

# **A PARENT HANDBOOK FOR SICKLE CELL DISEASE IN NIGERIA**



## **PART I 0 - 6 Years**

# Nigerian Team

Handbook adapted by:

Biobele Brown, FWACP, Senior Lecturer, Consultant Paediatrician, Head of Paediatric Sickle Cell Program, University College Hospital, University of Ibadan.

Adeyinka G. Falusi PhD, FAS, Professor of Haematology, Former Director, Institute for Advanced Medical Research & Training, University of Ibadan, President, Sickle Cell Hope Alive Foundation (SCHAF)

Paula Kienberger Jaudes, MD; Professor of Pediatrics, Global Health Initiative, University of Chicago, Visiting Professor, Institute for Advanced Medical Research and Training, University of Ibadan.

## Authors

Shellye Lessing, MS & Elliot Vichinsky, MD  
Editors  
Children’s Hospital – Oakland Sickle Cell Center

Shelley Mann, MPH, Marna Copeland-Taylor, MPH & Joy DuVaul, MA  
Education Programs Associates

Kathleen Velazquez, MPH & Sylvia Campbell, GPP  
California Department of Public Health, Genetic Disease Screening Program

**Children’s Hospital—Oakland Sickle Cell Centre**

Ann Earles, RN, PNP	Coordinator, Clinical Studies
Marsha Gad, PhD	Psychologist
Deborah Hurst, MD	Associate Director, Sickle Cell Program
Klara Kleman, MT, MS	Supervisor, Hemoglobinopathy Laboratory
Shellye Lessing, MS	Genetic Counselor
Susan Fortune Pinheiro, MS	Genetic Counselor
Joseph Telfair, MSW, MPH	Social Worker
Elliot Vichinsky, MD	Director, Sickle Cell Program

**Design and Illustration**

Wendy Hoag  
Susan Stasi and Jim Campbell  
Dayo Adepoju

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# Foreword

The greatest burden of sickle cell disorder worldwide occurs in Nigeria due to our large population as well as the inheritance of the most problematic type of the disorder. The sickle cell disorder is a lifelong condition and there is yet no cure. The care of the affected cannot be overcome only by the medical segment of society thus a multidisciplinary public health approach to care is essential.

These two Parent Handbooks on Sickle Cell Disease (SCD) on children age 0-6, and 6-18 years will save thousands of children's lives in Africa. During my childhood days, I have seen many children both within and outside my locality that may have had SCD but I did not know the diagnosis then. They had all the physical characteristics of SCD but we called them "ABIKU" literally translating to "BORN TO DIE". We held them with awe. They repeatedly fell ill, had bone pains, yellow eyes, swollen abdomen and had stunted growth. Sadly, these manifestations and experiences often plunge parents into various degree of emotional turmoil and sometimes, it could spark off a marital disharmony among parents. All manifestations were then attributed to their association with their 'spiritual world'.

Over the years in my medical career, I have seen so many children come into the hospital at death's door because their family did not know how to care for their child with Sickle Cell Disease. No more now! Investments in educational materials by parents or guardians, along with improved medical care, can amazingly reduce morbidity and mortality rates of these children.

This handbook is unique in a number of ways; first is its response to the clarion call by the community on the University of Ibadan to provide a leadership role in the care of those affected by this disorder with its enormous experience in tertiary education and research in Nigeria. There is also the need to fill the gap of a platform for those affected who constantly yearn for excellent care. This handbook will also serve the much needed multidisciplinary approach to the management of this disorder as parents will be much more involved with the care of their affected wards.

I am very grateful to my colleagues at the University of Ibadan, Dr. Biobele Brown and Professor Adeyinka Falusi, as well as Professor Paula Jaudes from the University of Chicago, who adapted the American handbooks to suit our settings in Africa in general and Nigeria in particular. These handbooks represent a giant step forward in providing education for millions of families and health care providers all over Africa. The University of Ibadan proudly counts this achievement as the first university in the continent to provide Parent Handbooks on Sickle Cell Disease on our website free for downloads or for viewing online. This effort is one of the core dividends of a virile academia to her community. This is a worthy contribution to global efforts and commitments to eradicating this needless suffering and death of children with Sickle Cell Disease and the heartbreak of their families in our communities!

Home care by parents or caregivers plays a vital role in the well being of affected persons. By adapting this handbook to meet the needs of Nigerians, the authors have filled a major gap in the care of children and adults with sickle cell disorders in Nigeria and other tropical countries in the Sub-Saharan region of Africa. In a unique fashion, the authors have focused on common problems in individuals with sickle cell disease and appropriate steps to be taken by parents. In addition, questions frequently asked by the public about sickle cell disease (SCD) are raised and

appropriate answers provided. The simple language in which this book is written makes it easily understandable by the lay public. In addition to being of immense value to parents of children with sickle cell disorders, it will be of great value to the affected children, their caregivers and the lay public. The guidelines for the management of SCD outlined in this hand book will also be of tremendous value to medical students, doctors, nurses and other professionals who have to care for those affected.

The Parent Handbooks presented here, and also available in printed form, will serve to advance the world’s largest and most important promise to our children as we aim to achieve the Millennium Development Goals, specifically Goal 4, which is to reduce child mortality by two-thirds by 2015.

May these handbooks enlighten all who care for children with Sickle Cell Disease.

Professor Isaac F. Adewole, MB; BS, FMCOG, FWACS, HFESN, FAS  
Vice-Chancellor  
University of Ibadan  
Ibadan, Nigeria

# Preface

Nigeria has the largest endemic population of adults and children with Sickle Cell Disease/Disorder (SCD) in the world. A quarter of all Nigerians have the Sickle Cell trait and approximately 150,000 children are born each year with the disorder (World Health Organization, 2006). Sadly, over 100,000 children die each year from SCD. Eight percent of child mortality in Nigeria occurs because children under 5 years old die from Sickle Cell Disorder. One of the reasons that these children succumb is the lack of educational material for parents instructing them on how to manage their child's Sickle Cell Disease (Disorder). We believe this Parent Handbook, which we have adapted for Nigerian families, will help children with Sickle Cell Disorders live healthy and productive lives.

If you have a child with sickle cell disease who is 6 years of age or younger, this handbook is for you! This handbook is the first part of a series for parents of children with sickle cell disease. Part II focuses on older children and teens.

By using this handbook and working together with your child's health care provider, you can make sure that your child gets the best care. If you have a special concern, use the Table of Contents to find the chapter that covers this concern. For example, if your 5 year-old child is having a problem with gallstones, you will find that Chapter 5 covers health concerns for young children. Or, if you want to know more about childcare, you will find it covered in Chapter 7. Once you find the right chapter, go through the pages until you find your concern.

We hope that you will share this textbook with others who are close to you. This can help them learn more about sickle cell disease. Relatives, friends, teachers and your family physician may have questions that this handbook can answer. The more they know, the more they can help you and your child. You don't have to manage all by yourself.

**Note:** In some of the chapters in this book, your child will be referred to as male. In others, your child will be referred to as female. **ALL** of the information applies to both girls and boys unless it is clearly stated.

# Acknowledgements

First, we would like to thank the Vice Chancellor of the University of Ibadan, **Professor I. F. Adewole** for his immense support for this programme. Special recognition goes to a visionary **Professor O. O. Akinyinka**, Provost, College of Medicine, University of Ibadan. **Professor Adesola Ogunniyi**, Director Institute of Advanced Medical Research and Training (IMRAT), deserves commendation for hosting the programme.

We would like to thank the authors and the staff at **Children’s Hospital, Oakland Sickle Cell Center in California, USA**, for writing an informative handbook. Their outstanding program and team leads the United States in the care of children with Sickle Cell Disease. We appreciate all their hard work and sage advice. Thank you from all of us in Nigeria.

A special thank you to the California Department of Public Health Services, especially to **Fred Lorey**, PhD, and the Genetics Screening Program for giving permission to adapt the Parent Handbooks for Nigerian Families.

**Olufunmilayo I. Olopade, MD** Walter L Palmer Distinguished Professor of Medicine, Director, Center for Clinical Cancer Genetics, Associate Dean for Global Health, University of Chicago; **Christopher Olusola Olopade, MD, MPH, F.A.C.P., F.C.C.P.**, Professor of Medicine Clinical Director, Global Health Initiative, University of Chicago; and **Rebecca Incledon**, Global Health Initiative Senior Program Coordinator, University of Chicago, have given continued support to actualize the effort. **The University of Chicago** and **La Rabida Children’s Hospital** in Chicago have been extremely supportive.

**Healthy Life for All Foundation**, an NGO at the University College Hospital/University of Ibadan, helped with all the logistics and resources. **Dayo Adepoju**, was exceedingly helpful with technical aspects and **Titilayo Babatunde** updated parents’ support groups for Nigeria.

The Information Technology Unit at the College of Medicine led by **Abiodun Alao** and **Babatunde Ayinla** have performed creditably.

We are grateful to **Dr. J. O. Olaniyi**, a Haematologist at the University of Ibadan and **Semtendu Akindele** at Institute of Advanced Medical Research and Training (IMRAT) for their assistance.

This handbook anchored at the University of Ibadan will be of invaluable benefit to Caregivers (Parents, Medical team, Teachers etc.) in the Nigerian community for improved care of Sickle Cell Patients.

Our appreciation goes to all who have in one way or the other helped to bring this Parent Handbook to fruition.

**Biobele Brown**, FWACP  
**Adeyinka G. Falusi**, PhD  
**Paula Kienberger Jaudes**, MD

# Note to Health Care Providers

This handbook was developed in response to requests from parents of children with sickle cell disease for more detailed information that they could refer back to as needed. The parents' role in early identification of infection and other problems is difficult yet so critical to the health of their child, particularly during the first few years of life. It was hoped that the document would assist in empowering parents to assume this role as partners in the delivery of health care to their child. It was also hoped that the handbook would be useful for parents to share with their primary care provider and emergency room staff unfamiliar with the treatment of sickle cell disease.

The role that parents are being asked to play in the treatment of sickle cell disease has become very complex, particularly with statewide newborn screening and prophylactic penicillin treatment. This handbook is one method that can be very useful to providers in teaching this important information to parents. The intent was not for parents to sit down at one session and read the document, but rather for health care providers to utilize it as a teaching tool at visits. Parents should be encouraged to keep the booklet and write down their notes and questions in it. The various sections could be reviewed as appropriate at different visits. Also, the parents could use the guide to look up terms and explanations given at clinic visits that they either did not understand, or needed to review.

Parents of children with sickle cell disease were involved in the development of this booklet from the very early stages. The formal field test with consumers consisted of asking for feedback on the readers' understanding of the material, usefulness, quantity of information, usability as a reference tool, completeness, message of graphics, cultural sensitivity and overall appeal of handbook. Field testing was done both with individuals and focus groups. Approximately thirty families throughout California participated in the formal field testing process.

Reading level was an important issue to us from the onset and testing was done throughout the process of developing this booklet. We never set out to develop an easy-to-read pamphlet; however, we did want the handbook to be at a reading level suitable to as many adult readers as possible without compromising the original purpose. The final version of the handbook is at a ninth grade reading level using the Fry test. It varies from section to section but most of the document ranges from eighth to tenth grade.

We realize that this reading level is high. However, when the document is used as intended in conjunction with clinic visits, with specific information being highlighted by the staff, the document has been useful to people with varied levels of reading skills. Furthermore, the format of the booklet, such as size of margins, use of graphics to reinforce messages and the amount of empty space on each page, all contribute to making the document more readable and appealing overall. The feedback from parents has been very positive.

Another consideration in use of the booklet is time of its introduction. We do not recommend giving it out to all parents of infants with sickle cell disease at their first visit. Only when parents seem ready for more information should they be given the handbook.

Shellye Lessing, MS and Elliot Vichinsky, MD  
Editors  
Children's Hospital - Oakland Sickle Cell Center

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## *Basic Questions*

This section provides answers to many of the first questions asked by parents of children with sickle cell disease.

These questions include:

- **What is sickle cell disease?**
- **What problems are caused by sickle cell disease?**
- **How serious is sickle cell disease?**
- **What causes sickle cell disease?**
- **How can I help my child with sickle cell disease?**

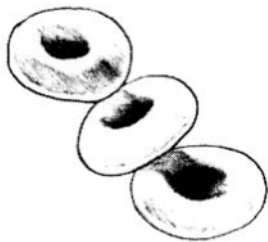
The answers to these questions and the suggestions in this handbook will help you give your child the best start. With good medical care and home care, most children with sickle cell disease can grow up to lead full and productive lives.

# What is Sickle Cell Disease?

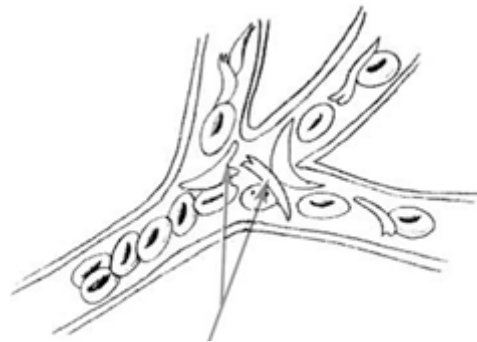
Sickle cell disease is a disease that affects a special protein inside our red blood cells called haemoglobin. Red blood cells have an important job. They pick up oxygen from the lungs and take it to every part of the body. It is the haemoglobin in these red blood cells that carry the oxygen to different parts of the body.

A person with sickle cell disease makes a different kind of haemoglobin called haemoglobin S. This haemoglobin S causes the red blood cells to change their shape. Instead of being smooth and round, the cells become hard and sticky. Their shape looks like a banana or like a sickle, a hand tool used to cut wheat or tall grass. It is this sickle shape of the red blood cells that gives “sickle cell” disease its name.

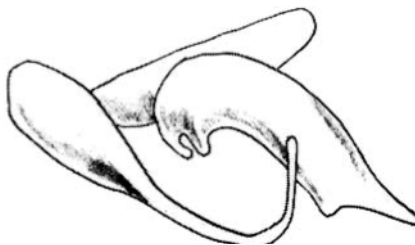
The hard, sticky sickle red blood cells have trouble moving through small blood vessels. Sometimes they clog up these blood vessels and cause other changes so that blood can't bring oxygen to the tissues. This can cause pain or damage to these areas.



*Normal red blood cells*



*Hard, sticky sickle cells clogging up a small blood vessel*



*Sickle red blood cell*

### Types of Sickle Cell Disease

There are many different types of sickle cell disease. The most common types are: sickle cell anaemia (SS disease) and sickle C disease (SC disease). sickle beta ( $\beta$ ) thalassaemia disease (S  $\beta$  thal disease) and sickle cell alpha ( $\alpha$ ) thalassaemia disease (S  $\alpha$  thal disease) are other types but are less common.

There are many rare combinations of sickle haemoglobin with other types of haemoglobin. Some are as serious as sickle cell anaemia. Some types of sickle cell disease cause fewer problems than others

# What problems are caused by Sickle Cell Disease?

Sickle cell disease can cause many kinds of problems. Some of the most common problems are:

- Infections
- Pain
- Anaemia (low blood)
- Damage to the body organs

Not everyone who has sickle cell disease will have all of these problems. In fact, many people with sickle cell disease feel well most of the time. However, most people with sickle cell disease will have to deal with these problems during their lives.

### Infections

One of the most serious problems that people with sickle cell disease have is infections. Infections, like pneumonia, pose a special problem for infants and small children who can get very sick or even die if they don't get prompt treatment. These infections are caused by problems with the spleen, a large organ in the body that removes damaged red cells and helps fight infections. The sticky sickle cells will clog the spleen so it can't do its job. This leaves the body open to infections.

Thankfully, we can prevent many of the sickle cell infections by giving young children penicillin every day until they are at least five years old, or as recommended by the National Institute of Health (NIH) Consensus Development Conference. There are also many ways to treat infections, especially if they are found quickly. Later sections of this book describe ways to prevent and treat these deadly infections.

### Pain

The hard, sticky sickle red blood cells can sometimes cause pain. The shape of these cells makes it hard for them to get through tiny blood vessels. The sickle cells can cause changes in the blood that block the blood vessel. This cuts off the blood supply to nearby tissues so that no cells can get through to bring oxygen. Without oxygen, the area starts to hurt. This is the source of the pain that comes from sickle cell disease. Some sickle cell pain can be very strong and needs to be treated in the hospital. Most pain is milder and can be handled at home. There are many ways to treat the pain to make your child feel better. This pain is sometimes called a "crisis". In fact, most sickle cell pain is not a crisis. Later sections of this book will describe ways to help you deal with this pain.



*Playing like other children*

### **Anaemia (low blood)**

Besides causing pain, something else happens because of the shape of the sickle cells. These cells are pulled out of the blood by the spleen and broken down faster than regular red blood cells (17 – 30 days). Regular blood cells live for 120 days before broken down. The body can't make enough new red blood cells to replace the old ones. This decreases the number of red blood cells and the amount of haemoglobin in the body. This "low blood count" is called anaemia. If the anaemia becomes severe, your child may need to be given a blood transfusion to prevent heart failure and other problems.

### **Damage to the body organs**

Over many years, lack of oxygen due to clogged blood vessels can lead to tissue damage. This damage can happen to any organ.

While not all tissue damage can be prevented, some of it can. With early treatment and good self care, people with sickle cell disease can lessen the damage to their bodies.

### **Most children and adults with sickle cell disease can lead full lives**

Not everyone with sickle cell disease will have all of these problems. Many have very few problems and may go years without pain or hospital care. Only a few have a lot of pain or need to go to the hospital often.

For the most part, children and adults with sickle cell disease can lead lives like other people. While they may miss school or work or go to the doctor or hospital more often than others, their lives can still be full and happy.

# How Serious is Sickle Cell Disease?

Sickle cell disease is a chronic disease. The problems it causes can be treated. For some people with sickle cell disease, a bone marrow transplant can cure the disease. People with sickle cell disease can live well into middle and late adulthood. With penicillin and medication to prevent malaria infections and treatments, today's children with sickle cell disease are living longer than ever before.

Sickle cell disease affects different people in different ways. No one can know how serious the disease will be for your child. But we do know that three things can make a difference:

- The type of sickle cell disease.
- The kind of care a person gets.
- How the person and the people around him deal with the disease.

### The type of sickle cell disease

There are many different types of sickle cell disease/disorders. The two most common types are sickle cell anaemia (SS disease) and sickle "C" disease (SC disease). Sickle  $\beta$  thalassaemia disease (S  $\beta$  zero thalassaemia disease or S  $\beta$  plus thalassaemia) is another type, but it is less common. The most severe is SS disease, followed by SC disease and then Sickle  $\beta$  thalassaemia.

### The kind of care a person gets

Poor medical care and home care can make a chronic disease like sickle cell much more serious. For example, if a fever is not treated early, a child can become very sick. On the other hand, getting the best medical and home care can help a person live longer and better. Good medical care includes frequent visits to a doctor who has experience with sickle cell disease. It can also mean getting help from other health care providers, like social workers, counselors and physical therapists.



*Getting good medical care*

Good home care includes many things, from giving young children penicillin twice a day, anti-malarial medication once a day; to having them drink lots of fluids. Children with sickle cell disease also need to have good nutrition and a balanced diet. They need plenty of rest and sleep and to dress warmly when it is cold. Since we spend much of our time at home this care can often have a big impact.

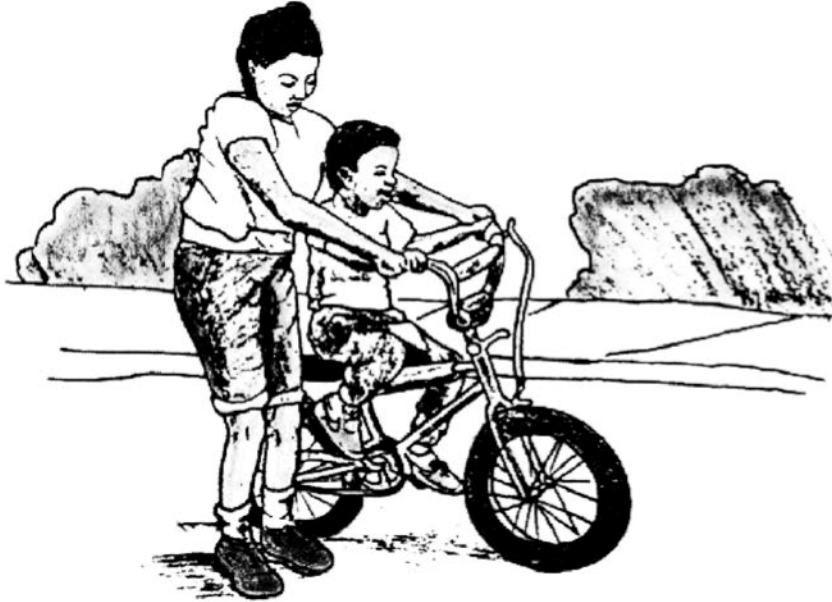
## Chapter 1: Basic Questions

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### How the person and the people around him deal with the disease

While people with sickle cell disease share common experiences, the way they deal with them can be very different. For example, when it comes to pain, some children are able to deal with it as if it is a part of their everyday life. Other children may have the same amount of pain, but have a tougher time handling it.

People can learn to handle these experiences better, and families can react in ways which help their child. If a person with sickle cell disease learns positive ways of dealing with his problems, the disease will often feel less serious.



*Living with sickle cell disease*

# What Causes Sickle Cell Disease?

### **Sickle cell disease is inherited**

Sickle cell disease is an inherited disease. An inherited disease is one which is passed from parent to their children through their genes.

Genes are our body's map for development. We have pairs of genes, for the color of our eyes, for our height, for our blood type and for each of our other features, including our haemoglobin type. The most common haemoglobin type is AA (A is the usual adult haemoglobin). Haemoglobin type and blood type are not the same. Everyone has both a haemoglobin type and a blood type.

### **A baby gets one haemoglobin gene from each parent**

To make up our pair of haemoglobin genes, we get one gene from our father and one gene from our mother. Each of our parents has two genes for haemoglobin, but they pass only one of these genes on to each child. Which gene is passed on is a matter of chance, like having a boy or a girl or tossing a coin and getting heads or tails.

To inherit sickle cell disease, a child must get the sickle (S) gene from one parent and a sickle (S), C,  $\beta$  thalassaemia or another gene that is not A from the other parent. If a baby inherits at least one haemoglobin A gene, he won't get sickle cell disease.

### **Both parents have a haemoglobin trait**

Someone who has one gene for haemoglobin A and one gene for a different type of haemoglobin has a haemoglobin trait. This trait could be AS (sickle cell trait), AC (C trait) or A $\beta$  (beta thalassaemia trait). In addition there are other less common traits. The trait is not harmful.

### **A trait is not a disease**

People with a haemoglobin trait are healthy. They do not have a mild case of the disease. They do not have a "trace" of the disease. A trait does not cause health problems. If a man and a woman both have haemoglobin trait, some of their children may be born with sickle cell disease.

### **How to find out about your haemoglobin genes**

The only way to know for certain what type of haemoglobin you have is to have a special blood test called haemoglobin electrophoresis with a full blood count (FBC). Many families carry genes to make other types of haemoglobin besides haemoglobin A without knowing it. Your doctor or sickle cell centre can order this test for you.



Chances of Having a Baby with Sickel Cell Disease

Both parents have sickle cell trait

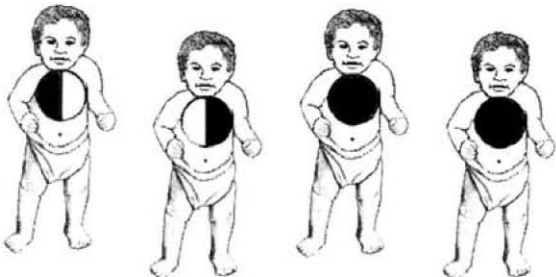
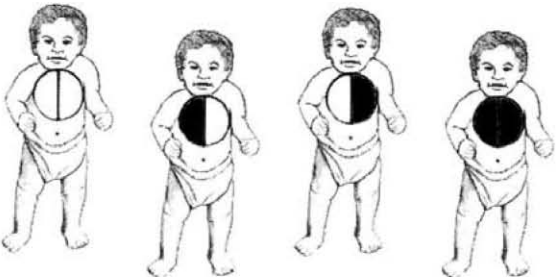
One parent has sickle cell disease and one parent has sickle cell trait

Sickle Cell Trait (AS)

Sickle Cell Trait (AS)

Sickle Cell Disease (SS)

Sickle Cell Trait (AS)



No Trait (AA)    Sickle Cell Trait (AS)    Sickle Cell Trait (AS)    Sickle Cell Disease (SS)

Sickle Cell Trait (AS)    Sickle Cell Trait (AS)    Sickle Cell Disease (SS)    Sickle Cell Disease (SS)

When both parents have sickle cell trait, they have a 25% chance (1 out of 4) of having a baby with sickle cell disease. Each time they get pregnant, they have the same chance.

When one parent has sickle cell disease and the other has a trait, they have a 50% chance (or 1 out of 2) of having a baby with sickle cell disease. Each time they get pregnant, they have the same chance.

A 25% or 1 out of 4 chance does not mean that if you have 4 children, 1 will have the disease. You have the same 25% chance with each baby.

## Chapter 1: Basic Questions

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### How many people have sickle cell trait?

In Nigeria, 1 out of 4 persons has sickle cell trait. Sickle cell trait is also found in other ethnic groups, such as African Americans, Ghanaians, Greeks, Yugoslavians, Western Asians, Turks, Southern Iranians, Asiatic Indians, Mexicans, Puerto Ricans, Cubans, Spaniards, and American Indians. Although sickle cell trait is more common in some groups of people, anyone could be a carrier of sickle cell trait.

### How many people have the sickle cell disease?

Nigeria has the largest population of adults and children with sickle cell disease in the world. Sickle cell disease affects about two to three out of every 100 Nigeria babes. Approximately 150,000 children are born each year with sickle cell disease.



*Approximately 150,000 children are born with sickle cell disease each year.*

# How can I Help my Child with Sickle Cell Disease?

There are many things you can do to help your child manage his disease. While you can't get rid of the disease, you can help your child get sick less often and feel better. You can also help your child learn how to live with the disease so that he can make the most of his life.

Here are some of the important things you can do.

### Get the best medical care

- Find a doctor for your child who is experienced in sickle cell disease. Take your child for well child exams as often as the doctor orders.
- Make sure your child gets all his baby shots (immunizations) on time.
- Help the doctor give your child the best care. Answer his or her questions fully and ask any questions you have about what to do for your child.
- Learn as much as you can about the disease. The more you know, the better care you will be able to give your child.
- Buy a thermometer for taking temperature at home.
- Buy Oral Rehydration Salts (ORS) to prepare the solution at home.

### Take good care of your child at home

- Give your child penicillin twice a day, until at least age five. Don't stop until your doctor tells you to stop.
- Give your child anti-malarial drug daily (Proguanil).
- Give your child lots of fluids to drink when he is sick, in pain, very active or taking a trip and when it's hot outside. The rest of the time, just make sure your child gets fluids to drink whenever he is thirsty.
- Call the doctor/nurse right away if your child has a fever of 37.5°C or higher. Check your child's temperature when you think he might be sick.
- Help your child handle any pain he has from the disease. Try more fluids, quiet play, warm baths, heating pads or warm towels, massage and or acetaminophen (Paracetamol, Tylenol). If these home remedies don't ease the pain, then call the doctor.

## Chapter 1: Basic Questions

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### Get help for your child when it's needed

Read the list of danger signs on page 40. There is a copy of these signs in Appendix A for you to hang on your wall or refrigerator. Put it up in a place you can find when something is wrong with your child. Check the list to see what you should do. If your child should be seen right away, call your doctor or nurse first so they can tell you where to take him.

You know your child better than anyone else. If you think something might be wrong, call your doctor or nurse. They will help you decide what to do.

### Take care of yourself and your family

Having a child with sickle cell disease is not easy. The disease affects the whole family. Help those who are close to your child learn about the disease. Let them read this book or talk to them about what you've learned. When they know more, they can help both you and your child.

You can also get support from family and friends. Let them know how they can help you. You might need someone to listen to you or someone to watch your other children. Think about what you need and ask for it.

Other parents who have children with sickle cell disease can give you a special kind of support. Find out if there is a parent support group (Sickle Cell club/association) near you and join it.

If things get to be too much for you, get help. Talk to your doctor, family, Pastor, Muslim cleric, or a social worker. You are not alone. Make sure that you get what you need to give your child the best care.

### Read this handbook

The rest of this book will describe these things in much more detail. We hope that you will use this book to learn how to best help your child live with the sickle cell disease. Together with your child's health care team, you can help your child live the fullest life.



*Getting support from others*

## Chapter 2

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# *Routine Medical Care for your Child*

Regular check-ups are a must for all children with sickle cell disease. At these visits, the doctor will check your child's growth and development. Your doctor will also check to see if your child is having any health problems.

In this chapter, you will learn about the following areas:

- **Where to go for care**
- **Well child exams**
- **Baby shots**
- **Common lab tests**
- **Questions to answer**
- **Information to share**
- **Learning from your medical team**

Different centres and doctors may use other approaches to treating these problems. Follow your doctor's advice.

### Where to Go for Care

Your child can get basic medical care from a pediatrician or family physician. Depending on where you live, a combination of these may work out best.

#### Paediatrician or family physician

Your family physician or paediatrician can provide most of the care your child will need. This includes well-baby care, routine shots (immunizations) and treatment for some illnesses. Your family physician will refer you to a sickle cell centre or a haematologist for special care. These specialists will work together with your family physician to make sure your child gets the care she needs.

#### Sickle cell centre/clinic

In some places, there are special centres that have a team of experts trained in sickle cell disease. These centres do most of the research on sickle cell disease. They also train other doctors and health care professionals.

The health care team at sickle cell centres includes a paediatrician and other doctors who can provide both routine medical care and special care related to sickle cell disease. Besides doctors, this team may also include public health nurse, nurses, genetic counselors, social workers, psychologists and others who can help you and your child.

#### Getting a complete evaluation

To help your family physician give your child the best care, we suggest that your child start with a complete evaluation at the nearest sickle cell centre. The medical team at the sickle cell centre will share the results of this evaluation with you and your family doctor. The sickle cell centre will also let you know how often they think your child should come back to the centre to keep track of how she is doing.



*Taking your child to a sickle cell centre for a complete evaluation*

## Well Child Exams

During the first five years of life, your child will have many checkups. From birth to six months old, your child should be checked once a month and you and your family should learn about sickle cell disease. Between six months of age and one year, your baby should go to the doctor every two months. After one year, visits should be set up for every three to four months until your child is five. If your child is sick, she will need to be seen more often.

<u>How often your child should see a doctor</u>	
Age	How often
Birth - 6 months	every month
6 months to 1 year	every 2 months
1 year to 5 years	every 3 – 4 months

At these doctor visits, the medical staff will check your child’s:

- 1. Temperature
- 2. Heart rate and breathing rate
- 3. Height and weight
- 4. Blood pressure (when she is old enough)
- 5. Head size

Next, the doctor will check your child’s:

- 1. Eyes, ears, mouth and throat
- 2. Soft spot on the head (until one year of age)
- 3. Neck
- 4. Heart and lungs
- 5. Abdomen
- 6. Spleen size
- 7. Skin
- 8. Penis and scrotum or vaginal area
- 9. Joints
- 10. Back

You should have your questions written down or ask questions you may think of at these visits. Do not be afraid to ask any questions, your doctor is there to help you understand your child’s illness.

Baby Shots (Immunizations)

“Baby shots” are a very important way to protect your child’s health. Because children with sickle cell disease get more infections than other children, they need these shots even more. Your child will get the same baby shots that other children get. Plus, she will get some other shots to help her fight infections.

Here is a list of the shots your baby will get and why they are given.

Regular Baby Shots (immunizations)		
Shots	Protects Against	Age Given
BCG	Tuberculosis	Birth
DTP	Diphtheria, Tetanus (lockjaw), Pertussis (whooping cough)	6 weeks, 10 weeks, 14 weeks, 15-18 months, 4 – 6 years
OPV	Polio	Birth, 6 weeks, 10 weeks, 14 weeks, 15-18 months, 4 – 6 years
Measles	Measles,	9 months, 4 - 6 years
H-flu Vaccine (HIB)	Meningitis	6 weeks, 10 weeks, 14 weeks, 15-18 months
Hepatitis B Vaccine	Hepatitis (liver infection)	Birth, 6 weeks, 14 weeks.
Extra shots for children with sickle cell disease		
Pneumococcal Vaccines  *PCV10  Pneumovax (PPV23)	Some pneumonias and blood infections	2-6 months (3 doses, 6-8 weeks apart); 12-16 months  24 months (6-8 weeks after last PCV 10), 3-5 years after 1st PPV23 dose
**Meningococcal Vaccine	Meningitis	2 years, 5 years
Hepatitis A Vaccine	Hepatitis (liver infection)	After 12 months (2 doses 6-12 months apart)

(New vaccines are developed occasionally and the exact vaccine your child receives may not be on this list. New vaccines will be explained by your doctor.)

\* Pneumococcal schedule depends on age started.

\*\*Northern Nigeria



# Common Lab Tests

When your child goes to the doctor, she may be sent to the lab for blood or urine tests. For a blood test, they will take some blood from her finger or arm with a tiny needle. This may hurt like a little pinch. It is important to tell your child that taking blood is not the same as a shot, and it won't hurt afterwards. If a urine sample is needed, the nurse will explain how to get it. These are some of the most common tests:

### Haemoglobin electrophoresis

This is the test which is used to find out a person's haemoglobin type. It is this test which tells you what type of sickle cell disease your child has. This test is also done when it is important to know how much sickle haemoglobin is in your child's blood. Before a blood transfusion, doctors use the test to help decide how much blood should be given. After a transfusion, the test is used to see if enough blood was given to lower the amount of sickle haemoglobin and prevent complications from sickling.

### Full Blood Count (FBC)

The most common blood test is the full blood count (FBC). It is mainly done to find out the number, shape and size of the red blood cells and the haemoglobin level. This information is used to tell if any treatment is needed. The normal haemoglobin level in children without sickle cell disease is 11 – 14. Children with sickle cell disease usually have a lower haemoglobin level of 6 - 10. This varies with the type of sickle cell disease. If your child's haemoglobin level is less than 5 or 6 g/dl, she may need to be given blood or go to the hospital to be observed. The Packed Cell Value (PCV) is often used as an approximation level of haemoglobin amount. In children with SS anaemia, the PCV is 18 – 30%. If the PCV level is < 15%, the child may need to be given blood or taken to the hospital.

### Reticulocyte (Retic) count

Reticulocytes are young red blood cells. The number of these cells shows whether the bone marrow is doing its job well, making and releasing young red cells into the blood.

### Kidney and liver function tests

These tests show if these organs have been damaged by sickle cell disease. In young children, damage is rare. However, over time, the sickle cells can plug up the small blood vessels of these organs so that they can become damaged.

### Urine test (urinalysis)

In sickle cell disease, children can get kidney or urinary tract infections. Urine is checked under a microscope for signs of infection. Red blood cells in the urine can be a sign of slight bleeding from the kidney. A lot of protein in the urine can mean kidney damage, but a small amount doesn't usually matter.

### Blood Chemistry Tests

These tests measure substances in the blood which are important for health and growth, such as iron, glucose (sugar), and minerals.

### X-Rays

X-Rays are used to see if there is an infection in the lungs and to look at bones which may be damaged by sickle cell disease.

### Learning from Your Medical Team

An important part of every visit is to get answers to questions that you have. Be sure to ask your doctor or nurse about anything that you don't understand or that concerns you. No questions are silly or stupid. All of your questions are important, and the staff will be happy to answer them.

Sometimes it helps to write down your questions or concerns before you take your child in. Then you can check your notes to make sure that you remembered everything.

Your child's visits are a time for you to learn more about sickle cell disease and how to help your child. Get to know the people who are caring for your child and learn from them at each visit. The more you learn about the disease, the better care you will be able to give to your child.



*Getting answers to the questions you wrote down*

### Questions to Answer

During the exams the doctor or nurse will usually ask you for information about your child. Your answers will help them learn more about your child's health, development, and habits. Try to answer the questions fully so that they can give your child the best care. You may want to write down your answers to these questions before you see your doctor.

Here are some examples of the kinds of questions you may be asked:

**1. Has your child had any fevers, jaundice (yellow eyes or skin) or colds?**

Your doctor needs to know about any illnesses you may have treated at home or had treated elsewhere. It is very important to always call or see your doctor right away if your child has a fever, jaundice or seems sick.

**2. What is your child eating?**

This helps the medical staff know if your child is eating right. Sometimes children eat too much, too little or the wrong foods. If your child is having problems with weight or food, the staff can help you plan a healthy diet.

**3. What medicines are you giving at home and how much?**

Your doctor also needs to know the kinds and amounts of medicines you give your child. This includes both prescribed medicines and those you buy over-the-counter at the store. Bring all your child's medicines to each visit to make sure you give the doctor the right information.

**4. Is your child having any problems taking prescribed medicine, like penicillin or anti-malarial drug, at home?**

Your doctor needs to know if your child is having any problems taking medicine. For example, you may have trouble getting the prescription filled or getting the child to swallow it. If there is a problem, tell the staff so that they can help you figure out a way to make sure she gets the medicine she needs.

**5. What does your baby do? Smile? Roll over? Talk?**

It is important to know if your baby is developing normally.

### Information to Share

Many things can affect your child's health. The more the doctor or nurse knows about your child's life, the better care they can give. Be sure to tell your doctor or nurse at the sickle cell centre or clinic if:

**1. Your child has been treated by another doctor or clinic.**

Your doctor needs to know about what problems your child was having and what treatment or tests were done. If any medicine, shots (immunizations) or tests were given, your doctor needs to know so that the tests won't be repeated unless needed. Your doctor will give you an Authorization for Release of Medical Information Form because he or she will want a copy of the records so that they can be added to your child's medical record.

**2. Your child looks or acts in a way that concerns or upsets you.**

You know your child better than anyone else. Your doctor may not see things during the visit that you may see at home. Help your doctor by sharing things that upset or concern you.

**3. Your child has had a major loss, such as divorce or the death or illness of a family member or friend.**

Emotional upsets can affect the body. If your child is going through a stressful time, your doctor may want to watch her more closely.

**4. You or your child is upset by something that happened at the clinic or hospital.**

Talking about problems can help lead to solutions. Your doctor may be able to help you make sure something doesn't happen again, or you may find a better way to handle a problem.

**5. Your child is having trouble in day care or school.**

Here, too, talking about a problem may help you solve it. Teachers or day care staff may need to learn more about sickle cell disease so that they can better understand your child. Your doctor will be able to help you get the right information for them.

**6. You are planning to take a trip.**

Ask your doctor to give you a letter stating:

- What kind of sickle cell disease your child has
- Her normal haemoglobin level or PCV level
- The medication she takes
- Other special problems

Also, ask your doctor or nurse about where you should take your child if she needs medical care on your trip. Take the letter with you when you travel with your child.

**7. You are planning to move.**

Ask the staff for the name of a sickle cell centre or another doctor near where you will be moving. Your doctor can send a copy of your child's medical records to your new doctor.

## Chapter 3

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# *Health Care at Home*

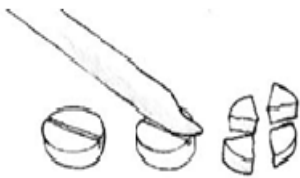
Children with sickle cell disease need some extra health care at home to help them stay well. Giving your child penicillin twice a day (at least until age 5) is one of the key parts of good home care. Extra fluids and a good diet also help to keep your child well. With just a little extra care, your child can be active, go on trips, and do almost all of the things that other children do.

In this chapter, you'll learn about the following areas so that you can help your child stay well:

- **Penicillin**
- **Malaria**
- **Fluids**
- **Nutrition**
- **Active Play**
- **Taking a trip**

# Penicillin

## Preparing penicillin



**Step 1:** Cut the pill into small pieces



**Step 2:** Mash the pieces in a bowl with a spoon.



**Step 3:** Mix the mashed pills with some food.

Your doctor will tell you when to start giving your baby penicillin. He will need it twice a day, once in the morning and once in the evening. Studies have shown that daily doses of penicillin for babies and young children with sickle cell disease greatly reduce the number of infections they get. Your doctor will write a prescription for your child. Making sure your child gets his penicillin is one of the most important things you can do.

Your child needs to take a dose of 125 milligrams (mg), twice a day, until he is three years old. At three years of age, the dose will double to 250 mg, twice a day. If your child is allergic to penicillin, erythromycin can be given instead.

Keep giving your child penicillin until your doctor or nurse practitioner tells you to stop. Don't stop because your child feels well or sick, unless your doctor tells you to stop. Most doctors recommend taking penicillin until at least age five.

## Pills

It is better to give penicillin in pills because they last for several years. Liquid penicillin only lasts for two weeks after you get it from the pharmacy, and it must be refrigerated.

Pills can be crushed and mixed with a teaspoon of applesauce, ice cream or flavored yogurt. It is not good to put them in formula or juice because the baby may not drink all of it.

## Liquid

Liquid can be given by spoon or dropper. Liquid penicillin should not be put in a baby's bottle because the baby might not drink all of it.

## Shots

If your child is having problems taking penicillin at home, penicillin shots can be given once every three weeks at a doctor's office. This is not a good long-term solution as the shots are very painful and your child will be taking penicillin for years. Ask the doctor or nurse about ways you can give your child their regular medicines at home.

It can help to give the penicillin at the same time each day. Involve your child as he gets older. Make it a game or put your child in charge of how he takes it. Even a four year old can help remind you that he needs to take his pills.

Amounts of penicillin	
Age	Dose
2 months-3 years	125 mg. 2 times a day
Over 3 years	250 mg. 2 times a day

# Malaria

Malaria is an infection caused by a parasite that is carried by mosquitos. Children with sickle cell disease are vulnerable to malarial infections. The infections can cause a painful crisis and severe anaemia. It is important to prevent malaria in children with sickle cell disease.

## Prevention of Malaria

Malaria can be prevented by giving anti-malarial medications daily and keeping the mosquitos from biting your child in the first place.

- Give your child anti-malarial mediation (Proguanil) daily from 6 months of age for as long as he lives in a malaria-endemic environment. Recommended dosage:

Amount of Proguanil	
Age	Proguanil Tablets
6 months – 1 year of age	25 mg (1/4 of 100 mg tablet) daily
1-4 years of age	50 mg (1/2 of 100 mg tablet) daily
5-8 years of age	75 mg (3/4 of 100 mg tablet) daily

- Use insecticide-treated mosquito nets over the bed when sleeping.
- Use mosquito repellent on her skin if she goes outside at dawn or dusk.

## Symptoms of Malaria

Early signs or symptoms of malaria are:

- Fever greater than 37.5° C
  - Poor appetite
  - Trouble sleeping
  - Pain
  - Chills
  - Fast breathing
- Bad temper, cranky
  - Drowsy
  - Sweating after fever
  - Headache
  - Enlarged spleen
  - Seizures

If she has a fever greater than 37.5° C and has other symptoms described above, take her to the clinic or the Emergency Room immediately. The doctor will take blood to see if she has malaria. She will likely be given medications and may have to stay in the hospital.

# Fluids

Children with sickle cell disease need more fluids than other children. They usually get thirsty more often than other children. Give your child fluids whenever he is thirsty. Fluids can include any clear liquids like water, juices or soft drinks. Keep enough fluids on hand so that your child can have as much as he wants.

Special times when your child needs to drink more

Your child needs more fluids when:

- 1. He has a fever.
- 2. He has pain.
- 3. It’s hot outside.
- 4. He is very active.
- 5. He is traveling.



Drinking a big glass of juice on a hot day

Your child may not want to drink a lot of fluids at these times, but he still needs them. You may have to push your child to drink more clear fluids. Try ice chips, popsicles, jello, milk or soup as well as water, juices and soft drinks. Use the chart below to figure out how much fluid your child needs during these special times.

A baby who is breastfeeding or on infant formula only needs extra fluids during special times. At these times, you need to encourage him to take all of his breast milk or formula, unless he is vomiting.

Amount of Clear Fluids Your Child Needs each Day During Special Times	
Child’s Weight	Number of 8 oz. (250 ml.) Cups Per Day
5 kg	2 cups
7 kg	3 cups
9 kg	4 cups
11 kg	5 cups
14 kg	5-6 cups
16 kg	6-7 cups
18 kg	7 cups
23 kg	8 cups
30 kg	9 cups
More than 30 kg	10 or more cups



# Nutrition

Like everyone, children with sickle cell disease need to eat a well-balanced diet. Because their red blood cells break down faster, they need to have good food sources of protein, vitamins and minerals every day. They also need to have more calories in their diet to make new red blood cells.

### Vitamins

When your child is about 9 months old he may be given a vitamin supplement called folic acid, 2.5 mg/a day (1/2 of 5mg tablet). This can be crushed and mixed with milk, juice or food. Folic acid helps the body make new red blood cells. Some children don't need extra folic acid.

In addition to folic acid, some children with sickle cell disease may need to take other vitamins and minerals such as zinc and vitamin E. Your doctor will prescribe these when needed. Do not give iron unless recommended by doctor

### Height and Weight

Your child may be smaller or thinner than his brothers and sisters, even with a good diet. This is because he has to use more energy to make new red blood cells. As he grows older, he will usually catch up.

If you are concerned about your child's weight or eating habits, talk to a nutritionist who knows about sickle cell disease. She or he can evaluate what your child is eating and suggest changes if they are needed. These changes may include giving your child extra snacks or more calorie-rich foods.

# Active Play

Sickle cell disease won't keep your child from doing most kinds of activity that he enjoys as long as he takes care of himself. Taking care of himself means:

1. Resting when he feels tired.
2. Drinking extra fluids when he is active.
3. Dressing for the weather.

Tell your child to rest as often as he needs to. Then let him find his own level of activity and enjoy it.

A few activities can sometimes cause problems related to sickle cell disease and should mostly be avoided:

1. Ones that expose him to cold temperatures, such as swimming in cold water.
2. Ones at high altitude, such as backpacking, hiking, or skiing.
3. If your child wants to do any of these, talk to your doctor first.

All preschool and day care playground activities and most elementary PE class activities are fine for your child. If he is in a program where there is a leader or a teacher, tell them about your child's need to drink extra fluids and to rest when he is tired. They can help your child take good care of himself.



*Playing with his friends*



*Putting on a jacket when it's cold*

# Taking a Trip

Most travel is fine for children with sickle cell disease. There are a few rules your child should follow when you take a trip.

**1. Fly only in a pressurized plane.**

This should not pose a problem for most trips because almost all commercial planes are pressurized.

**2. Drink plenty of fluids when traveling.**

This is important when your child is:

- Flying in an airplane
- Riding in a car
- Visiting an area that is very dry
- Riding or walking at high altitudes

**3. Be careful at high altitudes (above 1,500 metres).**

If your child is riding in a car or walking above 1,500 metres, he needs to rest often and drink plenty of fluids. If he starts to feel sick, take him to a lower elevation.

Let your doctor know if you plan to take your child on a trip and ask him or her for a “Travel Letter.”

Make sure that you take along the penicillin your child needs as well as any other medicines he is taking. Talk about your plans with your doctor to see if any other special care needs to be taken.

**Travel Checklist**

- \_\_\_Talked to doctor
- \_\_\_Travel Letter filled out by doctor
- \_\_\_Filled prescription for penicillin
- \_\_\_Filled prescription for anti-malarial medication
- \_\_\_Made arrangements for other medicines
- \_\_\_Packed extra fluids
- \_\_\_Names and addresses of doctor or centre to contact if needed
- \_\_\_Thermometer

## Chapter 4

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# *Fever, Pain and When to Get Help*

With sickle cell disease, there will probably be times when your child doesn't feel well. You are a key part of your child's health care team. You need to know when to get your child help and when you can help her feel better at home.

This chapter will teach you how to find problems early so that you can get help. It will also give you ways to deal with the pain that sometimes is a part of sickle cell disease.

The following topics will be covered:

- **Fever**
- **Easing pain at home**
- **When to call the doctor**

# Fevers

It is important to know when your child has a fever and what to do about it. When your child has a fever, it is a sign that her body is fighting an infection. Infections can be very serious in children with sickle cell disease. Noticing symptoms of an infection early can let you take actions to prevent it from getting worse.

If you think your child might have a fever, take her temperature.

Your child has a fever if her temperature stays over:

- 38.3°C Rectal (in the rectum)
- >37.4°C Axillary (in the armpit)

Rectal temperatures are about 0.5°C degree hotter than armpit temperatures.

### When to call the doctor

**If your child's temperature is 38.3°C or higher, call your doctor or nurse right away.** A child can have a fever of less than 38.3°C with a cold. But a fever of 38.3°C or more may mean a serious illness which the doctor needs to know about.

When you talk to your doctor or nurse, describe where you took the temperature, rectum or armpit. Since the body's temperature is different in each of these places, it is important for the medical staff to know where you took it. Before you give your child any medicine for a fever, call and speak with your doctor or nurse.

Aspirin should **not** be given to children because it can cause a serious disease called Reye's syndrome.

You don't need to take your child's temperature every day if your child is well. It is not needed and can be upsetting to your child.

## Chapter 4: Fever, Pain and When to Get Help

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### Oral and rectal thermometers

There are two main types of fever thermometers: rectal and armpit. Rectal and armpit thermometers look different. Armpit thermometers have a long, thin end for fast, accurate readings. Rectal thermometers have a short, stubby end so they won't break in the rectum or cut the skin. An oral thermometer should never be used in the rectum.



Digital thermometers are now available. These can be used in the rectum or armpit. Many parents like to use them because they are fast and easy to read.



### Ways to take a temperature

There are three ways to take your child's temperature:

1. In the rectum, using a rectal thermometer.
2. Under the armpit, using any kind of thermometer.
3. In the mouth, using an oral or digital thermometer. Do not use a rectal thermometer.

### When to take a rectal temperature

Take a rectal temperature with a baby or a young child who can't hold a thermometer in her mouth for 2-3 minutes or with a child who is congested and can't breathe through her nose. Use Vaseline to make it go in smoothly.

### When to take an oral temperature

When your child is old enough to hold a thermometer in her mouth and keep her mouth tightly closed, switch to an oral temperature. Place the thermometer under the tongue.

# Chapter 4: Fever, Pain and When to Get Help

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## Taking a temperature

Before you take your child’s temperature with an oral or rectal thermometer, shake the thermometer to get the silver or colored bar to below 35.0°C. Then place it in your child’s armpit or rectum for 2-3 minutes.

You don’t need to shake a digital thermometer. Just place it in your child’s armpit or rectum for 1 minute.

- If your child is sick, take her temperature early in the morning and late in the afternoon. If your child seems very sick, check her temperature more often.
- When your child is sick for several days, try to take her temperature at the same time each day.
- Don’t give your child anything hot or cold to drink or eat for a half hour before taking an oral temperature. Food or drink can change the reading by warming or cooling the child’s mouth.
- Stay with your child to be sure she stays still while her temperature is being taken.

## Reading a digital thermometer

A digital thermometer shows you the exact temperature. Read it and then wash the tip with warm water. Wipe it with methylated spirit and put it back into its case. Make sure that the thermometer is working normally and does not need a new battery.

## Reading the thermometer

To read the temperature, take the thermometer out of your child’s armpit or rectum and follow these steps:

1. Turn the thermometer until you can see the colored bar (usually silver or red).
2. Line up the end of the colored bar with the degree mark.
3. Read the mark. Each mark usually stands for one-tenth (1/10ths) of a degree.

No matter what kind of thermometer you use, your child’s temperature is found by reading the amount written at the end of the colored bar.

After reading the temperature, wash the thermometer with cool water and soap. Then wipe it with methylated spirit and put it back into its case.

**Remember**

If your child’s temperature is 37.5° C or higher, call your doctor or nurse right away. Make sure to say where you took the temperature.

## Easing Pain at Home

Your child may have pain at times from sickle cell disease. Usually, the pain is mild enough to treat at home. Infants and toddlers may show pain by crying, refusing to walk, or pointing to the areas that hurt. Pay attention to these signs. Try different ways to ease pain to see which ones help the most.

### Home remedies

#### 1. More fluids

Extra fluids can help keep the sickle cells from clogging up small blood vessels. Since this is a major cause of pain, extra fluids can do a lot to ease the pain. Give your child up to double the amount of fluids she usually drinks.

#### 2. Quiet play

Cutting back on physical activity can be helpful. Complete bed rest may not be needed, just less active play. Find things for your child to do quietly inside for a while. See if quiet play will help her feel better.

#### 3. Warm baths

Let your child soak in a warm bath for a while. When it cools off, you can add more hot water or she can get out. Sometimes it feels good to do mild exercises in the warm water.

#### 4. Warm, moist towels

Apply warm towels to the painful area. Wet them with warm water, and then wring them out. Change them when they cool off. You can apply these as often as it helps.

#### 5. Massage

Gently massage the painful area with warm baby oil or lotion to relax tense muscles and increase blood flow. You can massage the arms, legs, back and neck areas easily.

#### 6. Acetaminophen (Paracetamol, Tylenol)

Acetaminophen can provide a lot of relief for the pain caused by sickle cell disease. Make sure to give your child the right dose for her weight. Never give your child aspirin, unless ordered by your doctor, because it can cause a serious disease called Reye's syndrome.



#### 7. Pain Medication

Call your doctor if acetaminophen is not helping ease the pain. Do not give your child pain medication that has not been prescribed for your child. Another child's or an adult's pain medication should not be given to your child.

### Helpful hints

Your child will feel less pain if she is involved in something she enjoys. Some children like to be alone when they feel pain. Others want to be busy. Learn what works best for your child. If she likes to be busy, keep her busy with games, stories and other fun things. Read her books, talk to her or let her watch movies or TV.

### Call your doctor right away if your child has any of these symptoms:

- |  |   |
|--|---|
| 1. Chest pain or shortness of breath             | 4. Pain which isn't relieved by home remedies |
| 2. Abdominal pain                                | 5. Severe headache                            |
| 3. Pain along with fever or swelling and redness |   |



## Call to be Seen Right Away

Call your doctor or nurse **immediately** to find out where you should bring your child to be seen if your child has any one of these danger signs:



Fever:	38.3° C or higher
Head/Neck:	Severe headache or dizziness
	Stiff neck
Chest:	Pain or trouble breathing
Stomach:	Severe pain or swelling
Color:	Very pale
Penis:	Painful erections
Behavior:	Seizures
	Weakness or paralysis (can't move arm or leg)
	Can't wake up

If you think something is wrong, call your doctor. Trust your own judgment.

**If you can't reach your doctor, go to the emergency room. These symptoms could be a sign of serious problems that need medical attention right away.**

## Call for Advice

Call your doctor or nurse for advice if your child does or has any of these problems.



Stomach:	Vomits more than once
	Has diarrhea more than once
Color:	Jaundiced (eyes or skin look yellow)
Arms, legs, and back:	Pain, with no other symptoms
Chest:	Coughs without fever or chest pain
Nose:	Runny or stuffed nose
Behavior:	Isn't acting right
	Refuses to take medicines
	Refuses to eat or drink
	Is less active than usual

Again, if you think something is wrong or your child just doesn't look right, call your doctor. Many times, you can handle problems at home after talking with your doctor or nurse. You may be asked to call in each day for several days to be sure your child is getting better.

See Appendix A for a copy of this list to post in your home.

# *Medical Problems in Early Childhood - Birth to Five Years Old*

This section describes the most common problems your child may have because of sickle cell disease. Signs and treatment approaches are included to help you understand what might happen to your child.

These are the most common problems:

- **General infections**
- **Pneumonias**
- **Problems with the spleen**
- **Anaemia (low blood)**
- **Hand-Foot Syndrome**
- **Gallstones**
- **Pain**
- **Problems with kidneys and urine**
- **Delayed growth**
- **Less common problems - stroke and priapism**

If your child gets one of these problems, use this chapter to learn about it.

Different centres and doctors may use other approaches to treating these problems. Follow your doctor's advice.

### General Infections



*Taking penicillin twice a day and anti-malarial medicine once a day helps to keep your child well.*

Infection has always been the leading cause of death in young children with sickle cell disease. Serious infections can occur in these areas:

1. Blood
2. Lungs (pneumonia)
3. Spinal fluid (meningitis)
4. Kidneys or bladder (urinary tract infections, pyelonephritis).
5. Bone infections (Osteomyelitis)

These infections can be caused by many different kinds of bacteria and viruses.

#### Prevention

To help protect young children from bacterial infections, they are given penicillin pills twice a day and anti-malarial pills once a day. They also receive pneumococcal vaccination shots. This greatly reduces the chance of infection by pneumococcus. This type of infection is the most common cause of serious illness or death in sickle cell disease.

#### Signs

The most important sign of infection is fever. If your child has a fever over 38.3° C, take her to the doctor right away.

#### Treatment

When you get to the doctor's office or clinic, the doctor will examine your child, take samples of her blood and urine, and do a chest x-ray. If she looks very sick, a spinal tap to check the spinal fluid will also be done. The samples of blood, urine and spinal fluid will be sent to the laboratory to find out what is causing the infection so that your child will get the proper treatment.

While waiting for the lab results, your doctor may decide to put your child into the hospital so that she can get antibiotics through an IV.

If your child goes home, your doctor may prescribe antibiotics or anti-malarial to treat infections. It is important for you to give your child all the medicine the doctor ordered, even if she seems well. This will help prevent the infection from coming back.



*Checking for a fever*

# Pneumonia

Pneumonia (lung infection) is very common in children and adults with sickle cell disease. In fact, children with sickle cell disease are about 300 times more likely to catch pneumonia than other children. This is one of the most dangerous infections your child can get. Prompt treatment is critical.

### Signs

Signs of pneumonia include some or all of these:

1. Fever
2. Frequent coughing
3. Rapid breathing
4. Shortness of breath
5. Difficulty breathing: “grunting”
6. Tiredness
7. Chest pain

If your child has a cough that won’t go away or has a cold and seems more tired than usual, have your doctor check for pneumonia. In a child with sickle cell disease, infections which might cause only a cold in another child can turn into pneumonia. The doctor will order a blood culture for infection and a chest x-ray. Pneumonia can usually be diagnosed from the x-ray.

### Treatment

The treatment for pneumonia is the same as the treatment for other infections. Your child will be given IV antibiotics in the hospital for several days.

If the pneumonia is severe, your child’s blood oxygen level may fall. This causes sickling in the lung known as “lung infarction”. This condition, called Acute Chest Syndrome, can cause severe chest pain and make it hard for her to breathe. If her blood oxygen level gets too low, she may need to get extra oxygen through a mask or a tube under the nose. A red blood cell transfusion may also be needed.

A few children get pneumonia often. They may have one infection after another.

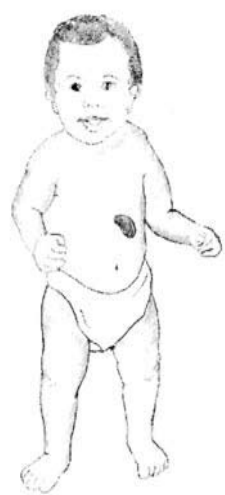


## Problems with the Spleen

The spleen is in the left upper corner of the abdomen, just under the edge of the rib cage. The spleen’s job is to filter out damaged red blood cells from the blood and to help fight infections.

### Enlargement and scarring

Most young children with sickle cell disease get enlarged spleens sometime in their first two years of life. One reason why it is important for your child to see a doctor often is to have the size of the spleen checked when she is healthy. Then, if your child becomes ill, the doctor will know whether the spleen is larger than usual for her. Different types of sickle cell disease affect the spleen differently. In most children with SS disease, the spleen stays enlarged for several years. By age six, their spleen becomes small again due to scarring from sickling. Children with SC disease and S  $\beta$  thalassaemia disease often have enlarged spleens for a longer time, sometimes for their whole lives.



*A normal spleen*

A mildly enlarged spleen doesn’t usually cause any problems. However, the scarring keeps the spleen from working well. This is one of the reasons that children with sickle cell disease can get serious infections.

### Splenic sequestration

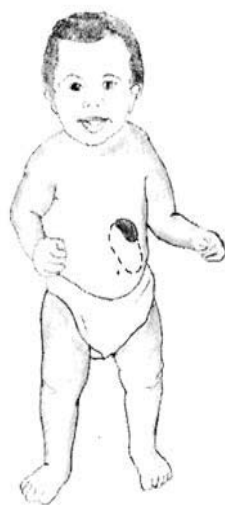
In some children, the spleen may become larger very quickly and begin to trap lots of blood cells. This “bleeding into the spleen” can cause the blood count to drop quickly. This can lead to heart failure and death if not treated promptly with a blood transfusion. Rapid spleen enlargement with dropping blood count is known as a “splenic sequestration crisis”.

### Signs

Splenic sequestration can happen when your child has a fever or cold. Other signs to watch for are abdominal pain or swelling, pale color and tiredness. If your child has any of these signs, examine her abdomen for an enlarged spleen to see if it is larger than normal for your child. Your doctor will teach you how to examine for a spleen.

### Treatment

If your child has one splenic sequestration, she will be more likely to have another. After a second episode, if your child is at least two years old, her spleen may be removed with surgery so that this won’t happen again. If your child is under two, she will probably get blood transfusions to protect her until she is old enough to have her spleen taken out. Your child does not need her spleen to live. However, if your child has her spleen taken out, she should keep taking penicillin twice a day until she is an adult to help prevent infections.



*An enlarged spleen*

# Anaemia (Low Blood)

People who have sickle cell disease have fewer red blood cells than normal. Since red blood cells carry oxygen to the muscles, they often become tired more quickly than people with normal blood counts. In general, people with SS disease have the most severe anaemia.

These are times when your child's blood count may fall much lower than usual. This can happen with a fever or an infection. Either the body stops making new cells or the cells are destroyed quicker than usual. When this happens, the destroyed red blood cells in the body fluids can make the eyes look more yellow and the urine look darker than usual.

### Signs

Bring your child into the doctor to have her blood count checked if you notice any of these signs of an extra low blood count:

1. More tiredness
2. Pale color
3. Loss of appetite
4. Yellow eyes or skin
5. Dark urine

### Treatment

If your child's blood count falls very low, a blood transfusion may be needed. An extremely low blood count can result in heart failure and death if not treated in time. Since the blood count often falls at the time of other medical problems, your doctor will usually check it daily when your child is in the hospital

# Hand-Foot Syndrome

About a third of children with sickle cell disease who are less than three years old may get a painful swelling of their hands and feet. This is known as the “hand-foot syndrome”. It is caused by the sickle cells blocking the tiny blood vessels in the bones of their hands and feet.

## Treatment

In most children, the pain is mild enough to be treated at home. Acetaminophen (Paracetamol, Tylenol) and extra fluids often help with the pain, and the swelling goes down within a few days. Your doctor may also prescribe stronger medicine like Ibuprofen (Ibupain, Brufen, Advil).

Follow your doctor’s instructions in giving this medicine; it is safe and will decrease the pain. The child should take this drug after a meal.

If your child has a fever or if the pain is very severe, call your doctor. Your child might need to go into the hospital for a few days to receive fluids through an IV and stronger pain medicine. Almost always, the hand-foot syndrome will go away without any lasting effects.



*A swollen foot*



*A swollen hand*

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# Gallstones

About a third of children with sickle cell disease have gallstones by the age of seven. Gallstones are formed from the waste products of broken down red blood cells. These cells collect in the gallbladder and form thick sludge or stones. Gallstones are not harmful. But if they get stuck in the gallbladder duct, they can cause blockage, liver swelling or a serious infection. Emergency surgery or other procedures may be done to remove the gallstone.

## Signs and Treatment

Eyes that are very yellow can be a sign that gallstones are stuck in the duct. Often, there is a warning before the stones get stuck. When the stones pass through the duct, they can cause pain in the right side of the abdomen. If the gallbladder is taken out after this warning, serious problems can be avoided.

Taking out the gallbladder doesn’t cause severe problems. Without a gallbladder, people usually don’t have any trouble eating fatty foods. Your child’s diet does not have to change if the gallbladder is removed.

# Pain

Pain from sickle cell disease is not that common in very young children. Pain may also be caused by something other than sickle cell disease.

All children have minor injuries and complain of aches and pains at one time or another. If the pain is very mild or goes away quickly, there is no reason why your child can't go on with her normal activities.

## Treatment

Most pain that is caused by sickle cell disease is mild and can be treated at home. Your child will usually get relief from some "home remedies":

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| 1. More fluids                       | 5. Massage                          |
| 2. Quiet play                        | 6. Acetaminophen (Paracetamol)      |
| 3. Warm baths                        | 7. Distraction (games, reading, TV) |
| 4. Heating pad or warm, moist towels |                                     |

If these don't help, your doctor may prescribe Dihydrocodeine (DF118). Codeine is stronger than over-the-counter medication for easing pain. Sometimes it also causes constipation. If this happens, give your child extra fruits and other foods high in fibre. Your doctor may also prescribe a stool softener like Bisacodyl along with DF118.

If the pain is too severe to manage at home, your child may need to go to the hospital to receive stronger pain medicine (narcotics) and extra fluids through an IV.

Certain kinds of pain may be a sign of something more serious. Call your doctor right away if your child has any of the following symptoms:

- |   |  |
|---|--|
| 1. Chest pain or shortness of breath      | 4. Severe headache                             |
| 2. Abdominal pain                         | 5. Pain which isn't relieved by home remedies  |
| 3. Pain with a fever, swelling or redness | 6. Weakness or inability to move arms or legs. |

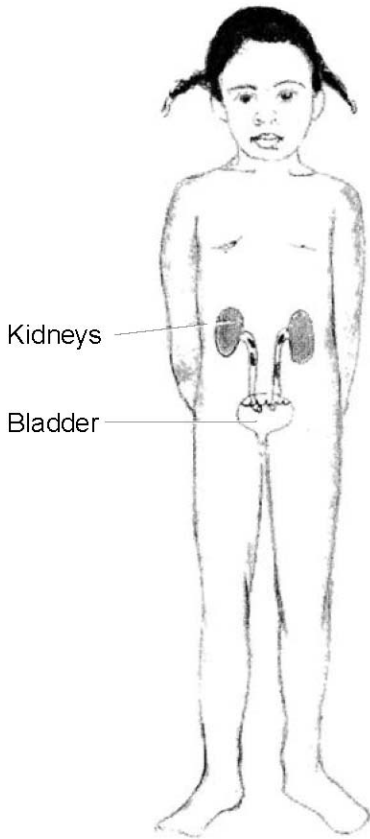
When your child feels mild pain in her arms or legs, treat her with sympathy, in a calm, matter-of-fact way. If you become nervous and overly concerned every time your child complains of pain, you may make it harder for her to deal with pain. Your child may become frightened, thinking that the pain means she will become very sick or die or she might learn to use pain complaints to get attention or special treats.

If you and your child are having trouble dealing with her pain, ask your doctor for help. He or she may suggest that you talk to a social worker or psychologist.



# Problems with Kidneys and Urine

## Dehydration



The kidneys help the body retain fluid. In sickle cell disease, the sickle cells damage the kidneys so that even young children urinate more frequently than other children. Children with sickle cell disease drink more fluids and pass urine more often than other children. When a child becomes sick and drinks less than usual or loses fluid by vomiting, diarrhea or fever, she can get dehydrated.

Signs of dehydration:

1. Tiredness
2. Urinating much less (e.g., fewer wet diapers)
3. Dry, sticky mouth and lips
4. Sunken eyes or soft spot (on a baby's head)

If you notice any of these signs, give your child extra fluids to drink and call your child's doctor.

## Bedwetting

Frequent urination can also cause bedwetting. This is common in most children with sickle cell disease. Bedwetting cannot be controlled by your child, it is of sickle cell disease damage to part the kidney. Most children stop bedwetting when they are older and can get up by themselves to use the bathroom.

There are ways you can help your child stop wetting her bed. It may help to wake your child to urinate twice during the night. This could be just before you go to bed and one other time. When she is old enough you can set an alarm clock to go off in the middle of the night so your child can go to the bathroom. Your doctor or nurse may have other helpful ideas.

## Chapter 5: Medical Problems in Early Childhood

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### **Kidney and bladder infections**

With sickle cell disease, infections in the kidneys and bladder can occur. If they are not treated promptly, the infection can move from the bladder up to the kidneys and cause kidney damage.

Call your doctor or nurse if you notice any of these signs:

1. An increase in the number of times your child goes to the bathroom
2. Bedwetting after your child has stopped wetting the bed
3. Being unable to hold the urine
4. Foul smelling or cloudy urine
5. Fever
6. Burning and pain when urinating
7. Abdominal or back pain

If your child has a bladder infection, she will need to have her urine tested again from time to time to make sure that the infection has not returned. If she gets repeated bladder infections, she will need to have testing to make sure the bladder and kidneys are normal. She may have to take an antibiotic other than penicillin every day to prevent repeated infections.

### **Blood in the urine**

Another problem caused by sickle cell disease is blood in the urine due to bleeding from the kidney. When this happens, the urine usually looks bright red or brownish. In more severe cases, there may be back pain and small pinkish specks or lumps in the urine. Usually, the blood disappears from the urine within hours, but in some cases, the bleeding can go on for days and become a serious problem.

Always call your doctor right away if you notice blood in your child's urine or diaper so that tests can be done to find out what is causing the bleeding. In most kinds of kidney bleeding, it is very important to get plenty of fluids, sometimes through an IV in the hospital, and to rest in bed.

### Delayed Growth

Most children with sickle cell disease grow normally when they are young babies. After their first birthday, they may start to grow more slowly. Throughout the rest of their childhood, some children with sickle cell disease are shorter and thinner than other children their age. Their height and weight is more like that of children several years younger. Puberty can also be delayed due to this slow growth.

In almost all cases, this difference in size is only temporary. Children with sickle cell disease keep growing after their friends have stopped. After a while, they will reach the height that would be expected from the size of their parents.

If your child is concerned about being small, let her know that she will grow bigger like her friends. It will just take her a little longer.

#### Eating extra food

If your child is very thin and much smaller than normal for her age, she may gain weight and grow better if she eats extra food between meals or before bed at night. Your doctor may also want to give her special vitamins or minerals. Most children don't need any special diet or vitamins and won't grow any faster if these are given. As with all children, they should eat three meals and several snacks each day. Limit the amount of candy, sodas and other "junk foods", which are not good for children in general, but especially not for children who have sickle cell disease.



*Your child may be smaller than her younger sister or brother who doesn't have sickle cell disease, but she'll catch up*

# Less Common Problems: Strokes and Priapism

## Strokes

Strokes are a very serious but fairly rare problem caused by sickle cell disease. They are caused by sickle cells blocking blood vessels in the brain. They happen to less than one in 20 children who have SS disease and even fewer children who have SC disease and S  $\beta$  thalassaemia disease.

These can be a sign of a stroke:

1. Sudden weakness of an arm or leg or the whole body
2. A difference in the way one side of the face or one eye moves compared to the other side
3. Sudden strong headache
4. Seizure (shaking that can't be stopped)
5. Difficulty speaking
6. Fainting

If you see any of these signs, call your doctor and bring your child to the hospital right away. The sooner the child is seen at the hospital, the better. Early treatment can keep a stroke from getting worse. Children who have had one stroke are usually transfused with red blood cells every month.

## Screening for Strokes

Because sickle cells can cause narrowing of the blood vessels of the brain, a special ultrasound called Transcranial Doppler (TCD) can be done to check these vessels. This test is recommended at age two, and once a year after that. TCD finds areas of abnormal blood flow in the brain. When blood vessels are narrowed due to sickle cell damage, the blood makes a louder noise as it travels through the narrow area. If there is faster flow, that means that the blood vessel may be narrower, and there is a greater possibility for having a stroke in the future. Your sickle cell doctor will recommend more frequent testing if the vessels appear to be slightly narrowed. If the TCD is abnormal and there is an increased risk for a stroke, your doctor may begin treating your child with monthly transfusion therapy.

## Priapism

A serious problem of sickle cell disease in boys can occur if sickle cells block the blood vessels in the penis. When this happens, the penis becomes erect, hard and painful. This problem is called “priapism”, and it can occur at any age.

Sometimes the penis may become hard and painful for brief periods of time and then become soft again without any treatment. If this happens more than once, talk about it with your doctor. These short episodes may precede a longer one. Repeated short episodes can cause the same problems as a longer more painful episode. There are medications that can be taken for this problem.

If the priapism doesn't go away within 30 minutes take him to the doctor. He may need to be treated quickly with IV fluids or blood transfusion to stop the sickling so the blood can flow out of the penis. Pain medication may also be given. In rare cases, surgery must be done to flush out these blood vessels.

## Chapter 6

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# *The Hospital*

Hospital stays can be difficult times for your child and your family. Your child's medical team will do whatever they can to keep you and your child as comfortable and informed as possible. They want to answer your questions and help you in every way they can while taking the best care of your child's medical problems.

Many hospital admissions for children with sickle cell disease are unplanned and occur because they have become suddenly ill. This adds to the stress of being in the hospital and may make parents feel they have no control over what is happening. This is normal, but you should let a social worker or your child's nurse or doctor know what you are feeling.

This chapter will describe what you can expect and things that can help with each part of a hospital stay. We have also included information about some of the procedures which may be done to your child in the hospital.

- **Medicines and IV's**
- **Transfusions**
- **Surgery**
- **Going Home**

Different centres and doctors may use other approaches to treating these problems. Follow your doctor's advice.

# Medicines and IV's

### Medicines

The most common medicines your child will receive in the hospital are:

1. Antibiotics to fight infections
2. Pain medications
3. Acetaminophen (Paracetamol, Tylenol) to reduce fever and pain

### IV's

When your child is first admitted to the hospital, he may be given fluids by an IV. “IV” stands for “intravenous” which means “into the vein”. The IV will be left in his vein so that he can get the fluids, and medicine he needs. It may take a few tries to get the IV in the right place. If your child is in the hospital for surgery, he will need an IV before, during, and after surgery to give him fluids and medicine.



*Keeping an IV in*

# Transfusions

Children with sickle cell disease sometimes need more or different blood. It is called a transfusion when they get this blood. While there are many reasons why your child may need blood, this is not the best treatment for all sickle cell complications. Some problems which may require a transfusion include:

1. **Severe anaemia** (blood count drops to a very low level). This anaemia can be caused by:
  - a. **Splenic sequestration** – the spleen enlarges and traps a lot of blood cells in it.
  - b. **Aplastic episode** - the body stops making new blood cells. Usually this is caused by a viral infection, but there are other infections and reasons for your child's blood counts to drop to a dangerous level.
2. **Life threatening problems**, like a stroke or severe pneumonia.
3. **Prolonged, painful erection of the penis** (Priapism)
4. **Surgery**



*Getting a simple transfusion*

### Types of transfusions

There are two types of transfusions your child may get: simple and exchange. Simple transfusions are the most common. They involve giving your child a set amount of blood through an IV. The medical team will always try to tell you before they give your child blood. With serious illnesses, transfusion will be discussed as a possible treatment.

An exchange transfusion involves giving your child a set amount of blood at the same time that the same amount of blood is taken out of his body. This can be the best way to increase the amount of blood flowing in your child's body and decrease the number of sickle cells. Your child may be put in the intensive care unit for this procedure so he can be more closely watched. This procedure can be done by nurses with syringes or with a machine run by special nurses that can exchange blood very rapidly. Sometimes your child will need a new IV line or a special IV line for these procedures.

**Each time** your child is transfused, he will be typed and cross-matched. This means that a sample of his blood will be taken to determine his blood type (such as "A" positive or "B" negative). Then the sample will be mixed with the blood he will receive to be sure the match is correct.

### Complications

Every effort will be made to give your child blood only when it is necessary because of possible complications. These are rare, but they can be serious. They include:

#### Infection

All blood products are thoroughly screened for HIV (AIDS), hepatitis and syphilis. But rarely, infections are transmitted by transfusions. Infections by the viruses that are screened (HIV, hepatitis B and C) are very rare, less than one in two or three million. Infection by bacteria that may be in the blood is also rare, but is more common than viral infections (less than one in thirty or forty thousand).

#### Allo-immunization

Your child may develop antibodies that destroy the blood he has been transfused with. Most sickle cell patients receive “phenotypically matched” blood that will reduce the chance this will happen.

#### Allergic reactions

These can cause rashes, hives, itching, or rarely, breathing problems. Rashes are very common; fever or breathing problems are much less common.

### Chronic transfusion programmes

Transfusions are sometimes needed on a regular basis to keep your child well. If your child needs transfusions once a month, he is said to be on a chronic transfusion program. Your doctor will not start such a program unless you are fully informed about the reason for it. You should understand why this is necessary and agree that this is a reasonable therapy. On a chronic transfusion program, a child can get iron overload from the breakdown of the extra blood cells he receives. This extra iron may build up in his heart, liver or kidneys and damage these organs. He will need to take a special medicine (desferrioxamine/Desferal) by needle under the skin at home every day to get rid of the extra iron or an oral medication (deferasirox/Exjade). The Desferal is given at night for eight hours using an infusion pump. He may also need to take the same medicine by IV when he comes to the hospital for transfusions. The Exjade is not to be taken with food and must be mixed in water or orange juice. It is taken once a day. This treatment is called chelation therapy. Your doctor will arrange for supplies and teach you how to use them.

### Designated donors

Friends or family members who don't have sickle cell trait or sickle cell disease can donate blood for your child, if their blood matches. This is called being a “designated donor”. Designated donors can't be used for an emergency. It usually takes at least three days to get the blood from the place where it is donated to the hospital. If your child is going to have a planned operation or needs to be on a chronic transfusion program, ask your doctor or nurse for more information about this way of getting blood. Usually this blood donation is not covered by insurance or must be paid for by the family. Directed or designated donations are not medically safer than regular donations, but they can make the family and the donor feel better about the transfusion. These donations cannot be used for chronic transfusion unless there are at least a dozen compatible donors for your child who can donate every two months (depending on the number of units for each transfusion).



# Surgery

Surgery is either elective or emergency. Elective surgery means that it can be planned ahead. Emergency surgery means that it needs to be done right away. If your child has to have emergency surgery, he may be given blood to quickly reduce the amount of sickle haemoglobin in his body. With an operation that can be planned ahead (elective surgery), your child will probably be transfused before the surgery to reduce the amount of sickle cells in his body, making the surgery safer.

For elective surgery, your child will usually be admitted to the hospital the day before so lab tests and other preparations can be done. The surgeon will talk with you about the surgery and possible problems. Another doctor will explain anesthesia, recovery time and any special care your child will need after the operation. All surgery requires your consent. You must sign an “informed consent form” before any procedure can be done.



*Preparing for surgery*

# Going Home

### The discharge meeting

When your child is ready to go home, the nurse, doctor or social worker will usually want to talk with you about important issues. Try to allow time to speak to them when your child is discharged. This is also a good time to discuss any questions or concerns you have about taking care of your child at home. You will usually be given medicines for your child to take at home. Make sure that you understand how much to give him and how often. If you have questions when you are at home, call the doctor or nurse. It is important that your child get the medicine as often and as long as the doctor says it is needed.

Sometimes children don't return to their old patterns when they come home. They may have some of these problems:

1. Trouble sleeping at night.
2. Wanting more attention.
3. Acting more unruly than before.
4. Wetting the bed or themselves when they had already stopped doing that at home.
5. Asking for a bottle when they didn't use one at home.

Keep in mind that these problems can be managed. If they don't last long or are mild, **consistency in your approach before and after the hospital stay is the key.** Your child needs to have the same expectations as any child his age who doesn't have sickle cell disease. For example, a four-year-old child should be sleeping in his own bed, not with you. However, your child who was hospitalized could be helped by a routine bedtime pattern, such as a bath, pajamas and story at the same time each night. If any of these problems last beyond a few weeks or are so severe as to disrupt your whole household, talk about them with your child's doctor, social worker or a member of the sickle cell team.



*Talking over your concerns with the social worker*

## Chapter 7: Taking Charge

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### *Taking Charge*

Now that you know more about sickle cell disease, you can begin to take charge to help your child. Taking charge involves learning more about yourself and your child. It also means dealing effectively with those who are close to your child.

These are areas in which you can take charge:

- **Your feelings**
- **Learning about the disease**
- **Helping your child at different ages**
- **Brothers and sisters**
- **Child care**
- **The medical staff**
- **Getting support**
- **Taking care of yourself**

It's hard to be a parent, whether your child has a chronic disease or not. Use this chapter to help you learn better ways to help your child and your family.

# Your Feelings after Learning Your Child has Sickle Cell Disease

Because sickle cell disease is a chronic, inherited disease, parents may feel a lot of different feelings when they find out that their baby has the disease. You may feel sad about the loss of the wished for “perfect baby”. You may feel guilty about the fact that the disease is caused by you and your partner’s genes. You may be angry that you or your partner did not know that you or your partner carried the trait. You may feel angry that your baby’s and family’s future will be changed in an unknown way. You may also feel afraid and helpless in facing your baby’s future.

No matter how you feel, it is okay to feel that way. Feelings aren’t right or wrong. What matters is how you deal with your feelings.

### Notice how you feel

The first step is to become aware of how you feel. Many people aren’t aware of their feelings. But unless you know what your feelings are, you can’t deal with them. Instead, your feelings will control you.

Try to notice what you are feeling:

- Do you feel mad, even when there isn’t a clear reason?
- Do you feel like crying more often than you used to?
- Do you feel like it’s your fault that your child has sickle cell disease?
- Do you worry all the time?
- Do you still want to see your friends and family or are you alone more than you used to be?

You might ask a close friend or your partner if they notice any changes in you. They may see things that you can’t see. Also, just talking with others will help you learn more about how you feel.

### Learning about sickle cell disease

For most people, knowing more about the disease helps them feel less scared and less helpless. You may find out that some of your beliefs about the disease aren’t true. The disease may not be as bad as you thought.

You may also find out that there are many things you can do to help your child that you didn’t know about. Learning about these things can make you feel more in control. As you know more, you will make better choices for your child. You’ll be better able to plan for his future. You can also teach other people how to help him.

### Express your feelings

Just being aware of your feelings can help you handle them. Sometimes, though, you may need to do more than just know how you feel. You may need to express your feelings so you don’t take them out on your child or other people you love.

- Share your feelings with your partner, a close friend or your clergy.
- Write about your feelings in a poem or a letter.
- Find a place where you can be alone and say whatever is on your mind.
- Get help from a social worker or psychologist.

Sometimes feelings will change when you express them. But even if they don’t change right away, most feelings do change with time. They become less strong or even go away. Learning more about your feelings and expressing them will help you feel better and be a better parent.

# Helping Your Child at Different Ages

### Your infant

During their first year babies grow and change rapidly. Many babies are able to smile at others by two months. At three months you may notice your baby making happy sounds. By three months they begin to recognize their mothers and close family members. By four months babies may begin to be shy with strangers until they get to know them. At seven months they can respond playfully to other persons and by ten months they can wave bye-bye.

For the first months of your baby's life, he is protected from the disease. Most babies don't have sickle cell complications until they are two or three months old. This will give you some time to get to know your baby and deal with your own feelings.



*Getting to know your baby*

After the first few months, your baby may begin to have problems from sickle cell disease. The first signs of the disease may be hard for you. You may realize that there is little you can do to prevent fevers, infections or pain.

A baby has few ways to let you know if something doesn't feel right. He may cry, be fussy, eat less or be less active. Give him as much comfort as you can. When your baby isn't feeling well, your touch and soothing voice can make a big difference. If your baby is in the hospital, your presence can make him feel better.

### Your toddler

Toddlers are learning fast. Because they are curious and active they can get into dangerous places. They need opportunities for walking, running and climbing. This is a time to make sure your home is safe to prevent accidents. Children at this age must be watched at all times.

Like other parents, you may become tired of caring for the active toddler. Most toddlers do not have words to express how they are feeling. Because of this they may be happy one moment and grumpy the next. Try to be patient with this behavior. Providing the same time daily for eating, playing and sleeping can be helpful.

At this age, your child may be very afraid of being away from you. Most toddlers feel this way, but it is important for them to spend time with other people. As your child becomes more comfortable with others, it will be easier for you to leave him with someone else.

Your toddler needs to feel secure in your love. Play with him, comfort him, include him in family activities and let him learn things on his own.

## Chapter 7: Taking Charge

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### Your 2-4 year old

Children from the ages of two to four want to be independent. They say “no” and want to do things themselves. Let your child begin to make decisions for himself. Even in the hospital, he can choose his own meals or TV programs or walk to the playroom when he feels better. At home, he can help you remember when to take penicillin and remind you to give him drinks. Use your judgment about things he can try for himself and avoid doing most things for him.

Even though your child is more independent, he still needs you. Comfort him, respond to his fears, answer his questions and help him learn more about his world.

### Your 4-6 year old

Between the ages of four and six, children use imagination to understand their world, including their disease. For example, a child may believe that the pain is a punishment for something he did. Or he may believe he caught sickle cell disease from something he ate. Pay attention to what your child may be saying about his illness. Clear up any wrong ideas. Don't worry if you have to go over the same ideas more than once.

Let your child ask any questions he may have about sickle cell disease. Answer these questions clearly, in words that suit your child's age. You may want to use stories, stuffed animals or puppets to help you explain what will happen to him.

Even though your child is talking, he may not be able to tell you what he is feeling. Watch your child's play to get helpful information. Also, look for patterns in how your child acts when he feels sick or in pain so you can know how to help him. For example, he may want to stay in bed in the morning because he “feels funny” when he has pneumonia. He may act listless and want to be left alone when he is in pain.

This is also the age to start teaching your child how to take care of himself. For example, you can explain “You need to drink eight cups of water today”. Or you can let him do things for himself. He can pour his own drinks or get his own cup.

Because your child has sickle cell disease, you may feel he should be treated differently than other children (special treats, toys, attention, less discipline). This is not really best for the child, however. Children with sickle cell disease need to feel that they are the same as other children. If your child has brothers and sisters, they should all have the same rules to follow and your expectations for their behavior should be the same.



*Watching your child's play to learn her ideas about this disease*

# Brothers and Sisters

Whenever a new child comes into a family, each family member may have different reactions and feelings. For some brothers and sisters, the joy that is felt by their parents is shared by them. Others may be afraid that the new baby will threaten the share of love and affection they get. This feeling can be even stronger if the new child has special needs.

Your healthy child may feel afraid of becoming ill himself. He may be afraid he caused his brother's or sister's illness or feel angry about the extra attention the child with sickle cell disease is getting. This can be true even if the attention your child with sickle cell disease is getting is not fun, like having IV's, shots, and seeing doctors and nurses. Assure your healthy children that these feelings are natural. Encourage them to come to you to ask any questions or share any feelings that they have.



*Letting your older daughter help with the baby*

### Share your time and love with all your children

It is best for all family members if you make sure to spend time with each of them. Try not to miss school plays or sports events that your healthy children are involved in because your total focus is on your child with sickle cell disease.

### Let your other children help your new child

Many parents have found that by sharing the care of their child with sickle cell disease with their other children, these children have felt more loving and accepting of their younger brother or sister. Use your knowledge of your children to help you figure out how they can best be included in their brother's or sister's care.



*Disciplining your child with sickle cell disease like you do your other children.*

### Teach them about the disease

As you learn more about sickle cell disease, you can share what you learn with your other children. You can also let them ask the doctor or the medical staff questions, especially ones that you don't know how to answer. This will help them feel included.

### Avoid "special treatment"

Brothers and sisters of children with special needs know that these children are often treated in a special way by relatives, neighbors and parents. Some are able to understand why this happens, but others can't.

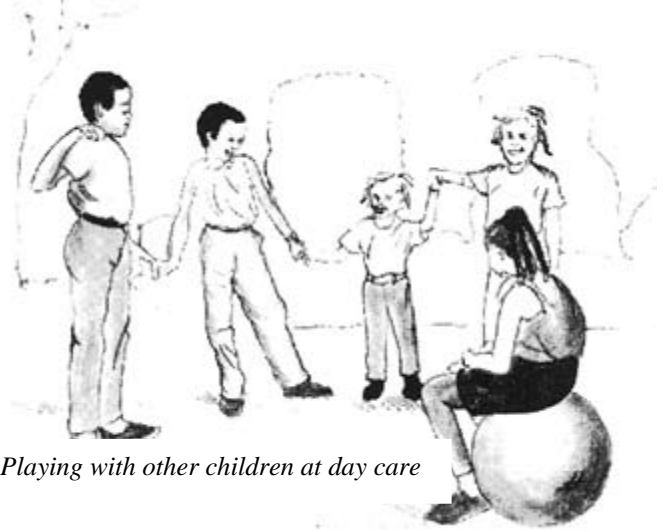
Try to use the same system of discipline and rewards with all of your children. This can relieve much of the resentment over one child getting special treatment.



# Childcare

Childcare is another common area of concern during the early years. Like many parents, you may be worried about what the caregiver will do if your child becomes ill. It is often helpful to tell your child's caregiver the following about your child:

1. **Treat your child like other children.** Except for having sickle cell disease, he is just like other children!
2. **Watch for signs of infections and respond.** Go over a list of signs of infection and other problems. Make sure your caregiver knows how to contact you or another responsible adult who can pick up your child and take him to the doctor if needed. The caregiver should also have your doctor's name and phone number so they can call the doctor if they can't reach you.
3. **Take care of his special needs.** While your child will have few extra needs, the ones he has are very important. These needs include drinking more fluids, resting when he is tired, and needing more frequent trips to the bathroom or diaper changes.



*Playing with other children at day care*

Many times, caregivers or teachers will want to learn more about sickle cell disease. You can bring them written materials, like this handbook, which will provide them with more information. If they have more questions, you can refer them to your child's doctor or medical staff.

Sharing all of this information with these providers can relieve much of the stress and worry that they may have in caring for your child. It will also relieve many of your own concerns because you will know that they are prepared.



*Drinking more fluids at snack time*



### Getting Support

The demands of parenting can often seem endless. When a child has special medical needs, even more involvement is needed from parents. In most cases, family, friends, neighbors, church members and community groups are a great source of love and support. Help them to give you the support that you need so that you don't have to do it all yourself. Ask them to watch your other children, make a meal for your family or give you a ride. Many people will be happy to know what they can do to be helpful.

It can be very helpful to talk to other parents of children with sickle cell disease or to join a parent support group. These groups have helped many parents learn ways of dealing with problems that only those who have experienced the same problems could know.

Ask your medical staff about sickle cell parent groups in your area or to introduce you to another family with a child with sickle cell disease.

Part of learning to live with sickle cell disease is telling others about the disease and handling their questions and opinions. Some people that you have contact with may have fears and strange ideas about sickle cell disease. With the help of your medical staff and your own knowledge of the disease, you can teach others to provide the support both you and your child need.



*Getting support from another mother who understands*

### The Medical Staff

You or your child's caretaker will be the first to notice if something is wrong with your child. Because you observe and deal with your child's everyday needs, you know how he functions from day-to-day. You and your child's caretaker will know before anyone else that your child is acting differently than he usually does. When you share this information with the medical staff, they can better figure out how your child's illness is affecting him. Let the medical staff know about your concerns. Also, teach your child and others caring for him to do the same.

Sharing information goes both ways. The medical staff has a lot of knowledge and experience with sickle cell disease. They want to answer your questions and provide you with some of the support that you will need during the early years of your child's life.

You may find that health care providers sometimes disagree on how to handle a problem that your child is having. Differing opinions are common in any type of medical care. Talk to the staff if this happens so that you can understand the issues.

It is also okay for you to have a different opinion than your doctor. If this happens, share your thoughts and reasons as well as what you plan to do. If a conflict arises between you and your doctor, talk about it so that your child can receive the best care. Many times problems are due to parents not understanding completely what the doctor is saying and the doctor not understanding what the parent's concerns are. Sometimes it is good to have a third party, like a social worker, help you and the doctor understand each other better.

To make sure that you have enough time to talk with your doctor, you can:

1. Make an appointment to talk to the doctor about your concerns or for more information about your child's health.
2. Write down your concerns as they come up. Use it as a reminder to bring with you to the appointment.
3. Get to know all of the health professionals and their roles in helping you and your child. Think about who could be most helpful to you in dealing with each specific problem.
4. Get tips from other parents about ways to express your concerns to health professionals. New families can learn a lot from the experience of other families who have worked with the same staff.

### Take Care of Yourself

It can be very challenging to deal with a serious illness that affects someone you love. You may find that your life is more stressful in other areas, such as your marriage, your family, your finances and your own personal life. It is important to take good care of yourself so you can take care of your child.

Although you may want to devote your whole life to your child, you can't. It won't help him, and it won't help you. Your needs are also important. Find time for your other children, for your partner and for your friends. Also, make time to do things that you enjoy. A short break, even when your child is sick, can give you a lift.

Money can be a major concern for parents of children with chronic disease. Talk to your doctor or a social worker about your concerns and how to get more information about health care coverage for your child. Enrolling your family in the National Health Insurance Scheme can be helpful.

Be sure to get help if you need it. Reach out to medical staff, friends, family, clergy, support groups or other parents to help you get through hard times. Sometimes you need more than support. You may need to talk to a social worker or psychologist. Don't wait too long before you ask for help.



*Taking care of yourself and your family*

## Chapter 8

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# *Planning Your Family*

Pregnancy can be a time filled with joy and with stress. There are so many questions in your mind. Will the baby be a girl or a boy? Short or tall? What will our child be like?

If there is a chance that you might have a child with a genetic disorder such as sickle cell disease, your questions may be more worrisome. Even though all pregnant women have a 3-5% chance of having a child with a birth defect or genetic disease, this chance is remote to most people.

If you already have a child with sickle cell disease you may even be more concerned. You may remember what you felt after you heard that your other child had sickle cell disease. You may also be concerned about caring for another child with special needs.

This chapter will answer many questions about planning your family. It will cover:

- **Genetic counseling**
- **Testing your baby before it is born**
- **Chances of passing on sickle cell genes**

With this information, you will be able to make informed choices about what is best for you and your family.

# Genetic Counseling

### Genetic counseling can help

Because pregnancy brings with it these extra worries and questions, genetic counseling can be very helpful. Genetic counselors are experts in hereditary disorders and counseling. They give information and support to families with concerns like yours. They can help you figure out your chances of having future children with sickle cell disease and let you know about options for family planning and prenatal testing.

Even if you are already sure that you want to have another baby, it can be helpful to talk about your concerns with a genetic counselor **before you get pregnant**. In fact, many people have found that talking about their concerns before they are pregnant has made the pregnancy more joyous and less stressful.

### Common questions

Whether you are pregnant or planning for the future, genetic counseling can address many common questions:

#### **Q: What are my chances of having a child with sickle cell disease?**

A: The chances depend on the haemoglobin type of both parents. If both parents have a sickle cell trait, or if one has sickle cell trait and the other has C trait,  $\beta$  thalassaemia trait or another type of trait, there is a 1 in 4 or 25% chance in each pregnancy that the baby will have sickle cell disease.

#### **Q: If I have a different partner than I had when I got pregnant with my child with sickle cell disease, am I still at risk?**

A: Again, it depends on your new partner's haemoglobin type.

#### **Q: How can my partner be tested?**

A: Testing can be done by a simple blood test called haemoglobin electrophoresis with a full blood count (FBC). This test can be ordered by your doctor.

#### **Q: My partner was tested years ago and was told he did not have sickle cell trait. Does he need to be tested again?**

A: Yes. Some sickle cell trait screening tests aren't very accurate. Also, many don't test for all the haemoglobin traits. Haemoglobin electrophoresis with a FBC gives the best results.

#### **Q: If we are both carriers of sickle cell trait, is there any way to test our baby before it is born?**

A: Yes. Prenatal testing can be done using one of two methods, chorionic villus sampling or amniocentesis.

# Testing Your Baby before it is Born

There are two types of tests which are usually used to test an unborn baby for sickle cell disease. These tests are:

### 1. Chorionic Villus Sampling (CVS)

This test is done by putting a tiny tube through the vagina or abdomen into the uterus. A very small amount of the outer placenta is then gently removed. This test is usually done between the 10th and 12th week after the woman's last menstrual period. With this test, you can find out if your baby has sickle cell disease when you are only three months pregnant.

### 2. Amniocentesis (amnio)

An amnio is done by putting a needle through the abdomen into the uterus. A small sample of amniotic fluid is then removed. This test is done between the 15th and 20th week of pregnancy.

Talk about the benefits and risks of these tests with your doctor or nurse and a genetic counselor. The earlier the test the better for the foetus.

### The test results

These tests can relieve worries you may have about your baby's health if the results show that your unborn baby doesn't have sickle cell disease. If the results show that your unborn baby does have the disease, you may have several different feelings. You may be sad that the baby has sickle cell disease. At the same time, you might feel you can manage the care for another child with sickle cell disease because your child with the disease is doing well with treatment. Knowing before the baby is born that he or she has sickle cell disease can help you plan ahead for the baby's care. You will also have the choice to decide whether or not to continue the pregnancy based on what you think is best for your family. A genetic counselor can offer support and assistance to you in deciding on testing and dealing with the results.

### Should you have the test?

You choose whether you want to have your unborn baby tested for sickle cell disease. A genetic counselor can help you look at whether testing would be helpful. The decision is yours. Only you can decide what is best for you and your family.

# Chances of Passing on Sickle Cell Genes

Sickle cell disease is inherited. Each parent gives their child one gene for haemoglobin. If either gene a child receives is for the usual haemoglobin A, the child will not have sickle cell disease.

To have a child with sickle cell disease, one parent must pass the Haemoglobin S (sickle) gene to the child and one parent must pass Haemoglobin S, C,  $\beta$  thalassaemia ( $\beta$  thal), or another different gene to the child. Both parents must have a **trait**.

For example, each time two people who have sickle cell trait get pregnant:

1. There is a 25% chance that their child will have sickle cell disease. (1 out of 4).
2. There is a 25% chance that their child will get only regular haemoglobin. (1 out of 4).
3. There is a 50% chance that their child will have sickle cell trait. (2 out of 4.)



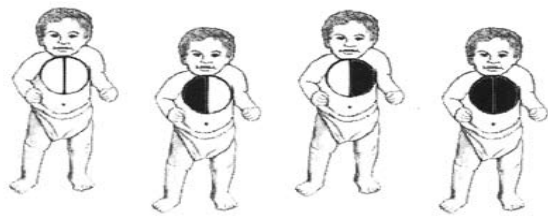
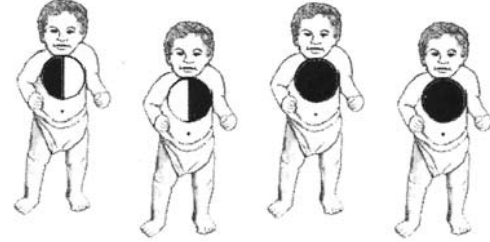
### The chances are the same with each child


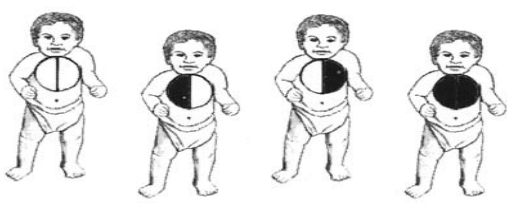
These chances are the same for every pregnancy with the same partner. This means that if you already have a child with sickle cell disease, your next child's chances of having sickle cell disease are the same—25%.

For example, if you have four children, you may not have one child with sickle cell disease. You may have two or three children with sickle cell disease, or none at all. It just depends on chance.

See Appendix H for charts to fill in your and your partner's haemoglobin types. Your genetic counselor or doctor can explain how this applies to your family.

Chances of Having a Baby with Sickle Cell Disease

Both Parents Have Sickle Cell Trait				One Parent Has Sickle Cell Disease and One Parent Has Sickle Cell Trait			
<div>Sickle Cell Trait (AS)</div> <div>Sickle Cell Trait (AS)</div> 				<div>Sickle Cell Disease (SS)</div> <div>Sickle Cell Trait (AS)</div> 			
							
No Trait (AA)	Sickle Cell Trait (AS)	Sickle Cell Trait (AS)	Sickle Cell Disease (SS)	Sickle Cell Trait (AS)	Sickle Cell Trait (AS)	Sickle Cell Disease (SS)	Sickle Cell Disease (SS)
When both parents have sickle cell trait, they have a 25% chance (1 out of 4) of having a baby with sickle cell disease. Each time they get pregnant, they have the same chance.				When one parent has sickle cell disease and the other has a trait, they have a 50% chance (or 1 out of 2) of having a baby with sickle cell disease. Each time they get pregnant, they have the same chance.			

One Parent Has Sickle Cell Trait and One Parent Has C Trait			
Sickle Cell Trait (AS)		C Trait (AC)	
			
			
No Trait AA	Sickle Cell Trait AS	C Trait AC	Haemoglobin SC SC



# *Research and Treatment*

There is no cure for sickle cell disease except for bone marrow transplantation, which can be done in some cases. Now, for the first time, treatments are being developed which could greatly improve the lives of people with sickle cell disease. These treatments are still being studied, so very few people can receive them. However, some of these treatments are now being used on small groups of patients.

Treatments are described in this chapter which hopefully will:

- **Increase fetal haemoglobin**
- **Transplant bone marrow**
- **Change the haemoglobin gene**

### Increasing Foetal Haemoglobin

At birth, newborns with sickle cell disease do not have any symptoms of the disease. They are not anaemic and do not have pain. This is because newborns have a very high level of fetal haemoglobin. Foetal haemoglobin does not sickle, so babies don't have problems. However, as the baby gets older, 9 months of age, sickle haemoglobin replaces foetal haemoglobin.

Since this fact has been known for a number of years, research has looked for ways to increase the fetal haemoglobin level in people with sickle cell disease. In the last few years, experimental treatments have been found which increased foetal haemoglobin levels in a few people. Unfortunately, these treatments have had many side effects. The treatments must be taken every day, and the patient must be watched closely for side effects.

Newer treatments to increase fetal haemoglobin levels include the drug Hydroxyurea. Hydroxyurea alone is effective in decreasing the symptoms of sickle cell disease by increasing foetal haemoglobin, decreasing elevated white blood cell counts, and increasing the total haemoglobin in some patients.

### Transplanting Bone Marrow

Bone marrow transplantation has been used to treat sickle cell disease, other blood diseases, some metabolic diseases, and cancer. It is a way to change the cells in the bone marrow, where blood cells are made.

Briefly, this technique involves giving a patient a dose of radiation or drug therapy to destroy the body's bone marrow cells. After the bone marrow cells are destroyed, bone marrow cells are taken from a brother or sister and given to the patient. Blood from the umbilical cord and placenta of a younger brother or sister can also be used (the procedure is called a cord blood transplant). The new bone marrow cells then begin to grow in place of the patient's bone marrow cells and produce new cells that do not have sickle haemoglobin. In many cases, the patient is cured.

This technique, however, can be very toxic and patients may die from it. Studies are being done to increase the safety of these procedures. Transplantation is one treatment option the sickle cell doctor or the bone marrow transplant doctor can discuss with you if your child has severe sickle cell disease. A bone marrow transplant is only an option if your child has a brother or sister who has identical HLA (Human Lymphocyte Antigen) types as your child with sickle cell disease.

### Changing Genes

In the future, genetic disorders may be fixed by putting a normal gene into the patient's tissue. Before this can be done in humans, we have to find a way to get the gene into the right place, where it will work correctly.

The whole area of changing genes raises many ethical and safety questions. Gene therapy is many years, maybe decades, away.

Other new treatments are being developed which may be available in the future. If you want more information about the ones described in this chapter or others that are not listed, ask your doctor to contact a sickle cell centre.

Remember, simple things like taking penicillin, a good diet, and good general medical care will help your child stay healthy. Blood transfusions and the newer treatments like Hydroxyurea and bone marrow transplantation have already changed the lives of thousands of children with sickle cell disease for the better.

# *Appendices*

# Danger Signs

## Call to be Seen Right Away

Call your doctor or nurse **immediately** to find out where you should bring your child to be seen if your child has any one of these danger signs:



Fever:	38.3° C or higher
Head/Neck:	Severe headache or dizziness Stiff neck
Chest:	Pain or trouble breathing
Stomach:	Severe pain or swelling
Color:	Very pale
Penis:	Painful erections
Behavior:	Seizures Weakness or paralysis (can't move arm or leg) Can't wake up

If you think something is wrong, call your doctor. Trust your own judgment.

**If you can't reach your doctor, go to the emergency room. These symptoms could be a sign of serious problems that need medical attention right away.**

## Call for Advice

Call your doctor or nurse for advice if your child does or has any of these problems.



Stomach:	Vomits more than once Has diarrhea more than once
Color:	Jaundiced (eyes or skin look yellow)
Arms, legs, and back:	Pain, with no other symptoms
Chest:	Coughs without fever or chest pain
Nose:	Runny or stuffed nose
Behavior:	Isn't acting right Refuses to take medicines Refuses to eat or drink Is less active than usual

Again, if you think something is wrong or your child just doesn't look right, call your doctor. Many times, you can handle problems at home after talking with your doctor or nurse. You may be asked to call in each day for several days to be sure your child is getting better.

Cut this copy out, write down your doctor's telephone number, and post in a place where it can be found easily.

# Comprehensive Sickle Cell Disease Care Plan

Evaluation	Interval
<b>General Physical exam</b>	
Under 6 months	Once a month
6 months - 1 year	Every 2 months
1 - 6 years	Every 3-4 months
<b>Immunizations</b>	See Appendix C
<b>Comprehensive Social Worker evaluation</b>	
Interview	Every 2 years
Home visit	Once a year
School Assessment	One a year
<b>Genetic Counseling Services</b>	
Family Studies	First visit
Counseling and Education	1 - 3 times a year
<b>Haematology (red blood cell) Evaluation</b>	Every 3 months to age 2; then every 6 months
<b>Liver Studies</b>	Once a year after age 12 months
<b>Gallbladder Evaluation</b>	Every year after age 12 months
<b>Renal</b> (Kidney tests)	Once a year after age 12 months
<b>Brain</b> (TCD Screening)	Annually beginning at age 2 (more often if needed)
<b>Cardiac</b> (Heart tests)	Every 2 years
<b>Pulmonary</b> (Lung tests)	Every 6 months or when needed after age 12 months
<b>Dental evaluation</b>	Once a year, starting at age 3
<b>Psychological/Family Therapy Consultation</b>	Once a year
<b>Physical Therapy Assessment</b>	When needed
<b>Developmental Screen</b>	Once a year or when needed
<b>Formal Nutrition Assessment</b>	Every 2 years or as needed

# Baby Shots for Children with Sickel Cell Disease (Immunizations)

Age	Type of Shot (Immunization)
Birth	BCG (Tuberculosis), OPV(Polio), Hepatitis B
6 weeks	DTP (Diphtheria, Tetanus, Pertusis), Hepatitis B, Hib (Haemophilus influenzae type b), OPV, Pneumococcal conjugate vaccine (PCV 10)
10 weeks	DTP, Hib, OPV, Pneumococcal conjugate vaccine
14 weeks	DTP, Hib, OPV, Pneumococcal conjugate vaccine, Hepatitis B
9 months	Measles, Yellow Fever, Pneumococcal conjugate vaccine
24 months	Pneumovax (PPV23)
4 - 6 years	DTP, OPV
4 to 6 years or 11 to 12 years	Meningococcal conjugate vaccine (MCV4) is recommended (Northern Nigeria)
Yearly	Influenza vaccine in Fall (must be at least 6 months of age)

Keep a record of the dates your child receives shots. Carry the record with you to show your doctor.

Appendix D

TRAVEL LETTER

Re: \_\_\_\_\_

SAMPLE

DOB: \_\_\_\_\_

To whom it may concern: \_\_\_\_\_ is a  
\_\_\_\_\_ month old child with haemoglobin \_\_\_\_\_ disease who is followed at  
\_\_\_\_\_ under the care of \_\_\_\_\_.

In order to decrease the morbidity from their disease, our patients and their families are educated to recognize the symptoms and seek immediate treatment of the following emergencies seen commonly in sickle cell disease. We would appreciate your cooperation in the event that any of these patients come to you for treatment.

Fever greater than 38.3o C: Aggressive evaluation for the source of such a fever in the young child with sickle cell disease is very important. This evaluation should include FBC, reticulocyte count, blood culture, chest x-ray and urine culture. If the patient is younger than five years, he or she should be started on IV parenteral antibiotics (Ceftriaxone) pending blood culture results. If the patient is over five years of age and nontoxic, oral antibiotics can be used after an initial dose of ceftriaxone.

Acute chest pain or difficulty breathing: The patient should have a chest x-ray, CBC, reticulocyte count, and consider arterial or venous blood gas studies if there is any evidence of acute respiratory distress or low oxygen saturation on a pulse ox machine. If the patient is febrile, antibiotics should be started. In a patient with severe chest pain or new pulmonary infiltrate, hospitalization is mandatory.

Acute pain not relieved by acetaminophen (Paracetamol®), fluids, bedrest: An aggressive evaluation for the source of the pain is mandatory. CBC, reticulocyte count, and other appropriate laboratory tests are also recommended.

Marked lethargy or tiredness: Physical examination documenting the size of the spleen, CBC, reticulocyte count and observation are required.

Vomiting, dehydration: Generally, these patients should be hydrated with saline containing solution. CBC and reticulocyte count should be done, and electrolytes are selectively indicated.

Neurologic symptoms (seizures, weakness in the arms or legs, severe headaches, marked dizziness or visual changes): The patient should undergo an extensive neurological examination. All patients with neurological symptoms should be admitted to the hospital. The possibility of a cerebrovascular accident should always be considered and verified or ruled out with an emergency Computerized Tomography and an MRI/MRA when available. Blood transfusion should not be delayed awaiting tests if a stroke is considered likely. A spinal tap for febrile patients may be indicated. Exchange transfusion should be considered, and we should be notified of such a situation immediately.

Telephone number \_\_\_\_\_ .

Dr \_\_\_\_\_ . is available at telephone number \_\_\_\_\_

during regular business hours to provide further information about individual patients, to answer any questions, and to screen calls for appropriate physicians. During other times, or if you need to speak to the on-call Paediatrician, the \_\_\_\_\_ hospital switchboard can page one of

our physicians 24 hours a day at \_\_\_\_\_.

# Suggested Acetaminophen/Paracetamol\* Dose Chart

\*Brand Names: Paracetamol, Tylenol®

	Drops		liquid	Tablets
Age	80 mg Dropperful	0.8 ml Dropperful	120 mg 5 ml	500 mg tablets
0-3 months	½ dropper	0.4 ml	-	-
4-11 months	1 dropper	0.8 ml	½ teaspoon	-
12-23 months	1½ droppers	1.2 ml	1 teaspoon	-
2-3 years	2 droppers	1.6 ml	1½ teaspoon	-
4-5 years	-	-	2 teaspoons	½ tablet
6-8 years	-	-	2 teaspoons	¾ tablet

Give your child the right dose 4 or 5 times a day or as ordered by your doctor. Don’t give your child more than 5 doses in 24 hours.

# Suggested Ibuprofen\* Dose Chart

\*Brand Names: Ibupain, Brufen, Advil®

Age	Suspension (100mg/5ml)	Tablets (400mg)
6 – 11 months	2.5 ml (50 mg)	
12 – 23 months	5.0 ml (100 mg)	
2 – 3 years	7.5 ml (150 mg)	
4 – 5 years	10.0 ml (200 mg)	½ tablet
6 – 8 years	12.5 ml (250 mg)	
9 – 10 years	15.0 ml (300 mg)	
11 – 12 years	20.0 ml (400 mg)	1 tablet

Give your child the right dose 2 to 4 times a day or as ordered by your doctor. Don’t give your child more than 4 doses in 24 hours.



# Temperature Conversion Chart

Celsius (°C) to Fahrenheit (°F)

	°C	°F
	36.0	96.8
	36.2	97.2
Normal armpit temperature	36.4	97.5
	36.6	97.9
	36.8	98.2
Normal temperature by mouth	37.0	98.6
	37.2	99.0
	37.4	99.3
Normal temperature by rectum	37.6	99.7
	37.8	100.0
	38.0	100.4
	38.2	100.8
Call your doctor if your child has a fever at or above 101° F or 38.3° C.	38.4	101.1
	38.6	101.5
	38.8	101.8
	39.0	102.2
	39.2	102.6
	39.4	102.9
	39.6	103.3
	39.8	103.6
	40.0	104.0
	40.2	104.4
	40.4	104.8
	40.6	105.1
	40.8	105.4

Different centres and doctors may use other approaches to treating these problems.

Nigerian Parent Support Groups

	Club/ Foundation	Location	Phone number	Contact person	Email address
1.	Sickle Cell Health Watch	Yenagoa/ Bayelsa	08038977327	Philomena Aladei	Oyinemi2001@yahoo.co.uk
2.	Sickle Cell Club	Calabar	08036779276	Dr. Enang E. Ukpong	geukpong @yahoo.com
3.	Oluwatoki Oluseye Siickle Cell Foundation	Ibadan	08033491006	Rev. Canon Oluseye Ogunrinde	Oluseye-ogunrinde@yahoo.com
4.	Sickle Cell Hope Alive Foundation (SCHAF)	Ibadan	08108192619 08033884293	Prof. A.G. Falusi	schafoundation@gmail.com www.schafng.org
5.	Nike Opalemo Sickle Cell Foundation	Lagos	08083858961	Mrs. Nike Opalemo	opalemojoslineadekoya@yahoo.com
6.	The Sonny Kuku Foundation	Lagos	08023081224	Mayowa Adeyemi	info@tskfoundation.org www.tskfoundation.org
7.	Sickle Cell Club	Kano	08065435023	Dr. Abubakar Bala	abbadara@yahoo.com
8.	Sickle Cell support Group	Kaduna	08137360788	Deacon Layi Adisa	deaconadisa@yahoo.com
9.	Sickle Cell Club	Badagry	08035821373	Abegunde A. S.	abegundearinola@yahoo.com www.sicklerloosed.8k.com
10.	Sickle Cell Patients’ Network	Kaduna	080378779799	Hajiya B. M. Inuwa	sicklecellpatient@gmail.com www.sicklecellpatient.org
11.	Sickle Cell Club	Island	08023273594	Dr. Braithwaite	banwotunjibraithwaite@co.com
12.	Sickle Cell Club	Yaba	08033729436	Mrs. Adele	t_jeleelat@yahoo.com
13.	Sickle Cell Club	University of Lagos	08033005540	Dr. Akinfala	femiakinfala @yahoo.com
14.	Sickle Cell Club	Festac	08034748125	Mr. Omitogun	omitogunmathew @yahoo.com
15.	Sickle Cell Club	Isolo	08037125465	Mr. Anthony Osegbue	okeyosegbue@yahoo.com www.sicklecellfoundation.com
16.	Sickle Cell Advocacy & Management Initiative	Surulere	08023132702	Ms. Toyin Adesola	info@sami-ng.org  www.sami-ng.org

## Appendix G

17.	Sickle Cell Club	Surulere	08023271415	Dr. M.O.Kehinde	mokehinde@cmui.edu.ng mo_kehinde@yahoo.com
18.	The Gene SS Folks	Igando	08024749448	Mrs. Niniola Philips-Adeleye	shunnamitewoman@yahoo.com` genessfolks@yahoo.com
19.	Sickle Cell Club	Ijebuode	08055125468	Mrs. Adebajo	taadebanjo@yahoo.com
20.	Maidunama Sickle Cell Foundation	Jos	08037022089	Rabi Maidunama	rabichina@yahoo.com
21.	Sickle Cell Club	Osogbo	08035150289	Dr. Raji	niyiraji@yahoo.com
22.	Run Sickle Cell Club	Mowe/Ogun	08052236377	Dr. O. O. Ilesanmi	toytundun@aol.com
23.	Society for Counseling & Support	Abuja	08028551863	Mr. Emmanuel Benjamin	heamatologistben@yahoo.co.uk
24.	Sickle Cell Club	Ibadan	07033747593	Mrs. E. O. Ajiboye	jewelbuk@yahoo.com
25.	Sickle Cell Humanitarian Organization	Katsina	08039703222	Mrs. Halima Idowu	Halimaidowu@yahoo.com
26.	Sickle Cell Club	Ife	08037115500	Mrs. Fashina	sicklecellclubife@yahoo.com
27.	Sickle Cell Club	Ibadan	08054044916	Dr. Ipadeola	ipadeolat@yahoo.com
28.	Sickle Cell Promotion Centre		08029087796, 08033217343		Sicklecellpatient@gmail.com www.sicklecellpatient.org
29.	Orient Sickle Cell Foundation	Awka	08038995415	Chudi T. Mokebe	tholcylab@yahoo.com
30.	Cannon Sickle Cell Club	Enugu	08037844949	Charity Aneke	anekecharity@yahoo.co.uk

# Diagrams of Inheritance (Punnett Squares)

	A	S
A	AA	AS
S	AS	SS


	A	S
A	AA	AS
A	AA	AS


	A	S
A	AA	AS
C	AC	SC


# Health Care Providers

### **Audiologist**

The person who tests your child's hearing if any problems come up.

### **Cardiologist (heart specialist)**

The doctor who does ECG, echocardiograms (ECHO) and checks your child's heart.

### **Dentist**

The doctor who helps your child keep his teeth healthy and clean.

### **Family Physician**

A doctor who provides medical care for people of all ages, from babies to older adults. A family physician can give your child routine health care, referring to other specialists as needed.

### **Genetic Counselor**

A person who explains how your child inherited sickle cell disease and your chances of passing it on to future children. They also can tell you if there are any other hereditary disorders that might be in your family. The genetic counselor teaches you and your child about the disease and how to deal with it.

### **Haematologist (blood specialist)**

The doctor who treats your child's sickle cell disease and other blood diseases. Usually pediatric haematologists are also oncologists (treat children with cancer) and are called Pediatric Haematologist Oncologists.

### **Nephrologist (kidney specialist)**

The doctor who treats your child's kidneys if they are damaged.

### **Neurologist**

The doctor who is an expert in the nervous system. The nervous system includes the brain. This specialist checks for seizures, strokes, or related problems.

### **Neuropsychologist**

This is a psychologist who helps evaluate and treat children with learning problems.

### **Public Health Nurse**

A nurse who has special training in community health. The Nurse provides educational and clinical services in the community.

### **Nutritionist**

The person who gives you advice on the best foods for your child and helps you find ways to get your child to eat what is good for him.

### **Occupational Therapist**

The person who takes your child to “O.T.” (Occupational Therapy) when he is in the hospital. These therapists help your child do activities that are useful as well as interesting. These activities can include dressing, cooking, sewing, computer games, etc. These activities can help your child focus on other things besides being sick or in pain.

### **Ophthalmologist (eye specialist)**

The doctor who checks your child’s eyes for any sickle cell damage. This doctor can use surgery or laser therapy to correct problems in and around the eye.

### **Orthopedist (bone specialist)**

The doctor who treats damaged bones or joints.

### **Paediatrician**

A doctor who provides medical care for children. A pediatrician can give your child routine care, referring your child to other specialists as needed.

### **Physiotherapist**

The person who takes your child to “P.T.” (Physical Therapy) when he is in the hospital. These therapists also bring hot packs to the clinic if your child is being treated for pain or provide activities designed to help relieve pain, such as mild exercise or whirlpool (hot tub) treatments.

### **Primary Care Physician**

A doctor who provides medical care for people of all ages, from babies to older adults. A primary care physician can give your child routine health care, referring to other specialists as needed.

### **Psychiatrist**

A doctor who has special training to help people deal with stress and can prescribe medications to help relieve stress.

### **Psychologist**

A person who provides counseling for families and children. Psychologists are trained to help children and families deal with a chronic illness, including stress and pain. They also help with other concerns, such as school problems, behavior problems, and depression.

### **Social Worker**

The person who helps children and families cope better with sickle cell disease. A social worker can help you with billing and health insurance, getting medical care in and out of the hospital, and finding support for your emotional needs. You and your child can also talk to a social worker about any of your problems or feelings.

Child Development Chart\*

BIRTH TO 6 MONTHS		
1. Signal with hands, feet, other body movements his wants and needs. 2. Follows things in front of him. By 3 months, able to track objects. 3. Able to grasp toy but not hold. By 3 months, able to recognize and grasp objects and bring to mouth.	1. Coos and gurgles when playing and happy, cries when irritated or anxious. 2. Responds to sounds and imitates by making noises. 3. Quiet when satisfied.	1. Responds to noise and sights around him. 2. By first month, responds to a familiar face. 3. Smiles and gurgles appropriately. 4. Able to engage in play with own hands and fingers. 5. Able to play with toys and own clothes, etc.
6 MONTHS TO 12 MONTHS		
1. Able to sit up briefly. By 9 months, able to sit up as long as he wants. 2. Able to support own weight briefly when standing. 3. Can use chair to stand up. 4. Rolls over and crawls.	1. Jabbers when crying. 2. Can say “mama” and “dada”. 3. Can say 1 or 2 other words.	1. Understands 3 or 4 words. 2. Begins to explore objects and her body (e.g., sucking fingers). 3. Responds playfully to other persons. 4. Learns through the senses (touch, taste, smell).
12 MONTHS TO 18 MONTHS		
1. Can stand alone for a short time. 2. Walks when hand is held. 3. Can pull up to stand and walk with the support of furniture. 4. Able to play by imitation.	1. Communicates by crude body language (e.g., shaking head for “yes” or “no”). 2. Can say 2 other words clearly besides “mama” and “dada”.	1. Can follow some commands. 2. Can play with others by choice. 3. Cooperates in dressing.

18 MONTHS TO TWO YEARS		
1. Toddles by self with very little falling. 2. Seats self in small chair and climbs into adult chair. 3. Picks up and throws toys (balls) while standing. 4. Crawls up stairs by self. 5. Capable of toilet training. 6. Feeds self with some spilling.	1. Develops own baby talk (special words for objects, people, etc.). 2. Speaks clearly 4 to 10 words, including names.	1. Follows simple commands. 2. Recognizes and names some faces or pictures. 3. Says “thank you” or shows appreciation. 4. Points to or states wants. 5. Likes to play with cuddly toys.
2 YEARS TO THREE AND ONE-HALF YEARS		
1. Runs well, doesn’t fall. 2. Walks up and down stairs alone. 3. Walks backwards. 4. Engages in increased physical activity. 5. Feeds self well. 6. Able to dress self with little help. 7. Throws ball overhand. 8. Able to help put toys away. 9. Rides tricycle using pedals.	1. Names some drawings (i.e., horse, shoe, ball or dog). 2. Refers to self as “I”. 3. Knows full name. 4. Uses pronouns. 5. Uses 3 and 4 word sentences. 6. Uses phrases.	1. Able to see others as helpers in getting what he wants. 2. Able to state toileting needs. 3. Learns by imitation. 4. Able to recognize differences between boys and girls. 5. Interested in fantasy play (make believe).
THREE AND ONE-HALF YEARS TO SIX YEARS		
1. Does broad jump. 2. Washes and dries face and hands, brushes teeth by self. 3. Hops on one foot. 4. Able to tell front of clothes from back. By age 5, able to dress and undress self. 5. Skips, alternating feet.	1. Names one or more colors correctly. 2. By age 4, names penny, nickel, dime. 3. Can make descriptive comments on pictures. 4. By age 6, defines words by their function (e.g., house is to live in).	1. Asks meaning of words. 2. Able to engage in play with others. 3. Begins to explore his living environment more. By age 6, his large increase in vocabulary allows him greater interaction with family and other persons. 4. By age 5, can do tasks by self. 5. By age 6, knows morning from night time. 6. By age 6, knows right from left. 7. By age 6, in effort to understand himself, becomes more like his parents. 8. By age 6, shows problem solving skills, may develop a hobby, and becomes more competitive with others.

\* Within each age group the items are in sequential order.  
Many items are taken from the Denver Developmental Screening Test.



## Nigerian Sickle Cell Disease Centres

Sickle cell centres are available at all tertiary hospitals in Nigeria.

## Additional Resources

### Books, Foundations, Information

#### Books on Parenting

Edelman, Marina Wright, *The Measure of Our Success: A Letter to My Children and Yours*, Harper-Collins, 1993.

Beal, Anne C, Villarosa, Linda, Abner, Allison, *The Black Parenting Book*, Broadway Books, 1998

Poussaint, Alvin S. and Comer, James, *Raising Black Children*, Plume, New York, 1992

Price H. *Achievement Matters: Getting Your Children the Best Education Possible*. Kensington Publishing Corporation, 2003

Boyd-Franklin, AJ. *Boys into Men: Raising Our African American Teenage Sons*, Penguin Group, 2001

Ginott H, Ginott A, Goddard HW. *Between Parent and Child*. Three Rivers Press, 2003

Corwin DG. *The Tween Years: A Parent's Guide for Surviving Those Terrific, Turbulent and Trying Times*. McGraw-Hill, 1998.

Leff PT., Walizer EH. *Building the Healing Partnership: Parents, Professionals and Children with Chronic Illnesses and Disabilities*. Brookline Books, 1992.

#### Books on Sickle Cell Disease

Akinyanju O., Olujohungbe A.: *How to Live with Sickle Cell Disorder*. BookBuilders, Editions Africa, 2009.

Kotila R.T.: *Sickle Cell Disease, that all may be aware*. Ibadan University Press, Ibadan. 2010.

#### Foundations

Nigeria: [www.sicklecellfoundation.com](http://www.sicklecellfoundation.com)

Ghana: [www.sicklecellghana.org](http://www.sicklecellghana.org)

United Kingdom: [www.sicklecellsociety.org](http://www.sicklecellsociety.org)

United States: [www.sicklecelldisease.org](http://www.sicklecelldisease.org)

## Appendix L

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### Information

National Center for Biotechnology Information, U.S. National Library of Medicine  
[www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

National Heart, Lung, Blood Institute Disease, Inc. (National Institute of Health): (301) 592-8573;  
[www.nhlbi.nih.gov/index.htm](http://www.nhlbi.nih.gov/index.htm)

March of Dimes: [www.marchofdimes.com](http://www.marchofdimes.com)

Brave Kids - Help for Children With Chronic, Life-threatening Illnesses or Disabilities: [www.bravekids.org](http://www.bravekids.org)

Medical Home (American Academy of Pediatrics) Particular focus on transition to adult care:  
[www.medicalhomeinfo.org](http://www.medicalhomeinfo.org)

MEDLINEplus: [www.nlm.nih.gov/medlineplus/sicklecellanemia.html](http://www.nlm.nih.gov/medlineplus/sicklecellanemia.html)

Sickle Cell Anemia Mini-Course and Virtual Lab: <http://k14education.uams.edu/SickleCell>

### Website for Children

[www.sicklecellkids.org/sicklecell\\_temp.html](http://www.sicklecellkids.org/sicklecell_temp.html)

# Glossary

### **Amniocentesis (amnio)**

A test done usually between the 15th and 20th weeks of pregnancy. It is used to find out if an unborn baby has sickle cell disease and certain other disorders. The test is done by putting a needle through the abdomen into the womb. A small amount of amniotic fluid is taken out and tested.

### **Anaemia (low blood)**

A condition in which there is less haemoglobin in the blood than usual so that the blood can't carry as much oxygen.

### **Aplastic episode**

An episode when the bone marrow stops making red blood cells. The blood count may fall much lower than usual. If it happens, it is usually with a fever or infection.

### **Carrier**

A person who has one gene for Haemoglobin A and one gene for another type of haemoglobin. This person is also referred to as having a haemoglobin trait. A carrier doesn't have the disease, but two carriers can have a baby with sickle cell disease.

### **Chorionic Villus Sampling (CVS)**

A test done between the 10th and 12th weeks of pregnancy. It is used to find out if an unborn baby has sickle cell disease and certain other disorders. The test is done by putting a needle through the abdomen or a thin tube through the vagina into the womb. A small amount of the placenta is taken out and tested.

### **Chromosome**

Structures containing the genes in the body. Most people have 46 chromosomes. Prenatal testing can be done to study an unborn baby's chromosomes.

### **Full Blood Count (FBC)**

A blood test which measures the size of the red blood cells and the amount of haemoglobin. It tells the number of red blood cells, white blood cells, and platelets.

### **Dehydration**

A condition caused by not having enough water in the body. Dehydration can happen with diarrhea, fever or exercise. It may cause a sickling episode in someone with sickle cell disease.

### **Echocardiogram (ECHO)**

Testing the heart for abnormalities including abnormal pressures, such as for pulmonary hypertension.

### **Electrocardiogram (ECG)**

A test of the electrical activity of the heart, usually used to check for abnormal rhythms, like missed beats or rapid heartbeats.

### **Electrophoresis**

One of the best blood tests to find out a person's haemoglobin type. It shows most haemoglobin traits and can determine different types of sickle cell disease.

### **Foetal Haemoglobin**

The most common type of haemoglobin in a fetus (unborn baby). It is later replaced by adult haemoglobin (although small amounts are produced throughout life).

### **Gene**

The basic unit of heredity. Genes are passed on by a mother in the egg and by a father in the sperm. People have about 35,000 genes which determine many characteristics, including haemoglobin type.

### **Hand-Foot Syndrome**

Painful swelling in hands and/ or feet in young children with sickle cell disease. It is caused by blockage of tiny blood vessels with sickle cells.

### **Haemoglobin**

The substance which carries oxygen in red blood cells. People with sickle cell disease often have lower haemoglobin levels.

### **Haemolytic Anaemia**

Low blood count due to increased breakdown of the red blood cells.

### **Hyperhemolytic episode**

A rapid breakdown of red blood cells which causes severe anaemia in people with sickle cell disease. It is associated with a quick increase in the size of the spleen.

### **Infarct**

A blockage of blood flow that causes tissue to die because it doesn't have enough oxygen.

### **Inherited**

A characteristic passed on from parents to their children. Sickle cell disease is an inherited disease.

### **Jaundice**

Yellowish color of the skin or eyes. It is caused by coloring material from red blood cell breakdown.

### **Leg ulcer**

A breakage in the skin that begins as a small sore on the lower leg -above, over and around the ankle. It can be caused by injury and decreased blood flow.

### **Malaria**

A disease carried by a certain type of mosquito in tropical areas of the world. Malaria causes fever, serious illness, and often death. People who have sickle cell trait are better able to survive malaria than those who only have Haemoglobin A.

### **Neuropsychological Testing**

This testing may be done in young children to determine how to help them if they are having a hard time learning. A specially trained psychologist will ask the child questions. There may be some questions for the child to read and then write their answers. Sometimes testing can take as long as eight hours and has to be done in two sessions.

### **Prenatal Diagnosis**

Testing for genetic disorders and some birth defects which is usually done before the 20th week of pregnancy. The most common tests are amniocentesis, chorionic villus sampling (CVS), and diagnostic ultrasound.

### **Priapism**

A persistent, painful, unwanted erection of the penis caused by sickling.

### **Prophylactic Penicillin**

Penicillin which is given in order to reduce the number and severity of infections in children with sickle cell disease.

### **Pulmonary Hypertension**

This is a term for the heart having to pump harder than usual to get blood to the lungs. In sickle cell disease it is caused by lung damage from sickling. An echocardiogram will help determine if pulmonary hypertension is present.

### **Sickle Cell Anaemia**

Another name for SS disease, the most common type of sickle cell disease.

### **Sickle Cell Disease**

A term which refers to all types of sickle haemoglobin disorders, such as SS disease, SC disease and S  $\beta$  thalassaemia disease. Some people call haemoglobin SS sickle cell anaemia.

### **Spleen**

An organ on the left side of the body that may be felt below the rib cage. It is a filter to remove bacteria from the blood. This organ does not work well in sickle cell disease. It can trap blood and become enlarged.

### **Splenectomy**

Surgery to remove the spleen. This is done to cure the serious anaemia that happens when blood is trapped in the spleen.

### **Splenic Sequestration**

One type of episode that can occur in patients with sickle cell disease which can be life threatening. It is caused by blood being trapped in the spleen.

### **Trait (see Carrier)**

### **Transfusion**

Blood given to someone because of a very low blood count, to prepare for surgery or to treat certain complications of sickle cell disease.

### **Transcranial Doppler (TCD)**

An Ultrasound used to measure blood flow in the blood vessels of the brain. This is a non-invasive test for stroke and can be used to screen for a chance of a future stroke.

### **Ultrasound in Pregnancy**

An instrument which uses sound waves to show a picture of an unborn on a monitor, similar to a television screen. Measurements can be used to figure out the baby's due date. It can also show the baby's position, the number of fetuses, and can help check the baby's growth. More detailed studies can detect certain types of birth defects. Ultrasound is also used to assist in amnio and CVS. Also called a sonogram.

### **Vaso-Occlusive episode**

Occurs when sickle cells block the flow of blood. This causes pain and, if severe, tissue damage.

### **White Blood Cells**

Infection-fighting cells in the blood.