CHD Whooping Cough Feb 2026

Suzanne Humphries, MD

Key Symptoms and Stages:

- **Initial Stage (1–2 weeks):** Symptoms resemble a common cold, including a runny nose, sneezing, mild cough, and fever.
- **Paroxysmal Stage (1–6+ weeks):** Severe, rapid, and uncontrollable coughing fits (paroxysms) occur.
- **"Whoop" Sound:** A high-pitched, loud "whoop" sound is often made when inhaling after a coughing fit.
- **Vomiting and Exhaustion:** Coughing often leads to vomiting, gagging, or choking.
- **Post-Coughing:** The face may turn very red or blue, especially in infants. Cleveland Clinic +5

Poor outcomes with infection

- Cyanosis/blueness due to relative lack of available O2.
- Encephalopathy, something the vaccines have been infamous for, especially DPT
- Lung damage (rare)
- Why?
  - Lack of foundational health
  - Impediments to liver and bowel detoxification and removal.
  - Underlying lung/airway conditions.
  - Incompetent medical personnel with lack of knowledge

The usual cause of death from pertussis (whooping cough), particularly in infants under one year old, is severe pneumonia or severe oxygen deprivation (hypoxia) resulting from apnea (breathing cessation) and exhausting coughing fits. Bacterial or viral pneumonia is the primary complication, accompanying almost all pertussis-related deaths. Centers for Disease Control and Preve... +2

Key Causes and Risk Factors

- **Pneumonia:** The most common cause of death, where the lungs become severely infected.
- **Apnea/Hypoxia:** Infants may stop breathing or experience severe oxygen deprivation, which can lead to brain damage or death.
- **Pulmonary Hypertension:** High blood pressure in the lungs, which can be fatal in infants.
- **Infant Vulnerability:** Over 90% of deaths occur in babies younger than 3 months who are too young to be fully vaccinated.
- **Secondary Complications:** These include seizures, encephalopathy (brain disease) due to lack of oxygen, and extreme dehydration. Centers for Disease Control and Preve... +4

Available pertussis vaccines: USA/NZ
No stand alone pertussis vaccine.

AI Overview

In the USA, two main types of combination vaccines are available to protect against pertussis (whooping cough), both containing acellular pertussis antigens: **DTaP (for children under 7 years)** and **Tdap (for older children, adolescents, and adults)**. These vaccines also protect against tetanus and diphtheria. Centers for Disease Control and Preve... +3

Available Pertussis Vaccines

- **DTaP (Diphtheria, Tetanus, and Acellular Pertussis):**
  - **Usage:** Given to babies and children under 7 years old in a 5-dose series.
  - **Common Brands:** Daptacel, Infanrix.
- **Tdap (Tetanus, Diphtheria, and Acellular Pertussis):**
  - **Usage:** Booster shot for adolescents (11-12 years) and adults, including pregnant individuals.
  - **Common Brands:** Boostrix, Adacel. National Institutes of Health (NIH) | (.g... +5

AI Overview

Pertussis (whooping cough) vaccines in New Zealand are all acellular combination vaccines, as no standalone vaccine exists. Key options include **Infanrix-hexa®** (6-in-1 for infants), **Infanrix-IPV®** (4-in-1 for pre-schoolers), and **Boostrix®** or **Adacel®** (Tdap for adolescents/adults). Immunisation Advisory Centre +3

Available Pertussis Vaccine Types & Usage:

- **Infanrix-hexa® (DTaP-IPV-HepB-Hib):** Used for primary immunisation in infants at 6 weeks, 3 months, and 5 months.
- **Infanrix-IPV® (DTaP-IPV):** Used as a booster for children at 4 years old.
- **Boostrix® (Tdap):** Used for school-based boosters (year 7), pregnancy protection, and adult boosters.
- **Adacel® (Tdap):** An alternative Tdap vaccine for booster doses. Health New Zealand | Te Whatu Ora +4

is it theoretically possible to make a single pertussis vaccine?

It is **theoretically possible** to create a single-component (monovalent) pertussis vaccine; in fact, several have been developed and licensed in the past. However, in most countries, they are now only available as **combination vaccines** (such as DTaP or Tdap) for practical and public health reasons. Healthify +4

Key Facts About Single Pertussis Vaccines:

- **Historical Availability:** The first pertussis vaccines licensed in the early 20th century were single-pathogen products. They were later combined with diphtheria and tetanus toxoids in the 1940s to reduce the total number of injections a child needs.
- **Current Global Status:** While most developed nations (including the US, UK, and New Zealand) do not offer a stand-alone pertussis vaccine, a monovalent acellular pertussis (aP) vaccine is still available in **Thailand**.
- **Clinical Research:** Recent studies have successfully tested monovalent aP vaccines for specific uses, such as providing early protection to neonates who are too young for the standard combination schedule.
- **Future Developments:** Researchers are working on new single-dose options, such as **BPZE1**, a live attenuated nasal vaccine designed to be given once at birth to provide early and potentially longer-lasting immunity. Mayo Clinic +6

Pertussis (whooping cough) vaccines available in the EU are primarily acellular (aP) vaccines, commonly combined with diphtheria, tetanus, and often polio, Hib, or hepatitis B for childhood immunization (e.g., Infanrix-hexa, Boostrix). VacPertagen is also authorized for boosters in adolescents, adults, and pregnant women. European Vaccination Information Portal +2

Key vaccines and their usage in the EU include:

- **Combined Vaccines (DTaP/Tdap):** These are the standard, such as *Boostrix* (diphtheria, tetanus, pertussis) and *Infanrix* series, used for both primary infant vaccination and booster doses in adolescents, adults, and pregnant women.
- **Pertussis-Only Vaccine (VacPertagen):** Approved in the EU, this allows for booster vaccination in pregnant women and adults without requiring additional tetanus or diphtheria boosters.
- **Vaccination Schedules:** Infants typically receive a primary course (e.g., DTaP-IPV-HepB/Hib) at 6 weeks, 3 months, and 5 months. Boosters are recommended for adolescents (around age 11) and routinely for pregnant women (second or third trimester) to provide passive protection to newborns. European Vaccination Information Portal +5

VacPertagen (Pertussis vaccine, recombinant, acellular, component, adsorbed) is a monovalent, two-component acellular pertussis vaccine. Each 0.5 mL dose contains the following active ingredients and excipients: European Medicines Agency +4

Active Ingredients (Per 0.5 mL dose):

- **Recombinant Pertussis Toxin (PTgen):** 5 micrograms (μg) — a genetically detoxified toxin.
- **Filamentous Haemagglutinin (FHA):** 5 micrograms (μg). European Medicines Agency +1

Adjuvant:

- **Aluminium hydroxide, hydrated (Al3+):** 0.3 milligrams (mg). European Medicines Agency +1

Other Ingredients (Excipients):

- **Sodium chloride**
- **Water for injection**
- **Formaldehyde:** May be present in trace amounts as a manufacturing process residual. European Medicines Agency +1

Daptacel

11 DESCRIPTION

DAPTACEL is a sterile isotonic suspension of pertussis antigens and diphtheria and tetanus toxoids adsorbed on aluminum phosphate, for intramuscular injection.

Each 0.5 mL dose contains 15 Lf diphtheria toxoid, 5 Lf tetanus toxoid and acellular pertussis antigens [10 mcg detoxified pertussis toxin (PT), 5 mcg filamentous hemagglutinin (FHA), 3 mcg pertactin (PRN), and 5 mcg fimbriae types 2 and 3 (FIM)].

Other ingredients per 0.5 mL dose include 1.5 mg aluminum phosphate (0.33 mg of aluminum) as the adjuvant, ≤5 mcg residual formaldehyde, <50 ng residual glutaraldehyde and 3.3 mg (0.6% v/v) 2-phenoxyethanol (not as a preservative).

https://www.fda.gov/media/74035/download

How many doses? 5!

- First dose 7 weeks
- Third dose finishes primary series
- Dose 4 and 5 are boosters, and are responsible for the most adverse events.
- Ineffectiveness of the vaccines and danger of toxin reversion to virulence driven by the formaldehyde inactivation.
- The other option to make the bacteria or toxins more benign for vaccine usage, is genetic modification, which is deemed more reliable and more safe.

Antigen Composition by Vaccine Brand

The number and concentration of these antigens vary by manufacturer and whether the vaccine is for primary childhood series (**DTaP**) or adolescent/adult boosters (**Tdap**). World Health Organization (WHO) +3

Vaccine Brand	Type	Pertussis Antigens Included	Typical Manufacturer
Infanrix	DTaP	PT, FHA, PRN	GlaxoSmithKline
Daptacel	DTaP	PT, FHA, PRN, FIM 2 & 3	Sanofi Pasteur
Boostrix	Tdap	PT, FHA, PRN (reduced doses)	GlaxoSmithKline
Adacel	Tdap	PT, FHA, PRN, FIM 2 & 3 (reduced doses)	Sanofi Pasteur
Pertagen	aP	Genetically inactivated PT, FHA	Manufactured in Thailand

Vaccination: what's the problem?

- Cannot be done until 6 weeks of age. By 2 months, WC is manageable with diligence and commitment.
- Unnecessary, as the mortality rate fell almost 100 percent before vaccination programs began. The decrease or suspension of vaccination (e.g., in the 1970s in Sweden) did not increase deaths from pertussis.
- Impair herd immunity.
- Cannot eradicate whooping cough, which is why eradication isn't even discussed.

Contin…

- Cannot prevent transmission.
- Provide defective, limited personal protection.
- Induce mutants that have higher invasive capacity.
- Create a perceived need for ongoing repetition of vaccines, subjecting recipients to the adverse effects of each one.

New inhaled vaccine: BPZE1

- 20 years in research (or more)
- Recently funded for development
- Trials in super healthy older people
- Exclusion criteria

Efficacy, immunogenicity, and safety of the live attenuated nasal pertussis vaccine, BPZE1, in the UK: a randomised, placebo-controlled, phase 2b trial using a controlled human infection model with virulent *Bordetella pertussis*

PMID: 41344352

Diane Gbesemete, Maheshi N Ramasamy, Muktar Ibrahim, Alison R Hill, Lucy Raud, Daniela M Ferreira, Jonathan Guy, Adam P Dale, Jay R Laver, Tyween Coutinho, Saul N Faust, Thomas A N Reed, Gavin Babbage, Lisa Weissfeld, Wei Lang, Camille Locht, Vivek Samal, Peter Goldstein, Ken Solovay, Keith Rubin, Stephanie Noviello, Robert C Read

Summary

Background Pertussis is a severe respiratory disease caused by *Bordetella pertussis*. Although vaccines prevent disease for a limited duration, they do not prevent infection and transmission. We aimed to assess the safety and efficacy of BPZE1 at preventing or substantially reducing colonisation by virulent *B pertussis* using a robust controlled human infection model.

Methods This randomised, placebo-controlled, phase 2b trial was conducted at University Hospital Southampton and University of Oxford in the UK. Eligible participants were healthy adults aged 18–50 years, who complied with the protocol, refrained from smoking and nasal sprays, and were fully vaccinated against SARS-CoV-2. Exclusion criteria were pertussis vaccination or illness (<5 years), baseline anti-pertussis toxin serum IgG (>20 International Units [IU]/mL) or anti-pertactin serum IgG (>30 IU/mL) concentrations, and a positive SARS-CoV-2 test. Participants were randomly assigned (1:1), using permuted blocks with a block size of four, to receive an intranasal dose of 10^9 colony-forming units (CFU) of BPZE1 or placebo (lyophilised buffer) and were challenged 60–120 days later with 10^5 CFU virulent *B pertussis*. Masked staff administered the study vaccine. Nasal mucosal secretion and

Lancet Microbe 2025; 6: 101211

Published Online December 1, 2025
https://doi.org/10.1016/j.lanmic.2025.101211

NIHR Southampton Clinical Research Facility and Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust, Southampton, UK
(D Gbesemete PhD, M Ibrahim PhD, A R Hill PhD, L Raud BSc, J Guy BSc, A P Dale PhD, J R Laver PhD,

5.2 Subject Exclusion Criteria

1. Have immunosuppression as a result of an underlying illness or treatment, or use of anticancer chemotherapy or radiation therapy (cytotoxic) within 3 years prior to study vaccination
2. Have known or suspected active chronic autoinflammatory condition
3. Have known active neoplastic disease (excluding non-melanoma skin cancer) or a history of any hematologic malignancy
4. Have a history of persistent asthma, major anatomic nasopharyngeal abnormality, or sinus polyp disease due to chronic sinusitis[6]

[6] *If a patient has a history of nasopharyngeal surgery such as, but not limited to rhinoplasty, tonsillectomy or sinus surgery, adequate healing time per the judgment of the investigator must occur prior to enrollment.*

5. Have known hepatitis B or hepatitis C infection
6. Have a history of alcohol or drug abuse within 5 years prior to study vaccination
7. Currently untreated or clinically unstable (in the opinion of the investigator) schizophrenia, bipolar disease, or other psychiatric diagnosis that may interfere with subject compliance or safety evaluations
8. Have been hospitalized for psychiatric illness, history of suicide attempt, or confinement for danger to self or others within 5 years prior to study vaccination
9. Have received corticosteroids (including oral, parenteral, inhaled, nasal, or intra-articular) of any dose within 30 days prior to study vaccination
10. Individual with PT serum IgG antibodies ≥ 20 IU/mL and/or PRN serum IgG antibodies ≥ 125 IU/mL
11. Unwilling to refrain from smoking tobacco for 28 days post vaccination
12. Receipt of immunoglobulin or blood derived products within 90 days of enrollment
13. Receipt of a vaccine against pertussis in the past 2 years
14. Receipt of a live vaccine within 30 days of study vaccination or an inactivated vaccine within 14 days of study vaccination
15. Planned vaccination with a licensed vaccine within 28 days of study vaccination
16. History of severe allergic reaction (e.g., anaphylaxis) or Bell's palsy, or Guillain-Barré syndrome, after a previous dose of any diphtheria toxoid-tetanus toxoid-, or pertussis-containing vaccine, or encephalopathy within 7 days of administration of a previous pertussis containing vaccine.
17. History of a progressive neurologic disorder
18. In close contact[7] with children less than 1 year of age or contact with persons with known immunocompromising conditions

What the medical industry has to offer for acute whooping cough cases:

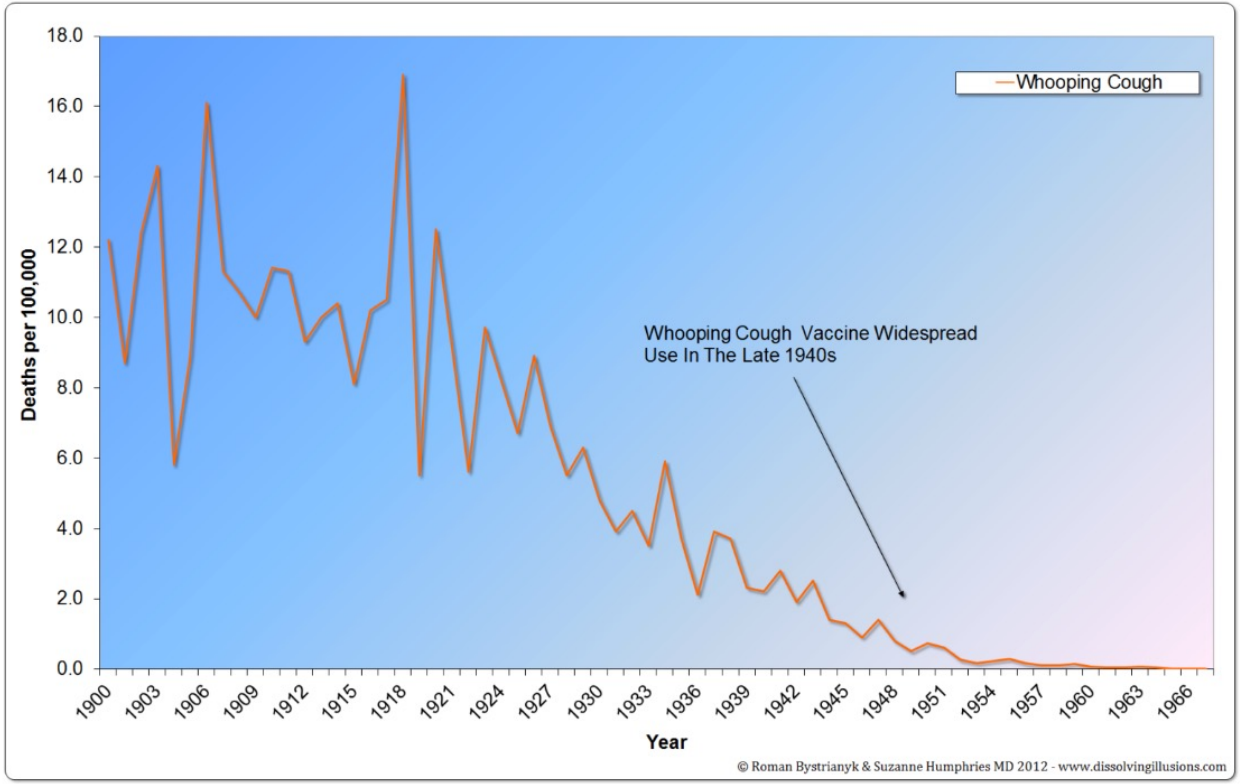
- Fear
- Antibiotics
- Cough suppressants
- Dexamethasone
- Salbutamol/bronchodilators
- Lying babies on their backs
- Monitoring oxygen with alarms going off
- ECMO (temporary lung replacement with a machine)

Are there any effective treatments for whooping cough outside the medical system? Yes

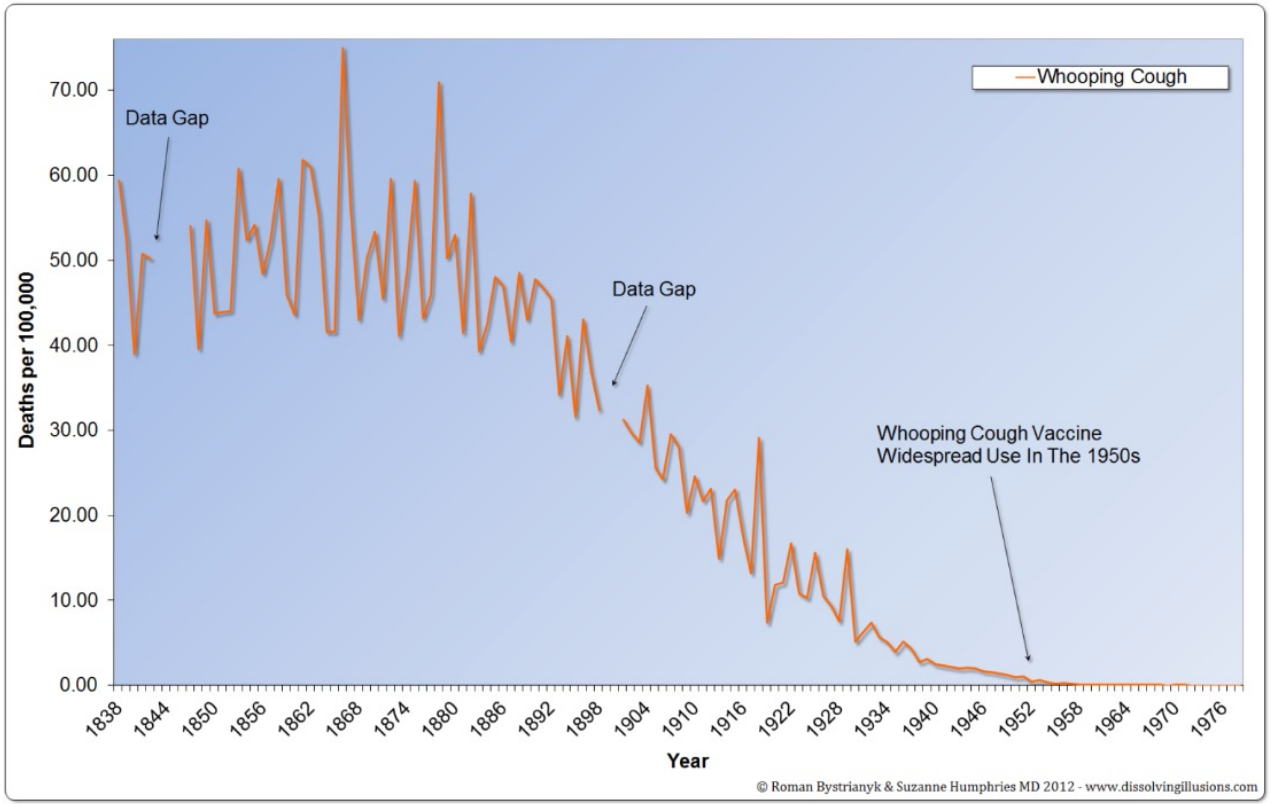
- Vitamin C in therapeutic regular doses
- Airplane treatment
- Herbs and homeopathy
- Regaining lost foundational health. Basics make a huge difference: birth, feeding mode, drugs, maternal and infant vaccines, nutrition/sugar intake
- Probably lots more

Vitamin C

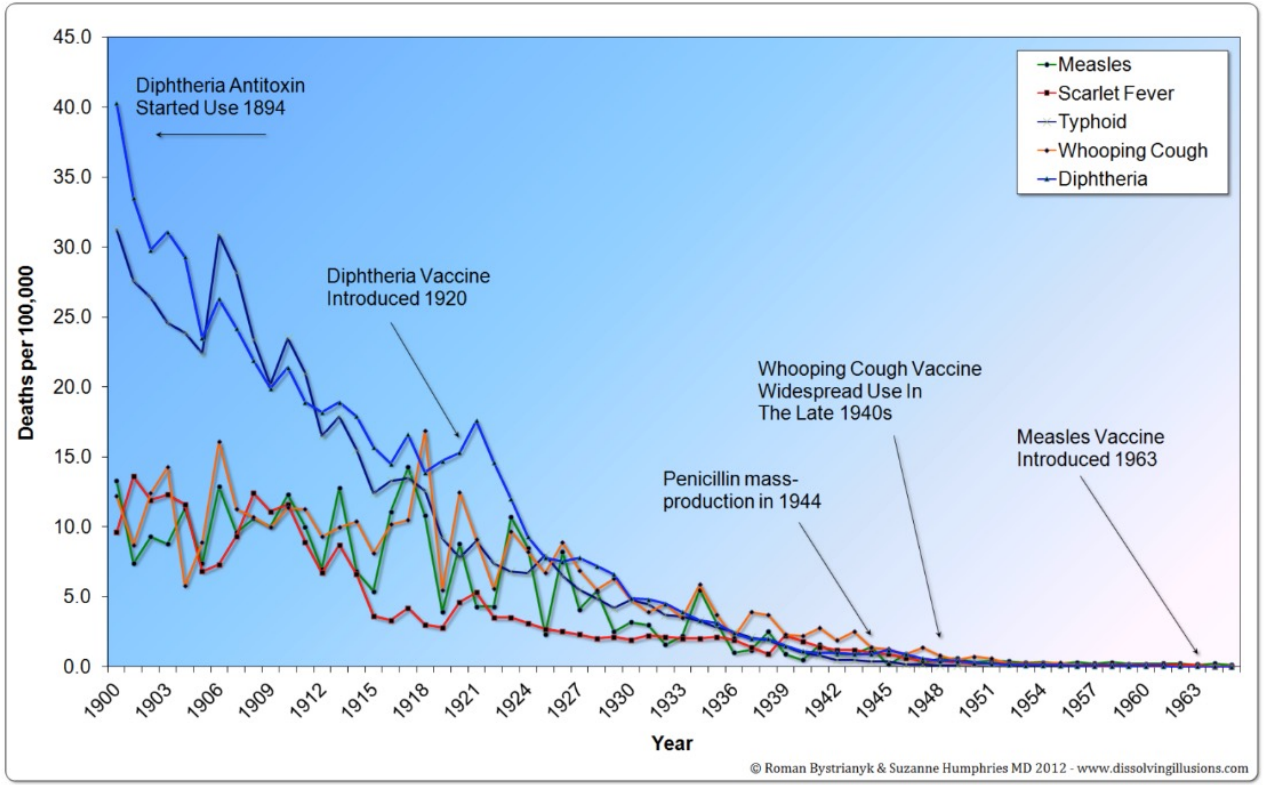
- https://drsuzanne.net/wp-content/uploads/2017/10/Vitamin-C-Whooping-Cough-PDF.pdf



Graph 14.5: United States whooping cough mortality rate from 1900 to 1967. (Vital Statistics of the United States 1937, 1938, 1943, 1944, 1949, 1960, 1967, 1976, 1987, 1992; Historical Statistics of the United States—Colonial Times to 1970 Part 1; Health, United States, 2004, US Department of Health and Human Services; Vital Records & Health Data Development Section, Michigan Department of Community Health; US Census Bureau, Statistical Abstract of the United States: 2003; Reported Cases and Deaths from Vaccine Preventable Diseases, United States, 1950–2008) *First Edition: Graph 11.5



Graph 14.3: England and Wales whooping cough mortality rate from 1838 to 1978. (Record of mortality in England and Wales for 95 years as provided by the Office of National Statistics, published 1997; Report to The Honourable Sir George Cornewall Lewis, Bart, MP, Her Majesty's Principal Secretary of State for the Home Department, June 30, 1860, pp. a4, 205; Essay on Vaccination by Charles T. Pearce, MD, Member of the Royal College of Surgeons of England; Parliamentary Papers, the 62nd Annual Return of the Registrar General 1899 (1891–1898)) *First Edition: Graph 11.3



Graph 17.3: United States mortality rates from various infectious diseases from 1900 to 1965. (Vital Statistics of the United States 1937, 1938, 1943, 1944, 1949, 1960, 1967, 1976, 1987, 1992; Historical Statistics of the United States—Colonial Times to 1970 Part 1; Health, United States, 2004, US Department of Health and Human Services; Vital Records & Health Data Development Section, Michigan Department of Community Health; US Census Bureau, Statistical Abstract of the United States: 2003; Reported Cases and Deaths from Vaccine Preventable Diseases, United States, 1950–2008) *First Edition: Graph 14.3

Take a ride in the sky

Altitude treatment for whooping cough

PMID 1859970

SIR,—I was intrigued by Dr P A Casey's letter about the effect of altitude on non-productive coughing after pertussis in children.[1] My experience (after 19 years of uniformed service) is that this phenomenon is widely known. I discussed the situation with my senior colleagues and can report that we in the Royal Air Force medical branch have been using this particular mode of treatment for many years—over 40 to my knowledge.

Our standard approach is to decompress victims to 3000-3350 m above sea level, after which disappearance of the cough is the norm. The pathophysiology of this remains enigmatic. What is without doubt is that the treatment works. Our only difficulty has been to obtain suitable insurance cover for the decompression run, given that the "victim" has almost invariably been a civilian. Fortunately, I am not aware of any complications occasioned thereby.

D HALL

Princess of Wales Royal Air Force Hospital,
Ely,
Cambridgeshire CB6 1DN

1 Casey PA. Altitude treatment for whooping cough. *BMJ* 1991; 302:1212. (18 May.)

Pg

To Cure Whooping Cough

Taken up in a plane, late Sunday afternoon, to an altitude of 10,000 feet in an effort to cure her of whooping cough with which she has been afflicted the past two weeks, little Rachel Charest, 2½ year old daughter of Mr. and Mrs. Harvey Charest, 102 South Main street, Auburn, was reported somewhat better an hour later. A full day will be necessary before it can be certain a cure has been effected, it is believed.

Rachel showed no fear at being so high, and even fell asleep when cloud level—9,000 feet—was reached. She was accompanied by her father and Roland Maheux, pilot of the plane. Rachel was at first going to make the trip alone, but at the last minute, she insisted her father go.

The plane, which left the ground at approximately 4:15 p.m., Sunday, was in the air 45 minutes. As the plane reached 10,000 feet, the pilot went into a series of short dives to make the little girl catch her breath. This sudden change of atmospheric pressure was believed to be the means of effecting the cure.

While landing, Rachel showed how little fear she has for the air, when she said, "Let's go down and get Mamma and give her a ride."

Her mother did not go up.

Charest said his daughter was apparently growing worse each

RACHEL CHAREST

day. His friends told him about similar trips made at Waterville the past year which have been rather successful and he decided to see if his daughter could be helped or cured by going up in a plane.

A slight feeling of tiredness was the only noticeable effect of the flight on Rachel. Her cough seemed to be less frequent and less violent Sunday night.

Plane trips tried as cough cure

Mr. and Mrs. Ken Caffyn, of North Fitzroy, were waiting anxiously last night to see whether their seven-month-old son Darren would cough away the congestion which has been causing his severe whooping cough.

Darren was taken on a plane flight yesterday afternoon in the hope that the lower air pressure at 10,000 feet would relieve his condition.

Mrs. Caffyn said last night that she and her husband, a construction manager, had been told by European friends that this treatment was often used on the Continent.

"When we read about the case in Adelaide we decided to give it a try," she said.

(Craig Walter Barber, eight months, of Salisbury Downs, SA has been reportedly cured of whooping cough after two flights in an unpressurised plane.)

As a result, young Darren found himself flying around at 10,000 feet for about an hour and a half yesterday afternoon, accompanied by hs family doctor and Mr. Rene Roks, a volunteer from the Victorian Air Rescue Service, which organised the flight.

"He was very good," said Mrs. Caffyn, "He slept most of the time."

Mrs. Caffyn said that, according to the doctor, it would be known in a couple of days whether Darren was cured or not.

"We have to wait till he starts coughing, which is usually at night, to see if he's going to bring it all up," she added.

PUBLISHED SINCE 1863. Nº 42,190
TUESDAY, APRIL 4, 2000

N2H

Kids with whooping cough got a real high

My late father was one of many club pilots in the late 1940s who took babies and young children in light aircraft (usually Auisters) up to 10,000ft altitude for a certain length of time (maybe an hour) for the whooping cough "cure." It was believed that the reduction in oxygen at this altitude killed the whooping cough bacillus.

The flights were usually done with a GP's knowledge and approval. Picture a planeload of miserable, sick children with perhaps one adult to keep an eye on them, in bumpy, wintry weather, but it worked. Often, by the time the plane was back on the ground, the children were considerably better, with breathing difficulties much reduced.

It became a thing of the past when immunisation for babies came in.

V.Sanders.
Howick.

PUBLISHED SINCE 1863. Nº 42,185
WEDNESDAY, MARCH 29, 2000

Whooping cough cure

NZH

In 1949 my three-month-old son developed whooping cough — he caught it from his two-year-old sister — and someone suggested taking the children up in an unpressurised aeroplane because this would cure them. At that time my husband had a friend who owned such a plane at Mangere and he readily agreed to try out this theory. I am pleased to say it worked and the children recovered very quickly.

Constance Johnson.
Waikowhai.

Flying Holiday in New Zealand

ON Monday morning, Miss Eileen Steenson was flying herself over Christchurch, New Zealand, to have a quick look at the city; on Tuesday afternoon, she was back on her job, teaching at Methodist Ladies' College.

Miss Steenson, who holds a commercial flying licence and an instructor's licence, went to New Zealand for the school holidays, spent as instructor to the Auckland and the Nelson aero clubs.

This is her second visit to the Auckland Aero Club as a "guest instructor," and she returned this year by special invitation. "But I wanted to see something of the South Island," she explained yesterday, "so accepted a position with the Nelson club for a few weeks, too."

Early Start

Although it was interesting, it was also hard work, said Miss Steenson. "Some of my pupils had me out at 5.30 a.m., and often I was flying from daylight to dusk."

Weather and the nature of the country made flying conditions more difficult in New Zealand than in Australia, she added.

Most of her pupils were men—and included a Church of Christ missionary from the United States who was running a mission at Nelson. "He thought it would be helpful to his work as a padre if he could fly his own plane," Miss Steenson said. She gave him his first lesson and when she left he was progressing well.

Not all her time was spent instructing; she also did charter work. "Last year I did a variety of jobs, including some emergency flights with sick people, but this year most of the charter work was to take people on sight-seeing flights, especially over the sound from Nelson," she explained.

However, she did do a series of altitude flights with whooping-cough patients—mostly children. "We took them up above 10,000 feet and kept them at that altitude for about 40 minutes and later received a number of calls from parents to say the flight had proved beneficial to the children," said Miss Steenson.

Plane Ride for Baby Whooping Cough Cure

(Wireless to The New York Times and The Gazette.)

Vienna, September 4.—The first attempt to cure a baby boy of whooping cough by flying him in an open sports plane was made 10,000 feet above Vienna today.

The mother took the boy to the airport, but remained aground. Accompanied by Dr. Urbantschich, adjutant of the seventeenth group of the Nazi Flying Corps, the boy went up in a plane piloted by Storm Troop Leader Baier. The doctor announced himself well pleased with the results of the trip, which lasted forty minutes.

FIG. 1.—Entering the decompressor.

HIGH FLYING AND DECOMPRESSION TREATMENT OF WHOOPING-COUGH

BY

H. STANLEY BANKS, M.D., F.R.C.P.

Physician-Superintendent, Park Hospital, Hither Green

In 1927 an air pilot of Strasbourg took his child suffering from whooping-cough for a flight to a height of 10,000 feet (3,050 metres). The child's cough was said to have ceased dramatically after three days. Before the war Dr. W. Matter (1946), of Strasbourg, did much pioneer work on aeroplane flights for whooping-cough, and the practice became popular in many countries of Europe and to some extent in South America. As a result of this and of some work done in Switzerland (P. Lauener and E. Maeder, 1942) during the war, several conclusions were reached : (1) that the best results were obtained in the fifth and sixth weeks of the disease ; (2) that several flights were no better than one ; (3) that an altitude greater than 10,000 feet was rarely necessary ; (4) that the extreme cold at this altitude was harmful to some patients, and that for this reason the closed plane was better than the open one.

Claims for the Treatment

In 1939 a controlled experiment in Berlin on 88 children treated by aeroplane flights and 33 children treated under similar atmospheric pressures in the decompression chamber yielded slightly superior results for the latter, and in addition none were made worse by the decompression treatment. The highest claims made for the treatment about the year 1945 were : approximately 30% cured—that is, cessation of paroxysms within four days ; 30% improved—that is, marked diminution of the paroxysms within seven to 10 days ; and 40% no change or worse after seven days. At the same time it was generally agreed that the beneficial effect of the treatment depended upon low barometric pressure and low oxygen tension in the alveolar air rather than upon the actual purity of the air breathed. These results were statistically open to considerable criticism owing to the absence of controlled studies and the difficulties of assessment of cure and improvement in out-patients.

In 1946 Baldry and Richou published their first report on 300 cases treated in a decompression chamber in Paris. Selected cases of all ages from 2 months to 40 years were treated, and of those followed up for 21 days (44% of the total) there were 22% of cures in four days, 51% "improved," and 4% whose paroxysms were aggravated for some days after the treatment. Up to 1948 Richou had treated some 6,000 cases in Paris. His published conclusions include the following principles : (1) that the results obtained were independent of age and weight ; (2) that the best time for the treatment is after the third week of the disease, preferably the fourth, fifth, or sixth ; (3) that repetition of the treatment does not increase the percentage of successes—that is, a good result is obtained with the first treatment or not at all ; (4) that contra-indications for the treatment are fever, respiratory and cardiac complications, epistaxis and any haemorrhage, nasopharyngeal infections, ear infections, hernia, surgical emphysema, and malnutrition. The rarefied air-pressure is regarded as the chief factor in a beneficial result. How it acts is unknown. It has been suggested that it may lead to a relaxation of bronchial muscle, damping down of the cough reflex, or alteration of the bronchial mucosa in some unknown way.

The method has its severe critics. In 1948 Bergquist treated 45 children in Stockholm—20 by aeroplane at 11,000 feet (3,350 metres) for 45 minutes, and 25 at similar low pressure in a chamber for 45 minutes. He stated that an analysis of the course of the disease, the frequency of paroxysms and vomiting, duration of the disease, bacillary findings, and changes in the blood picture showed no significant difference, and in his opinion flying and low-pressure chambers were completely without value in treatment of whooping-cough.

It is clear that a critical assessment of the treatment is required, preferably in in-patients, with radiological and haematological observations before and after. This is not easy to arrange, and to a large extent it will probably be

FIG. 2.—Inside the decompression chamber. Note the observation windows for use of doctor and technician, the telephone, the thermometer, and oxygen masks (for use in emergency only).

DECOMPRESSION TREATMENT OF WHOOPING-COUGH

A CLINICAL SURVEY OF 903 CASES

BY

H. STANLEY BANKS, M.D., F.R.C.P.
Late Senior Physician, Park Hospital, London

Weekly or twice-weekly clinic sessions for the treatment of whooping-cough by low air-pressure in a decompression chamber have been held in this hospital since May, 1949, except for short periods when the prevalence of the disease was very low. The chamber was purchased from the Royal Air Force by the Ministry of Health in 1948, was conveyed to its present site by the London County Council, and was reconditioned and refitted by the Lewisham Group Hospital Management Committee. At that time considerable public interest had been aroused in high flying and decompression treatment, and, by request, I published a brief preliminary account of it with illustrations of the chamber in action (Banks, 1949).

Selection and Examination of Patients

During the five and a half years 903 patients were treated.

course of the treatment. The pressure of air in the chamber was reduced progressively for about 20 minutes until the equivalent of a height of 12,000 feet (3,660 metres) was reached. This low pressure was maintained for 45 minutes and then gradually increased during the 20 to 25 minutes "descent." The treatment thus lasted about 90 minutes. Some pain in the ears and deafness were commonly experienced during the "descent" and for a short time thereafter. In this routine a hitch occurred only on two occasions, once when a woman in the chamber became hysterical, and once when the motor failed. In both cases "ground level" was regained without incident.

Assessment of Results

A form was provided upon which the parent or ward staff was asked to record the time and character of each cough and food vomit during a period of 48 hours *commencing one week after the treatment*; in addition they were asked to report in a few words their impressions of the progress or otherwise of the child from the date of treatment until the date of the report. The completed forms were sent to me generally about the tenth day after decompression. They were delayed for two weeks or so in a small proportion and occasionally a reminder had to be sent out after about two weeks. The factual report on coughs and vomits, and the mother's or ward sister's statement of her impressions of the result of the treatment, taken in conjunction with the recorded data before treatment and the stage of the disease, formed the basis upon which the assessment

Results

Effect on Cough, Vomiting, and General Conditions.—Table II indicates that marked rapid improvement with virtual cessation of paroxysmal cough (XX) occurred in

TABLE II.—*Cases Treated by Decompression and Assessed Results*

Classified Result*	1949	1950	1951	1952	1953	1954	Total	%
XX	20	68	55	30	26	21	220	28·2
X	21	93	60	33	36	23	266	34·1
X–	15	48	34	17	16	11	141	18·0
O	18	36	37	18	29	13	151	19·2
OO	—	3	—	1	—	—	4	0·5
Total assessed ..	74	248	186	99	107	68	782	100·0

* See text.

28.2% of the assessed cases, and slower but probably significant improvement (X) in a further 34.1%; while in 37.7% the treatment appeared to have no effect.

Effect on Vomiting.—A particularly valuable sequel to the treatment in many cases was the relief of vomiting (Table III). Among the 427 children who were vomiting

TABLE III.—*Cases Vomiting Food (more than once daily)*

	1949	1950	1951	1952	1953	1954	Total	%
Vomiting stopped	18	84	60	33	30	21	246	57·7
,, reduced	10	30	22	7	10	6	85	20·0
,, unrelieved ..	9	34	22	12	15	4	96	22·3
Total ..	37	148	104	52	55	31	427	100·0

food more than once daily just before treatment, the vomiting stopped fairly abruptly in 57.7%, was reduced in a further 20%, and was unrelieved in 22.3%. This was something for which the parents were especially grateful.

Lauener and Maeder (1942), in Berne, treated 256 cases by flights to a height of 12,000 ft. (3,660 metres), each lasting one and a half hours. They reported "abrupt cure" after one flight in 57 (22.8%) and slower cure over about eight days in 80 (32%). They also took 24 cases up the Jungfrau to an altitude of 10,000 ft. (3,050 metres) and kept them there three hours with results that were disappointing. There may have been a counteracting effect here of cold and other factors. A trial of low-pressure chamber treatment, however, in 65 cases taken to the equivalent of 14,000 ft. (4,270 metres) yielded "rapid cure" in 31%, "undoubted