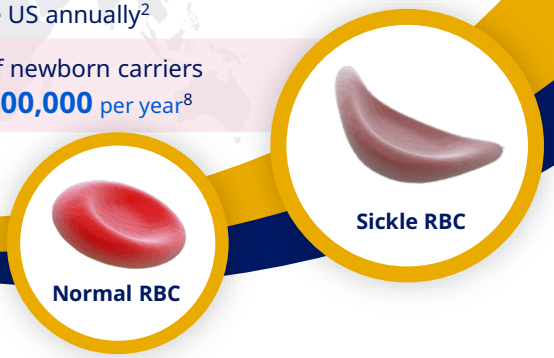
Identifying Unmet Needs in Sickle Cell Disease

» **Sickle Cell Disease (SCD)** is an **inherited blood disorder** which causes the red blood cells to become abnormally shaped like a sickle and get stuck inside the blood vessels, making it difficult to transport oxygen throughout the body.[1]

» SCD symptoms appear at ~6 months of age, with complexities differing across child and adulthood.[2-4]

Global footprint

- **~8 million** people affected globally with SCD[5]
- **100,000** in the US[6]
- Majority in sub-Saharan Africa, the Mediterranean basin, the Middle East, and India[7]
- **~2000** newborns in the US annually[2]
- by **2050** the number of newborn carriers is expected to grow to **400,000** per year[8]



Complications of SCD

SCD is mainly associated with *hemolytic anemia* and *painful vaso-occlusive crisis*, however, there is a spectrum of complications affecting individuals physically, physiologically, mentally, emotionally, and socially.[2-4]

Despite recent advances in treatment, most patients with SCD still suffer from lifelong disability, significant morbidity, reduced quality of life, and a life expectancy reduced by >20 years.[9]

VOCs & Organ Damage[1,3,4,7,10-12]

- Painful VOCs
- Chronic inflammation of vascular system
- Acute chest syndrome (pulmonary hypertension, chronic lung disease)
- Progressive organ failure and early mortality
- Long-term impairment from stroke
- Sensory and cognitive impairments
- Progressive retinopathy
- Impaired splenic function (increased infection risks)

Chronic Pain Management[13,14]

32% ED providers reported lack of awareness of NHLBI's guidelines for treating VOCs

Complex and multifactorial nature of pain

Difficult for patients to identify and describe properly to care providers

Neurological & Cognitive Complications[3,4,15]

- Impaired ability to function (mentally and physically)
- Poor quality of life outcomes
- Psychosocial and behavioral comorbidities
- Susceptibility to depression
- Higher healthcare utilization and cost
- Neuropathic pain

ED; emergency department; NHLBI, NHLBI, National Heart, Lung, and Blood Institute; RBC, red blood cell; SCD, sickle cell disease; VOCs, vaso-occlusive crises.

Reference: 1. Mayo Clinic. Sickle cell anemia. December, 2023; 2. Kanter J and Kruse-Jarres R. Blood Rev 2013;27:279-87; 3. Kato GJ et al. Nat Rev Dis Primers 2018;4:18010; 4. NASEM 2020: Addressing Sickle Cell Disease: A Strategic Plan and Blueprint for Action. Washington, DC: The National Academies Press; 5. NIH National Heart, Lung and Blood Institute. Sickle Cell Disease. Available at: Sickle Cell Disease - What Is Sickle Cell Disease? | NHLBI, NIH; 6. Data & Statistics on Sickle Cell Disease | CDC; 7. Piel FB et al. N Engl J Med 2017;376:1561–1573; 8. Mangla A, et al. Sickle Cell Anemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan; 9. AJMC. March 2023; 10. Swanson ME et al. Am J Prev Med. 2011;41:S390-S397; 11. Lanzkron S et al. Pub Health Rep. 2013;128:110-116; 12. DeBaun MR, Kirkham FJ. Blood. 2016;127:829-838; 13. NASEM 2020: Addressing Sickle Cell Disease: A Strategic Plan and Blueprint for Action. Washington, DC: The National Academies Press; 14. Challenges in Sickle Cell Disease Management (changeforscd.com); 15. Adam SS et al. Blood Adv. 2017;1:1983-1992.

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Medicine, research and the unmet needs thereof

Individuals with SCD often **face a multitude of challenges**, which can exacerbate the impact of the diseases

Delayed Diagnosis & Screening[1-3]

- Newborn screening is rare or lacking in many regions
- Mortality burden is highest in children
- Early diagnosis and comprehensive treatment significantly reduce mortality rates

Limited Access to Comprehensive Care[3-5]

Poor access to public health infrastructures in many regions (US, LMIC)

Improving access could save an estimated **10 million** people born between 2015 and 2050

Economic Burden[6,7]

$34 477	$1.7 million	$700 000
Average annual total medical costs	Lifetime burden of total medical costs	Lifetime income loss (estimated)

Disease management **costly** in lower-income countries

Crucial Transition of Care in Young Adults[8,9]

- Transition difficult in complex care needs
- Highly effective and generalized models of transition care do not yet exist
- Sharp increase in mortality in their **early 20s**
- **2X** more ER visits

Delayed Treatment[10]

54% SCD patients reported delays in receiving ED care on time

Low Awareness and Education[11]

73% Physicians believe that more education and support tools would help avoid complications in managing SCD

Healthcare Disparities[1,12]

- Medical bias, particularly among minority populations due to racial & social stigma
- ~50% Survive to 20 years in resource-poor countries

Very Limited Clinical Data on[13]

- General medical comorbidities impacting SCD patients
- Clinical outcomes beyond pain

Insufficient Funding and Policy Support[3,14,15]

Limited government and private funding for SCD research and treatment

Limited Combination & Precision Therapies[16,17]

- Limited efficacy of few approved disease-modifying treatments
- Combination therapies required for optimal outcomes

Approaching the burden of unmet needs in SCD

With the absence of evidence-based protocols for effective pain treatment in SCD, patient-centric research approaches are needed to develop the most effective therapies through:[18-20]

- Precision medicine and integrative health management
- Multimodal research agenda
- Subsequent portfolio of therapies
- Individualized approach to diagnosis and treatment

Psychosocial Support[14]

- Provide comprehensive support to psychosocial challenges (depression, anxiety, substance abuse)
- Integration of mental health into clinical care
- Community support groups and advocacy

The multimodal approach of treatment can be tailored to the individual needs of each patient, aiming to:

- **Reduce complications**
- **Manage symptoms**
- **Improve overall quality of life**

Ongoing research and advancements in innovative treatments augmented with AI hold promise for more effective management of SCD related complications – **ranging from VOCs to other medical, non-pain related crises.**[19,21]

AI, artificial intelligence; ED; emergency department; ER, emergency; LMIC, lower & middle income countries; SCD, sickle cell disease; VOCs, vaso-occlusive crises.

References: 1. Makani J et al. ScientificWorldJournal 2013;193252; 2. Quinn ZR et al. Blood, 2010;103:3447–52; 3. Thomson AM et al. Lancet Haematol, 2023;10: e585 - e599; 4. Piel FB et al. PLOS Med. 2013;10:e1001484; 5. Kato GJ et al. Nat Rev Dis Primers 2018;4:18010; 6. Johnson KM et al. Blood Adv. 2023;7(3):365-374; 7. Cannas G et al. Mediterr J Hematol Infect Dis. 2019 Jul 1;11(1):e2019042; 8. Formabridge - About us; 9. Boucher AA et al. JAMA Health Forum. 2023;4(5):e230877; 10. Challenges in Sickle Cell Disease Management (changeforscd.com); 11. ASH_Infographic_083016 2 copy (scdcoalition.org); 12. Challenges of Sickle Cell (sparksicklecellchange.com); 13. NASEM 2020: Addressing Sickle Cell Disease: A Strategic Plan and Blueprint for Action. Washington, DC: The National Academies Press; 14. Potential Opportunities for Improving Sickle Cell Care (sickle-cell.com); 15. Essien EA et al. Medicine (Baltimore). 2023;102(47):e36147; 16. Rai P et al. Hematology Am Soc Hematol Educ Program. 2023 (1): 519–531; 17. El Hoss et al. Hemasphere. 2022;6(9):e762; 18. Admiraal M et al. Eur J Haematol. 2023;111(3): 382-390; 19. Smith WR et al. Front. Pain Res. 2023;4:1279361; 20. NASEM 2020: Addressing Sickle Cell Disease: A Strategic Plan and Blueprint for Action. Washington, DC: The National Academies Press.; 21. Collado A, et al. HemaSphere. 2023;7(3):p e844.