**CHILDHOOD Hib VACCINES: NEARLY ELIMINATING THE THREAT OF BACTERIAL MENINGITIS**

By “teaching” the immune system to defend against infection, vaccines prevent serious illness, disability, and death from dozens of infectious diseases,¹ making vaccines one of the most important public health achievements ever.

As a leader in biomedical research, NIH has contributed to the development of many vaccines throughout its history – one standout vaccine has nearly eliminated Haemophilus influenzae type b (Hib) infection in the U.S. Once the leading cause of bacterial meningitis in children, Hib infection can result in serious, long-term disability and death. Today, the near elimination of Hib has had profound benefits throughout the world.² NIH, in concert with many other governmental, non-profit, and private organizations, played a key role in making an effective Hib vaccine a reality, resulting in thousands of lives saved.³

**HAEMOPHILUS INFLUENZAE TYPE B (Hib)**

- Bacterial infection spread by direct person-to-person contact as well as coughing and sneezing
- Causes fever, bacterial meningitis, pneumonia, infection of the blood, and swelling of the throat and joints
- Long-term consequences can include deafness, blindness, brain damage, and intellectual disability
- Predominately affects young children, especially infants

Also see Hib information provided by the Centers for Disease Control and Prevention (CDC): [http://www.cdc.gov/vaccines/vpd-vac/hib.htm](http://www.cdc.gov/vaccines/vpd-vac/hib.htm)

**Hib INFECTIONS: THEN AND NOW**

**THEN**

- Antibiotics were not always prescribed at the right time and dose. Even with effective antibiotic treatment, 5 percent of those who contracted the infection died.⁴
- Hib was the leading cause of bacterial meningitis and acquired intellectual disability in children – most of whom were under 5 years of age.⁶
- Upwards of 1,000 children died from Hib every year and 6,000 suffered from deafness, seizures, intellectual disability, or brain damage primarily due to bacterial meningitis.¹⁰
- $2 billion per year in health care costs were attributed to Hib and related illnesses in 1968.¹²

**NOW**

- More than 20,000 cases of Hib were reported in the U.S. each year.⁸
- Cases have dropped by more than 99%, with only around 40 reported in 2009.⁹
- Highly effective Hib vaccines have been in use since the late 1980s.⁵
- More than 90% of children in the U.S. received a Hib vaccine in 2014.⁷
- The CDC predicts that more than 19,000 cases and 700 Hib-related deaths will be prevented over the lifespan of the 4 million U.S. children born in 2009 alone.¹¹
- For the group of children born in 2009, Hib vaccination is predicted to save $1.8 billion in direct costs and $3.7 billion in total societal costs.¹³
**RESEARCH-TO-PRACTICE MILESTONES FOR THE Hib VACCINE**

For more information on the supporting evidence and research sponsors for these milestones, see the Web appendix.

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**1920s**

Hib (seen below right, in photo) was found to be the primary cause of bacterial meningitis in children. The bacteria could be distinguished under the microscope by their unique outer coat. Later, scientists determined this coat was made up of chains of specific sugar molecules.

Because sugar chains typically do not stimulate immune responses as well as proteins, researchers began to look for ways to link the chains to bacterial proteins in order to enhance their immunogenicity.

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**By deactivating disease-causing components of bacteria, vaccines were developed to prevent tetanus and diphtheria.** These advances would later help enhance the effectiveness of Hib vaccines.

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**1968**

The first attempts at developing a Hib vaccine focused on the sugar chains – researchers worked on isolating, purifying, and preparing these chains for clinical use.

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**1969**

The Food and Drug Administration (FDA) approved the first Hib vaccines (including from Praxis Biologics) for use in children two years of age, while researchers explored ways to make the vaccines more effective in infants.

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**1985**

The Food and Drug Administration (FDA) approved the first 4 conjugate vaccines for use in infants.

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**1987-1993**

The conjugate vaccine developed by NIH-funded scientists was licensed, manufactured, and commercially distributed.

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**1993**

The conjugate vaccine developed by NIH-funded scientists was licensed, manufactured, and commercially distributed.

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**1995**

The conjugate vaccine developed by NIH-funded scientists was licensed, manufactured, and commercially distributed.

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**1977: A young girl receives a vaccination, administered by a public health nursing practitioner**

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**NIH** indicates NIH-funded milestones

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For their “groundbreaking work and ...leadership in the development and commercialization of the [Hib] vaccine,” the Albert and Mary Lasker Foundation awarded their prestigious Clinical Medical Research Award (often referred to as the “American Nobels”) to four NIH-supported scientists, NIH’s National Institute of Allergy and Infectious Diseases provided grant funding to Drs. Porter Anderson and David Smith, Drs. Rachel Schneerson and John Robbins performed the majority of their research within the intramural laboratories of the Eunice Kennedy Shriver National Institute on Child Health and Human Development.
IMPACTS OF Hib VACCINES

HEALTH
- First conjugate vaccine approved to treat an infectious disease.30
- More than 90% of children in the U.S. receive the Hib vaccine.31

- Incidence of Hib cases declined more than 99% following availability of the conjugate vaccine.32

SOCIETY
- Hospitalization for Hib-meningitis costs upwards of $38,000 depending on the severity of the disease.36
- NIH-supported researchers started a company and successfully moved Hib and other experimental vaccines through the full product development pipeline.37

- For children born in 2009 alone, Hib vaccination saves $3.7 billion, including more than $1.8 billion in direct treatment costs.35

KNOWLEDGE
- Hib vaccine research provided fundamental understanding of how the infant immune system works, stimulating new strategies for developing effective vaccines for infants.
- The Hib conjugate vaccine technology has been applied to create several vaccines against other disease-causing bacteria, such as pneumococci, meningococci, Salmonella typhi, group B streptococci, and E coli.38

CHILDHOOD VACCINES: OVERALL IMPACT ON SOCIETY
The Hib vaccine success story highlights how continued scientific investment leads to new tools that prevent deadly diseases and improve the lives of people around the world. The Hib vaccine is one of many childhood vaccines, and the CDC projects that over the lifespan of the 4 million U.S. children born in 2009 alone, childhood vaccination overall will:

- save 42,000 lives
- prevent 20 million cases of disease
- reduce direct health care costs by $13.5 billion
- save $68.8 billion in indirect costs39

For references, supplementary information, and more on the impact of NIH, please visit http://www.nih.gov/impact