

The Discovery of the Pertussis Vaccine in Depression Era America

Infectious diseases were the number one cause of death in the mid-twentieth century prior to the advent of antibiotics. Children, especially infants, were particularly vulnerable and few treatments were available. Pertussis, also known as whooping cough, is one of the many childhood diseases parents feared the most. In the United States alone, 178,000 children fell ill and 6,000 died every year. The disease killed more children than polio, scarlet fever, tuberculosis or diphtheria.

The hallmark of whooping cough is the persistent, strong, painful cough that lasts for weeks with a slow recovery. The strenuous coughing frequently caused hernias, broken ribs, and led to pneumonia. Recovery could take up to two months. Outbreaks would occur every year in most communities and households were quarantined in an effort to stop the spread and save lives.

In 1906, the bacteria that causes whooping cough, *bordetella pertussis*, was identified. By 1914, efforts to develop an effective vaccine had failed because the bacteria had many strains and was too difficult to grow in the lab. In 1932 in Grand Rapids, Michigan, two women began working together in the State Public Health Department and shared a common goal. Both had survived whooping cough in childhood and were determined to find a vaccine for the deadly disease. Pearl Kendrick and Grace Eldering developed a lifelong friendship and working relationship that culminated in the development of the pertussis vaccine in 1934. In 1942, the first combination vaccine, DTP, which provided immunity to diphtheria, tetanus, and pertussis in one injection was developed. Both women graduated from Johns Hopkins University with PhDs in microbiology; Kendrick in 1934 and Eldering, encouraged by Kendrick, in 1942.

Kendrick and Eldering began their research study during the whooping cough outbreak of 1932 in Grand Rapids -the first large scale research plan for a whooping cough vaccine in the world. Kendrick and Eldering became well known in the community, a unique and productive strategy that contributed to the success of the project. They forged relationships with local physicians and visiting nurse agencies, establishing a network of communication and shared collection of data. Many of the medical professionals were recruited by the women to contribute countless volunteer hours to complete the study. Day and night, in the cold Michigan winter, they visited homes of patients to collect samples and give comfort to the children and parents. Kendrick and Eldering also excelled in procuring funds. They formed ties with women's clubs and PTAs that solicited money for them and pursued grants from the Rockefeller Foundation and the American Public Health Association. In the height of the Great Depression, still short on funds, they invited Eleanor Roosevelt to visit their lab and learn about the project. She arranged for more funds and lab workers through the WPA (Works Projects Administration) Federal Relief Plan, a New Deal agency.

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Kendrick and Eldering created an agar that rapidly grew the bordetella pertussis bacteria in the lab. They made it in their own kitchen, modifying the standard medium by using sheep's blood, potatoes, and seaweed. They used cough plates, a small plate of agar brought directly to the patient's bedside, to collect samples of bacteria from active patients to grow in the lab. Soon they had enough data to determine an accurate quarantine policy. They found it took not 2 to 4 weeks but 5 weeks for a patient to be 90% free of the disease. These public health laws were quickly adopted across the state and the country, saving hundreds more lives.

In 1934, the first field trials of the vaccine were ready to begin. Unlike many other researchers of the time, Kendrick and Eldering refused to use orphans and other institutionalized children as part of the experiment. The first to be injected were the scientists themselves. Under an atmosphere of trust, parents rushed to have their children enrolled in the trials. A total of 5,815 children participated in the study. By 1937 it was proven that the vaccine was 90% effective with few side effects. In 1940, the vaccine was used all across Michigan. In 1943, it was approved by the American Academy of Pediatricians and the American Medical Association. By 1948 the rate of whooping cough infection had dropped to 51 cases per 100,000 with less than 1 death per year.

Today, whooping cough is largely in control across the world through prevention and vaccination but, even in the most developed nations, outbreaks still do occur. Worldwide, the WHO (World Health Organization) reports 16 million cases per year, 90% in poor and undeveloped nations. The resurgence in the United States is partly due to a trend of public anti-vaccination sentiment. In 2018 the CDC (Centers for Disease Control) reported 15,000 cases, mostly in infants. The DTP vaccination created by Eldering and Kendrick is still in use today, but begins to wear off after 10 to 20 years. A booster is recommended for teens and adults. Although the vaccine is given to infants, two more shots are required over time such that the child is not fully protected until age 5.

Much has changed in what is known about bacteria and viruses since 1932, bringing about the possibility of a new generation of vaccines. Scientists are working to develop better vaccines that will be more potent and provide lifelong immunity for whooping cough and a host of other diseases. It is useful to look back on the work of Kendrick and Eldering for inspiration as they overcame adversity to save millions of lives and paved the way for more women to pursue a career in science along the way.

About the Author

Mary Ferguson has been a volunteer at the PHM since 2016. She is a retired RN having worked in the community for over 40 years, much of that time as a Community Health Nurse. She is a graduate of Mt Auburn Hospital School of Nursing in Cambridge, MA and of University of New Hampshire. She is pursuing her many passions in retirement: writing, reading, history, sewing, hiking and nature as well as caring for her two grandchildren. She lives with her husband, dog and cat in Hollis, NH.

