

SICKLE CELL DISEASE

JUST THE FACTS

ABOUT

100,000

AMERICANS HAVE SICKLE CELL DISEASE¹

\$488 MILLION

ANNUAL COST OF HOSPITALIZATIONS DUE TO SCD-RELATED COMPLICATIONS²

\$1 BILLION

ANNUALLY IN DIRECT MEDICAL CARE COSTS ASSOCIATED WITH SCD³

SCD OCCURS IN

1 IN 365

AFRICAN AMERICAN BIRTHS¹

Nearly 20 Medicines Are in Development for Sickle Cell Disease, Including Gene Therapies

First described in 1910, sickle cell disease (SCD) is the most common inherited blood disorder in the United States.⁴ It is caused by a mutation in the gene that tells the body to make hemoglobin, which allows red blood cells to carry oxygen from the lungs to other parts of the body. Normally, red blood cells are flexible and round, allowing them to move easily through the blood vessels. But in SCD, the red blood cells are shaped like crescent moons or “sickles.” The irregularly shaped blood cells become rigid and sticky and can get stuck in the small blood vessels, causing slow or blocked blood flow and oxygen to parts of the body.

Symptoms of the disease include, anemia due to a shortage of red blood cells, chronic pain, periodic acute episodes of pain due to blocked blood flow, infections, swelling of the hands and feet, and delayed growth and vision problems. Pain is the most common manifestation of the disorder with 50 percent of adult patients reporting pain half of their days and 30 percent reporting pain most of the time.⁵ The disease is life-threatening, due to potential complications from blocked blood vessels, which can include stroke, difficulty breathing, pulmonary hypertension and other organ damage.

Sickle cell disease is considered a rare disease given it impacts fewer than 200,000 patients. SCD disproportionately impacts people of Black or African American descent with 1 in 13 babies born with the sickle cell trait and occurring in roughly 1 in 365 Black or African American births.¹ But nearly every ethnic population is affected, including those of Hispanic, South Asian, Southern European and Middle Eastern descent.

Life expectancy for people with SCD was just 14 years in the early 1970s.¹ But with improved screening and therapeutics, people with the disease typically live into adulthood, but still have a life expectancy that is about 30 years less than other people. Most people today with SCD are adults though the disease typically begins to manifest in children under one year of age.

“The NAACP applauds biopharmaceutical efforts to advance treatment of sickle cell disease, which disproportionately impacts African Americans. More effective therapies are urgently needed to improve health care, lifespan, productivity, and overall quality of life for those living with the disease. They too deserve a better chance to live life to the fullest.”

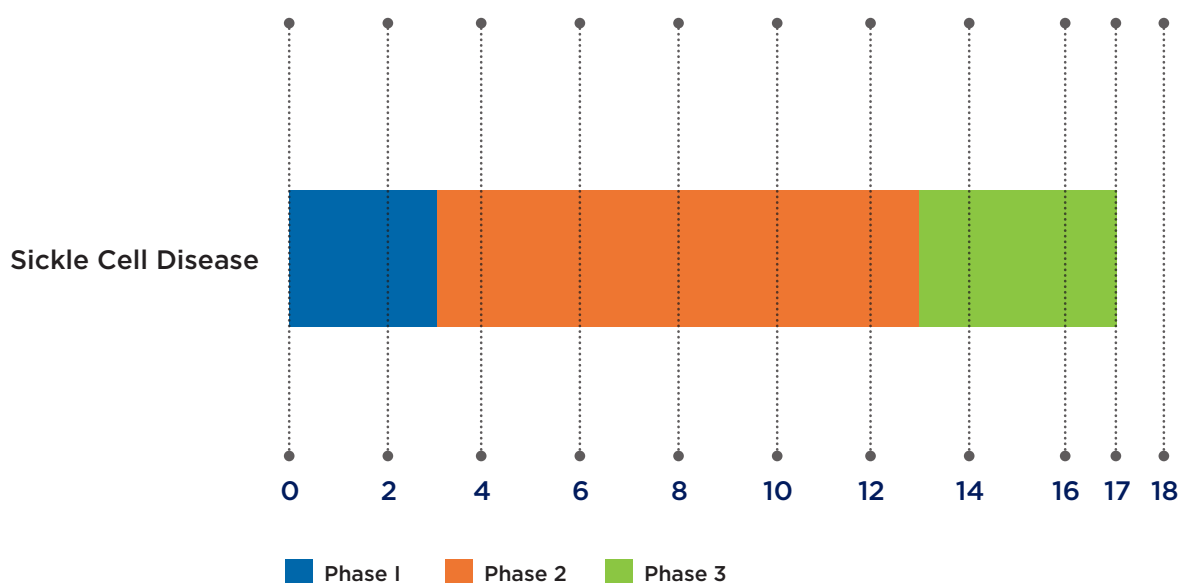
— Derrick Johnson, President and CEO, National Association for the Advancement of Colored People

Once diagnosed, the goal is to maintain health to prevent and manage disease complications, including chronic pain. Yet, more than 75 percent of adults with the disease and frequent pain crises do not receive the recommended treatment.⁵ And, children who do not receive the recommended treatment accumulate more than \$500,000 more in health care costs than those who do.⁵

At present, the only cure for SCD is a blood and bone marrow transplant, and most patients are unable to have the transplant due to age or lack of a well-matched genetic donor. Effective treatments can reduce symptoms and prolong life, but SCD is a life-long disease that requires regular medical care to control and prevent complications.

Approved treatments can improve the quality of life for sickle cell patients by reducing hospitalizations and acute disease crises (e.g., pain from blocked blood vessels). The U.S. Food and Drug Administration (FDA) approved in 2017, the first treatment in 20 years “to reduce acute complications.”⁶ In clinical trials, patients taking the investigational medicine experienced decreased hospitalization rates and 14.5 percent fewer instances of acute chest syndrome.⁶ Also in 2017, the FDA approved hydroxyurea for use in children with sickle cell disease. A recent study found that children who received a daily dose of hydroxyurea experienced less pain, fewer blood transfusions and were less likely to be hospitalized compared to children who did not receive hydroxyurea.⁶ The treatment is also associated with a 31 percent reduction in hospitalization costs.⁶

MEDICINES IN DEVELOPMENT FOR SICKLE CELL DISEASE



“Sickle cell disease is a life-threatening disorder that impacts 100,000 Americans and can manifest itself by causing chronic pain and other health complications. While there have been challenges to research in the past, with nearly 20 new treatments now in development that use innovative, cutting-edge technologies, the future is looking more promising than ever for people living with sickle cell and other genetic diseases. We are very optimistic about the potential to bring life-saving treatments to thousands of people across the country.”

— Julia Jenkins, Executive Director, EveryLife Foundation for Rare Diseases

New Discoveries Lead to Promising Research

It was just in the 1980s that scientists first began researching the potential of gene therapy to cure genetic disorders. Since then, new scientific breakthroughs and insights into treatments for SCD have led to emerging therapies and promising new techniques for treating the disease and its complications.

Today, despite significant research challenges, **17** new treatments⁷ are in development for SCD. All of the investigational medicines are in clinical trials or awaiting review by the FDA. The potential new medicines in development are exploring new ways to use established medicines and cutting-edge technologies such as RNA interference, gene-edited stem cell therapy and gene therapy. Examples of these exciting approaches include:

- An investigational potential one-time gene therapy is being researched to address the underlying genetic cause of SCD. The therapy uses stem cells from the patient and inserts a corrected gene using a lentivirus, before returning the cells to the patient.
- A gene-edited cell therapy that could potentially be a one-time treatment for SCD, uses zinc finger nucleases (ZFNs), which consists of a protein with a DNA-cutting enzyme, to modify a patient’s own hematopoietic stem cells to produce normal-shaped red blood cells containing increased fetal hemoglobin. Normally, levels of fetal hemoglobin begin to decline after birth, while levels of adult hemoglobin increase. Since, only adult hemoglobin contains the part of hemoglobin defective in patients with SCD, increasing fetal hemoglobin may be therapeutic for patients.
- An ex vivo gene-edited cell therapy uses a new technology called CRISPR (clustered regularly interspaced short palindromic repeats) to replace stem cells with those engineered to produce high levels of fetal hemoglobin in red blood cells, replacing the damaged hemoglobin. The increase in fetal hemoglobin has the potential to reduce or eliminate painful and debilitating sickle crises.
- An anti-P-selectin monoclonal antibody is being investigated for the prevention of vaso-occlusive crises (VOCs) in patients with SCD. The medicine binds to the P-selectin protein, a major driver of the vaso-occlusive process, on the surface of platelets and endothelial cells in the blood vessels. It inhibits interactions between endothelial cells, platelets, red blood cells, sickled red blood cells and leukocytes, preventing the cells from being able to bind to P-selectin.

Sources:

1. National Heart, Lung and Blood Institute, National Institutes of Health
2. Economic Impact of Sickle Cell Hospitalization, Blood, American Society of Hematology (2014)
3. Sickle Cell Disease Fact Sheet, Research America
4. NIH Medline Plus, National Institutes of Health (2011)
5. American Society of Hematology
6. U.S. Food and Drug Administration
7. Number of medicines obtained through government and industry sources, and the Springer “Adis Insight” database. Current as of **February 20, 2019**.

