

**INVESTMENT IN RESEARCH SAVES LIVES AND MONEY**

# Meningitis

Meningitis is inflammation or swelling of the protective membranes surrounding the brain and spinal cord, called meninges. Most cases of meningitis in the United States are caused by viruses, followed by bacteria, and, rarely, fungi.<sup>1</sup> Meningitis caused by viruses is serious but can often clear on its own and is often less severe than bacterial meningitis.<sup>2</sup> Bacterial meningitis is linked to several types of bacteria, including *S. pneumoniae* (pneumococcus), *N. meningitidis* (meningococcus), *H. influenzae* (Hib), and others.<sup>3</sup> Fungal meningitis is rare in the U.S. and can sometimes cause chronic meningitis.<sup>4</sup> Meningitis can also be caused by parasites, protozoa, and non-infectious means, such as cancer, certain medications, and head injuries.<sup>1</sup> Symptoms of meningitis can be hard to recognize in the early stages since some of them can mimic the flu (influenza), including headache and fever.<sup>1,5</sup> Vaccines are the most effective defense against certain types of bacterial meningitis and many are undergoing improvements to expand their effectiveness. Treatments for meningitis may include antivirals, antibiotics, or antifungals that must be administered as soon as possible.<sup>1,3</sup>

## TODAY

About **70%** of all bacterial meningitis cases occur in children aged 5 and under.<sup>6</sup>

In 2006, there were more than **72,000** meningitis-related hospitalizations in the U.S.<sup>7</sup>

Over **1.2 million** cases of bacterial meningitis are estimated to occur worldwide each year.<sup>8</sup>

## Research Delivers Solutions

While **Pneumococcal Conjugate Vaccines (PCVs)** have been effective against many types of infections caused by pneumococcal bacteria, studies have found that PCVs have had little impact in reducing pneumococcal meningitis cases, despite being caused by the same bacterial species. By reviewing articles published since 1930, researchers found that, even with the availability of PCVs, meningitis rates in children globally remain high. They found that the widespread use of vaccines has allowed the emergence of PCV-resistant strains of pneumococcus that cause meningitis. It is important to understand the effectiveness of vaccines and how to improve upon them for better disease coverage against multiple serogroups, or variations, of bacteria.<sup>10</sup>

Diagnosing meningitis quickly is necessary to begin treatment as soon as possible and improve a patient's prognosis. Researchers examined over 150 publications to determine whether or not **serum procalcitonin (S-PCT)** could be used as a tool to diagnose meningitis and distinguish between viral meningitis and bacterial meningitis. S-PCT is a biomarker often used to diagnosis sepsis, as its levels in the blood are significantly higher in bacterial, parasitic, or fungal infections compared to its levels in viral infections. Based on their findings, the researchers determined that S-PCT can help providers distinguish between bacterial and viral meningitis. This tool holds potential in fighting against the threat of antimicrobial resistance by confirming meningitis caused by microbes and reducing inappropriate prescription of antibiotics for viral meningitis.<sup>11</sup>

## COST

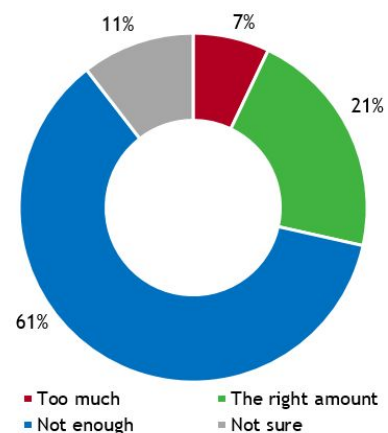
**\$1.2 billion:**

Total hospital cost for meningitis-related hospitalizations in 2006, where 43% of costs were for bacterial meningitis<sup>7</sup>

**\$36,891:**

Average inpatient expenditures for a patient hospitalized with meningitis<sup>9</sup>

The U.S. spends about 5 cents of each health dollar on research to prevent, cure and treat disease and disability. Do you think that this is too much, the right amount or not enough?



Source: A Research!America poll of U.S. adults conducted in partnership with Zogby Analytics in January 2020

# Meningitis

## Then. Now. Imagine.

### THEN

The first vaccine for *N. meningitidis* was licensed in the United States in 1974. This vaccine was only effective against serogroup C, one variation of *N. meningitidis*.<sup>12</sup>

### NOW

Research is focused on creating more effective vaccines that can protect against the multiple bacterial causes of meningitis and their serogroups.<sup>13</sup>

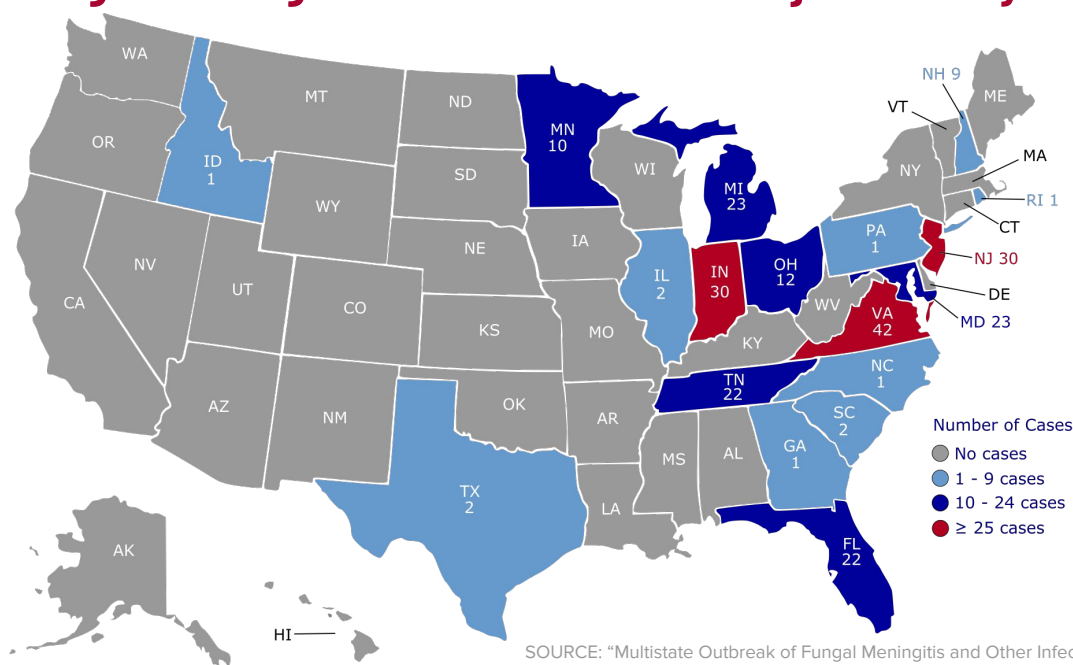
### IMAGINE

Eradication of meningitis through vaccine research.

## Defeating Meningitis by 2030

Many cases and deaths from meningitis are vaccine-preventable, but progress in defeating meningitis lags behind other vaccine-preventable diseases. In 2017, representatives from governments, global health organizations, public-health bodies, academia, the private sector, and civil societies called for a global vision to defeat meningitis. The World Health Organization (WHO) is leading a multi-organization partnership which has developed an initiative to defeat meningitis by 2030. The objectives of this public health challenge are: 1) eliminate meningitis epidemics, 2) reduce cases and deaths from vaccine-preventable meningitis, and 3) reduce disability and maximize quality of life for those affected by meningitis.<sup>14, 15</sup>

## Cases of Fungal Meningitis Linked to Steroid Injections by State, 2012\*



\*Though fungal meningitis remains rare in the United States, CDC data reflects a 2012 outbreak. These cases were tied to patients who received contaminated preservative-free steroid injections manufactured by a compounding center in MA.

1. "Meningitis." CDC. 2020.

2. "Viral Meningitis." CDC. 2019.

3. "Bacterial Meningitis." CDC. 2019.

4. "Fungal Meningitis." CDC. 2019.

5. "Meningitis." Mayo Clinic. 2019..

6. "Meningitis, Bacterial." NORD. N.d.

7. Holmquist et al. "Meningitis-Related Hospitalizations in the United States, 2006." Agency for Healthcare Research and Quality (US); 2006 Feb.

8. "Chapter 2: Epidemiology of Meningitis Caused by *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*." CDC. 2016.

9. Fulton et al. "Exploratory analysis of the potential for advanced diagnostic testing to reduce healthcare expenditures of patients hospitalized with meningitis or encephalitis." *PLOS One*. 2020.

10. Mukerji, R & Briles, DE. "New strategy is needed to prevent pneumococcal meningitis." *Pediatr Infect Dis J*. 2020.

11. Velissaris et al. "The role of procalcitonin in the diagnosis of meningitis: A literature review." *J Clin Med*. 2018;7(6):E148.

12. "Epidemiology and Prevention of Vaccine-Preventable Diseases - The Pink Book: Course Textbook - 13th Edition (2015)." CDC. 2019.

13. "Meningococcal Disease." CDC. 2019.

14. "Defeating Meningitis by 2030: A Global Roadmap." WHO. 2019.

15. "Defeating Meningitis by 2030." Meningitis Research Foundation. 2017.

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