



******SPECIAL EDITION******

Dear Reader's,

September is devoted to Sickle Cell Awareness. There are 4 sickle cell centers that serve Tennessee. It is our privilege to honor all the centers and the work and dedication they provide to the people visiting and living in our state.

Best wishes,
NBS Staff

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1. MEHARRY SICKLE CELL CENTER located in Nashville serves 40 counties in middle TN.

Newborn Screening and the Hemoglobinopathies

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Newborn Screening (NBS) involves a series of laboratory and medical tests performed mainly in blood collected by heel prick within 48 hours after birth. The newborn's blood is spotted on paper cards, also known as Guthrie Spots, and sent to the State Public Health Laboratories or another Participating Laboratory for testing. NBS is performed to detect genetic and congenital disorders in newborns, with the ultimate goal of treating the disease to prevent the morbidity and mortality associated with these disorders. In 1972, following the passage of the National Sickle Cell Anemia Control Act by President Nixon, along with the passage of the National Genetic Disease Act in 1978, funding was provided for the establishment of Sickle Cell Centers around the country. Before 1972, Meharry as an HBCU was already performing testing for SCD in populations at risk. **The Meharry**

Sickle Cell Center (one of the oldest in the country) was officially established in 1972, with a subcontract from the state of Tennessee (TN) to provide SCD screening and education to both, the population at risk and health care providers. In the mid 1980s, universal screening for SCD became a reality due to the political influence exerted by the Civil Rights Movement of the 1960s, the advent of new and affordable clinical laboratory tests for the diagnosis of SCD, and the discovery that prophylactic penicillin prolonged survival of SCD children that otherwise would have succumbed to infections. Early identification of affected infants through NBS for SCD prevents the mortality associated with pneumococcal sepsis and splenic sequestration during childhood. The state of TN started universal NBS for Hemoglobinopathies in 1988. From this time on, **The Meharry Sickle Cell Center** became (MSCC) the Hemoglobinopathy Confirmatory and Reference Laboratory for the state of TN NBS Program.

The state of TN currently screens for 40 analytes which may detect greater than 60 genetic disorders. The addition of Cystic fibrosis to the NBS panel is currently being evaluated in TN. Yearly, NBS in the USA detects approximately five-thousand newborns with severe genetic disorders.

Sickle Cell Disease is a serious genetic disorder caused by a mutation in the β -globin gene involving the substitution of glutamic acid with valine at position of amino acid six of the β -globin chain, giving rise to sickle hemoglobin (HbS) inside the red blood cells (RBC). When the concentration of Hb S (sickle hemoglobin) is greater than 50%, the condition is called sickle cell disease, which includes the homozygote state (sickle cell anemia, HbSS), the sickle beta-thalassemia states (sickle-beta plus, HbS β^+ and sickle-beta zero, HbS β^0) and combinations of HbS with other hemoglobins, i.e HbSC, HbSE, HbSD, and HbSOArab. If the amount of HbS inside the red blood cells is less than 50%, the condition is called sickle cell trait (HbAS) which is the heterozygote state, and the red blood cells in these individuals contain HbS (usually 35-45%) and normal adult hemoglobin HbA (55-65%).

Deoxygenating conditions trigger polymerization of Hb S inside the red blood cells, which lead to the formation of sickle cells (sickling), which is a key event in the pathophysiology of SCD. Even though SCD is a monogenic disorder, it shows a wide heterogeneity in the severity of its clinical manifestations. The main clinical manifestations of SCD are a chronic hemolytic anemia and recurrent painful vaso-occlusive episodes. The number of pain episodes per year are a measure of the clinical severity of SCD and correlates with early death. Secondary complications in SCD include infection, stroke, organ failure, acute chest syndrome, kidney disease, gout, osteomyelitis, gallstones, pulmonary embolism, osteoarthritis, and an overall impaired quality of life (QOL) with a reduced life expectancy. The median survival age for SCD patients is 42 years for males and 48 years for females; a reduction of 25-30 years in life expectancy. Still, life expectancy is longer than it was in the past, particularly related to the inclusion of hydroxyurea (HU), prophylactic penicillin and pneumococcal immunizations in the treatment regimen.

Newborn Screening Follow-Up: The identification of SCD or sickle cell trait (SCT) newborns is done efficiently at birth through the NBS Program at state public health screening laboratories. Follow-up of SCD and SCT involves confirmatory diagnosis, genetic counseling, education and clinical management. After confirmation, trait follow-up counseling is done through a letter communicating the newborn carrier status, or through a face to face meeting, if requested by the family. SCD counseling follow-up is done through a home visit by the genetic counselor and/or follow-up nurse or by appointment at the Sickle Cell Center.

In the past few years, in the state of Tennessee along with other states, there has been a large Hispanic population influx, and SCT is not uncommon in this population, with incidences ranging from 0.55 to 5.7% according to published data in similar Hispanic populations. Therefore, there is a need to screen immigrant children and adults, since most likely they have not been screened at birth, in their home countries.

Family protocols that provide SCD knowledge and coping techniques, and involve the extended family members of the affected individuals will increase family awareness and support of the primary caregivers. Innovative and effective educational methods that are age appropriate for individuals with SCD need to be developed as well. Summer camps and mini-camps have been effective ways to teach and give emotional support to children with SCD and their families.

Confirmatory Diagnosis: After the State Public Health Laboratory has identified an infant with SCD, SCT or any other hemoglobinopathy using dried blood; the follow-up nurse makes sure that a second blood sample (fresh liquid blood) is sent for confirmatory testing to the Hemoglobinopathy Reference and Confirmatory Laboratory. The laboratory methods used are isoelectric focusing electrophoresis, alkaline, acid and neutral electrophoresis, high performance liquid chromatography and DNA testing for rare hemoglobin variants.

Clinical Management of Infants and Children with SCD: Several factors have contributed to the increased in life expectancy for sickle cell disease. They are related primarily to early identification of the disease and proper health care management, including penicillin prophylaxis, immunizations against pneumococcal infections, and folate administration even though there is no real evidence that sickle cell patients are folate deficient. The management of sickle cell disease has to be done with age appropriate protocols, starting with pediatric primary and hematologic care, from birth to 15 years of age, then transitional protocols into adult care.

Incidence of SCD in the USA: Today, SCD is the most common genetic disorder detected by NBS in the USA population, with an incidence of 1: 2000 to 1:2500 individuals. Its incidence in the minority population is strikingly high. In the African American population 1 out of every 375 births is affected by SCD. In the Eastern USA Hispanic population 1 out of every 1114 infants are born with SCD. SCD is also prevalent in people of Mediterranean, Middle Eastern Indian, Caribbean, and South American descent. SCD is found in the Native American and Caucasian population as well, with an incidence of 36.20 and 1.72 per 100,000 population respectively.

In summary, NBS includes testing for an array of genetic and congenital disorders, such as inborn errors of metabolism, congenital hypothyroidism, **hemoglobinopathies** and congenital hearing loss. In the U.S.A approximately 4 million infants per year are tested by NBS. NBS Confirmatory Laboratories for Hemoglobinopathies have provided early identification of infants affected with these disorders and have facilitated early treatment and prevention of the morbidity and mortality associated with these disorders.



2. UNIVERSITY OF TN GENETIC CENTER-KNOXVILLE serves 24 counties in east TN.



(Joyce Dalton, parent volunteer at health fairs for UT Knoxville Genetics)

Mission Statement: The University of Tennessee Genetic Center of today represents almost 40 years of dedication to the health of the people of East Tennessee. Starting with one clinician (a surgeon with an interest in the “new” field of genetics) in 1966, the Center has grown through the addition of a cytogenetics laboratory, social workers, a biochemical laboratory, a molecular laboratory, additional clinicians (now board certified in genetics) genetic counselors, a nutritionist, and a variety of support personnel.

The Center’s mission is to provide diagnosis, counseling, treatment and outreach assistance for clients referred by area physicians or identified through the state newborns screening program. In addition the Center provides training in the areas of clinical and laboratory genetics to physicians and allied health personnel.

The Sickle Cell Program at the University of Tennessee Genetic Center Knoxville serves 24 counties in East Tennessee. Counseling and education is provided to all individuals and their families identified by the Tennessee Women’s Health and Genetic Newborn Screening Program to have, or be at risk for sickle cell disease, trait, or other hemoglobinopathies. Services include but are not limited to: informing parents of the possible diagnosis, coordinating diagnostic testing, disclosing test results, referral to hematology clinics for specialized care, identification of resources to help the family negotiate a complicated health care system and, home and hospital visits for education and support. These services are tailored to each family’s needs and desires. For families of newborns who are found to be carriers of any hemoglobinopathy, genetic counseling is provided as well as referrals when appropriate. In an effort to increase public awareness, Dee, other center staff, and a trained parent volunteer participate in community health events in our catchment area. There we provide an on site display as well as educational materials, and take home brochures. We also offer free hemoglobin testing to anyone who desires to know his/her hemoglobin status. So far this year, we have participated in 13 health fairs and provide testing to scores of individuals who otherwise would not have had the opportunity to know their hemoglobin status. If you have any questions about our programs please contact:

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3. ST. JUDE CHILDREN'S RESEARCH HOSPITAL located in Memphis serves 21 counties in west TN.



St. Jude Newborn Follow-up Team: Front row (left to right): Margery Johnson, Russell Ware, Jane Hankins, Banu Aygun, and Winfred Wang. Back row (left to right): Yvonne Carroll, Gloria Brunson, Jerry Newman, Kristi Lunsford and Katherine Griffith. Members not in the photo: Amy Cone, Jenny Marsh and Christy Matthews.

Comprehensive Sickle Cell Center St. Jude Children's Research Hospital

The mission of St. Jude Children's Research Hospital (SJCRH) is to find cures for children with catastrophic illnesses through research and treatment. SJCRH has been involved in research of sickle cell disease (SCD) since the hospital's inception in 1962 and has continued that commitment through the past 45 years. St Jude is one of four designated sickle cell centers in the state of Tennessee. For the past 25 years, the SJCRH sickle cell program has been led by Dr. Winfred Wang, who has participated in numerous local and multicenter clinical trials related to sickle cell disease. In 2004, Dr. Russell Ware was recruited to lead the Division of Hematology at SJCRH and in 2006 Dr. Ware was named the Chairman of the St. Jude Department of Hematology. Dr. Ware is also a member of the State Genetics Advisory Committee for the Tennessee Department of Health.

SJCRH currently provides medical care and treatment for approximately 750 children with SCD, beginning with the identification of infants by newborn screening and continuing through age 18 years and the transition to adult clinical care. Additionally, SJCRH provides free trait counseling to parents of newborns diagnosed with sickle cell trait or other hemoglobinopathy trait. SJCRH has 2 dedicated counselors, Gloria Brunson and Christy Matthews, who provide counseling on sickle cell trait and disease. Parents of children identified as having sickle cell disease, sickle cell trait, or other hemoglobinopathy trait are offered free family studies to determine their own trait status and counseling regarding their risk of having another child with sickle cell trait or disease or any other type of hemoglobinopathy. Recently the center created a sickle cell trait awareness video that helps families understand the significance of having sickle cell trait. The video is available at www.stjude.org/sicklecelltrait and is approximately 9 minutes long. A booklet to accompany the video is under revision and will be available in October, 2007.

The St Jude Sickle Cell Clinics are divided by age: Infant/Toddler (newborn through 6 years old), School Age (7 through 11 years old), and Teen Clinic (12 through 18 years old). The patients are transitioned to adult care at 18 years old and the teen case manager collaborates with the adult centers to ensure a smooth transition from pediatric to adult care.

Our center uses a multi-disciplinary team approach in clinic. The multi-disciplinary team includes hematologists, mid-level providers (PA's and NP's), nurse case managers, social

workers, academic coordinators, child life specialists, genetic counselors, and nutritionists. Dr. Jane Hankins and Dr. Banu Aygun are the primary hematologists in the Infant/Toddler Sickle Cell Clinic, with assistance from Dr. Russell Ware and Dr. Winfred Wang. Our nurse practitioners, Amy Cone, Katherine Griffith, and Jenny Marsh, and physician assistant, Jerry Newman, work with the hematologists to provide state-of-the-art care to infants newly diagnosed with sickle cell disease, and to provide valuable disease and age specific education to the parents and other family members. Infants newly diagnosed with sickle cell disease are seen 4 times a year during the first year of life, three times a year the 2nd year of life, and semi-annually thereafter.

Kristi Lunsford is the newborn case manager who provides education and medical case management for newborns diagnosed with sickle cell disease. All newborns identified with sickle cell disease are referred to Kristi, who arranges for confirmatory testing and sickle cell clinic appointments. Kristi provides education in phases and during the first clinic visit and gives parents a copy of the educational booklet "Your Child and Sickle Cell Disease" to reinforce education that is given during the visit. During the first year of life, Kristi makes a home visit to provide education in a comfortable environment for parents and patients. She continues to follow these children until they are 6 years old.

The social worker, Margery Johnson, provides assistance to families through referrals, transportation assistance, meal and lodging assistance (if the child needs for multi-day testing and lives more than 35 miles away). Margery performs a complete family assessment within the first six months of life.

Christy Matthews provides genetic counseling to families in 4 phases. Christy gives a pre-test before counseling to determine the family's level of knowledge and a post-test immediately after the last counseling session and 4 months after counseling is completed. Results demonstrate that parents had a 10-20% increase in knowledge from the pre to post test and retained the information more than 90% after 4 months.

Our office provides community outreach, educational lectures for healthcare professionals, and articles published in peer review journals. Additionally, our Service provides more than 4,000 pieces of educational material per year and provides information on sickle cell disease and trait on our website at www.stjude.org/sicklecell. For more information about our center or if you need to contact a member of our newborn team, please call one of the numbers listed below:

St. Jude Children's Hospital
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Toll Free:	866-269-6536
Kristi Lunsford	(901) 495-5692
Christy Matthews	(901) 495-5679
Gloria Brunson	(901) 495-5691



4. T.C. THOMPSON CHILDREN'S HOSPITAL located in Chattanooga serves 10 counties in southeast TN.

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