based on clinical history and confirmed with:
 - **Culture: Gold standard** but **low sensitivity after two weeks.**
 - **PCR:** Highly sensitive, ideal during **early** illness.
 - **Serology:** Useful in **later** stages when other tests are negative.
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b. Treatment:

Antibiotics: Effective in early stages to reduce severity and transmission.

- Recommended drugs: **Azithromycin, clarithromycin, erythromycin.**
- **Not** effective in altering the course during the paroxysmal stage.

Supportive Care: Includes oxygen therapy and hydration.

C. Complication Management:

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- Secondary bacterial infections may require specific treatments like antibiotics for pneumonia





Control and Prevention

a. Case Management

Isolation during the infectious period (catarrhal stage to three weeks into paroxysmal stage).

Early antibiotic treatment reduces transmission.

b. Contact Management

Prophylactic antibiotics for close contacts especially **unimmunized infants**.



C. Immunization

Essential to achieving herd immunity.

Booster doses are critical to **counter waning** of immunity.





Vaccination

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a. Vaccine Types:

- **Whole-cell Vaccine (wP):** Effective but associated with more side effects.
- **Acellular Vaccine (aP):** Contains purified components of *B. pertussis*, safer but associated with waning immunity.



a. Vaccine Types:

1. Whole-cell Pertussis Vaccine (wP)

Composition: Contains killed *Bordetella pertussis* bacteria.

Immunogenicity: High; induces strong and long-lasting immunity.

Side Effects: Higher risk of adverse events such as fever, swelling, redness, and pain at the injection site compared to acellular vaccines.

Usage: Predominantly used in low- and middle-income countries due to cost-effectiveness.

Efficacy: Shown to provide robust protection, but higher reactogenicity limits its use in some populations.



a. Vaccine Types:



2. Acellular Pertussis Vaccine (aP)

Composition: Contains purified antigens of *Bordetella pertussis*, such as pertussis toxin (PT), filamentous hemagglutinin (FHA), pertactin, and fimbriae.

Immunogenicity: Moderate; immunity wanes faster compared to wP.

Side Effects: Fewer side effects; better tolerated in infants and adults.

Usage: Commonly used in high-income countries due to improved safety profiles. Often combined with diphtheria and tetanus toxoids (e.g., DTaP for children, Tdap for adolescents and adults).

Efficacy: Effective in reducing disease severity and transmission but associated with shorter duration of protection. Booster doses are often required.

Combination Vaccines:

Both wP and aP are frequently combined with vaccines for diphtheria and tetanus (DTP or DTaP).

DTaP: Diphtheria, Tetanus, and acellular Pertussis (used in children under 7 years).

Tdap: Tetanus, reduced-dose diphtheria, and acellular Pertussis (used in adolescents and adults).

B. Vaccination Schedule:

- **Primary Series:** DTaP at 2, 4, and 6 months with boosters at 15–18 months and 4–6 years.
- **Adolescents and Adults:** Tdap at 11–12 years, then every 10 years.
- **Pregnant women:** are advised to receive Tdap during each pregnancy (27–36 weeks) to protect newborns.



DPT adverse reaction:

- (pain, redness, swelling) 20-40%
- Temp of 101°F (38.3) or higher 3%-5%

More severe adverse reactions not common

Local adverse reactions and fever increased with 4th and 5th doses of DTaP.

Reports of swelling of entire limb.

Extensive swelling after 4th dose NOT a contraindication to 5th dose.

Pertussis-Containing Vaccines Storage and Handling :

- **Stored at 35°–46°F (2°–8°C) at all times
Must never be frozen**
- **Vaccine exposed to freezing temperature must not be administered and should be discarded**
- **Do not be used after the expiration date printed on the box or label**

DTP Precautions:

- Moderate or severe acute illness
Temperature $\geq 105^{\circ}\text{F}$ (40.5°C) or higher within 48 hours with no other identifiable cause
- Collapse or shock-like state (hypotonic hyporesponsive episode) within 48 hours
- Persistent, inconsolable crying lasting ≥ 3 hours, occurring within 48 hours
- Convulsions with or without fever occurring within 3 days.

DTP Contraindications:

- **Severe allergic** reaction to vaccine component or following a prior dose.
- **Encephalopathy** not due to another identifiable cause occurring within 7 days after vaccination.

C. Challenges :

- **Waning immunity** leads to resurgence in older age groups.
- **Coverage gaps** in certain populations exacerbate outbreaks.



Scientific References:

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- Guiso, N., et al. (2011). "Acellular pertussis vaccines and resurgence of pertussis." Emerging Infectious Diseases, 17(4), 696-702.
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VACCINE

Thanks

