Newborn Blood Spot Screening in South Carolina

At present infants are tested for certain metabolic, hormone/enzyme, and genetic disorders. The specific disorders included on the test panel are listed below. This list uses terminology consistent with the American College of Medical Genetics report "Newborn Screening: Towards a Uniform Screening Panel and System," Genet Med 2006; 8 (5) Suppl: S12-S252. Infants are also screened for critical congenital heart defects (CCHD) and congenital hearing loss.

Metabolic Disorders:

Amino Acid Metabolism Disorders
Phenylketonuria (PKU)
Benign Hyperphenylalaninemia
Defect of Biopterin Cofactor Biosynthesis
Defect of Biopterin Cofactor Regeneration
Maple Syrup Urine Disease (MSUD)
Homocystinuria
Hypermethioninemia
Citrullinemia I
Citrullinemia II
Argininosuccinic Aciduria
Tyrosinemia I
Tyrosinemia II
Tyrosinemia III

Carbohydrate Metabolism Disorders
Classical Galactosemia (GALT)
Galactokinase Deficiency (GALK)
Galactose Epimerase Deficiency (GALE)

Organic Acid Metabolism Disorders
Propionic Acidemia (PA)
Malonic Acidemia (MA)
Methylmalonic Acidemia—Co-A Mutase Deficiency (MUT)
Methylmalonic Acidemia—Vit B 12 Disorders (CBL A,B)
Methylmalonic Acidemia—Other (CBL C,D)
Isobutyryl coA Dehydrogenase Deficiency (IBCD)
Isovaleric Acidemia (IVA)
2-methylbutyryl coA Dehydrogenase Deficiency (2-MBCD)
3-methylcrotonyl coA Carboxylase Deficiency (3-MCC)
ß-ketothiolase Deficiency (SKAT)
3-methyl-3-OH-glutaryl coA Lyase Deficiency (HMGL)
3-methyl-glutaconyl coA Hydratase Deficiency
Multiple Carboxylase Deficiency (MCD)
Glutaric Aciduria I (GA I)
2-methyl-3-OH-butyric Aciduria (2M3HBA)

Fatty Acid Metabolism Disorders
Medium Chain Acyl coA Dehydrogenase Deficiency (MCAD)
Short Chain acyl coA Dehydrogenase Deficiency (SCAD)
Medium/Short Chain 3-OH acyl coA Dehydrogenase Deficiency (M/SCHAD)
Dienoyl co-A Reductase Deficiency

Long Chain 3-OH acyl coA Dehydrogenase Deficiency (LCHAD)
Trifunctional Protein Deficiency (TFP)
Very Long Chain acyl coA Dehydrogenase Deficiency (VLCAD)
Multiple acyl coA Dehydrogenase Deficiency (MAD/GA II)
Medium Chain Ketoacyl CoA Thiolase Deficiency (MCKAT)
Carnitine Uptake/Transport Defect (CUD)
Carnitine Palmitoyltransferase I Deficiency (CPT I)
Carnitine Palmitoyltransferase II Deficiency (CPT II)
Carnitine/Acylcarnitine Translocase Deficiency (CAT)

Hormone and Enzyme Disorders
Congenital Hypothyroidism
Congenital Adrenal Hyperplasia (CAH)
Biotinidase Deficiency

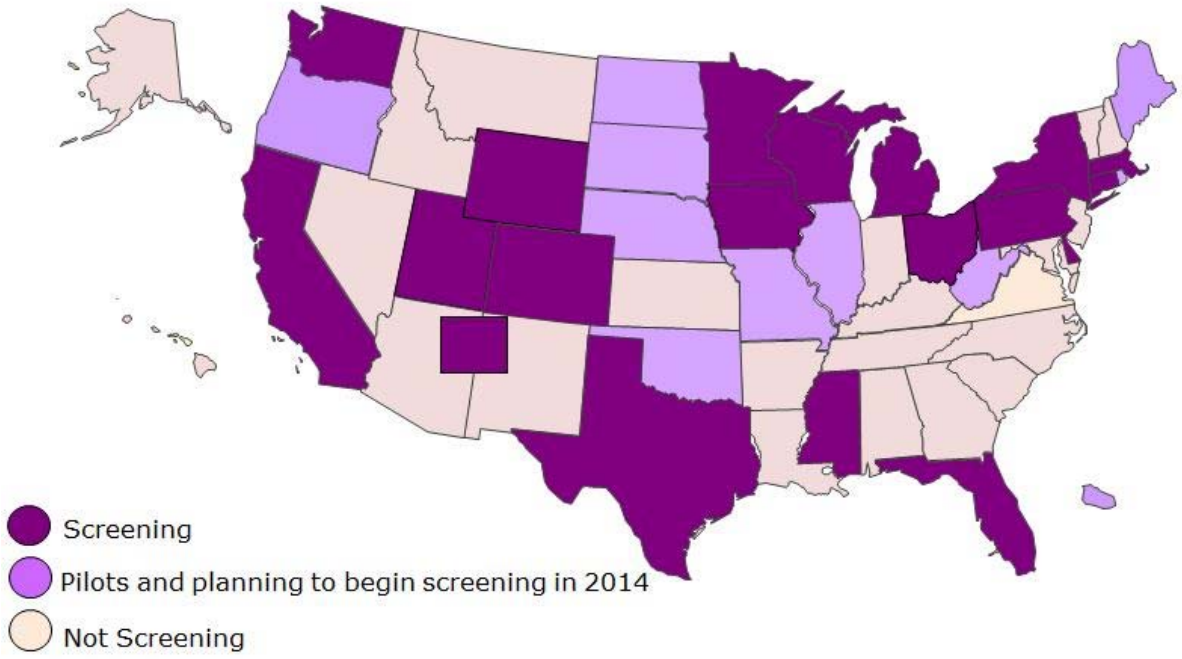
Other Genetic Disorders
Cystic Fibrosis
Sickle Cell Disease
Sickle C Disease
Sickle ß Thalassemia
Variant Hemoglobinopathy Disorders and Traits (including sickle cell trait)

Disorder	Average Number of Infants Born with Disorder In SC Per Year
PKU	3
Galactosemia	1
MCAD	4
Other disorders of amino acid, fatty acid or organic acid metabolism	8
Congenital hypothyroidism	18
CAH	2
Biotinidase deficiency	3
Hemoglobinopathy disorders (including sickle cell disease)	100
Hemoglobinopathy traits (including sickle cell trait)	2000
Cystic fibrosis	11

Similar results from newborn screening for SCID would include:

- 55,000 infants screened
- 112 full term infants with “not normal” results
- 63 pre-term infants with “not normal” results
- 65 referred for flow cytometry/diagnostic testing
- 7 - 8 confirmed cases
    - 1 - 2 classical SCID
    - 6 non SCID immunodeficiency

SCID Newborn Screening: Current Status of Implementation Map



States currently screening for SCID : California, Colorado, Connecticut, Delaware, Florida, Iowa, Massachusetts, Michigan, Minnesota, Mississippi, New York, Ohio, Pennsylvania, Texas, Utah, Washington, Wisconsin and Wyoming
Territories screening: Navajo Nation

States and territories currently planning to begin screening in 2014: Illinois, Maine, Missouri, Nebraska, North Dakota, Oklahoma, Oregon, Puerto Rico, Rhode Island, South Dakota, West Virginia

States where Advisory Committees have approved adding SCID, but have a longer timetable for implementation: District of Columbia, Georgia, Maryland, North Carolina, New Jersey, Virginia

Source: Immune Deficiency Foundation, January 22, 2014

What is Severe Combined Immunodeficiency Disease?

Severe Combined Immunodeficiency Disease (SCID) is the most serious primary immunodeficiency disorder. The defining characteristic of SCID is the absence of T-cells and, as a result, lack of B-cell function, the specialized white blood cells made in the bone marrow to fight infection. These genetic defects lead to extreme susceptibility to serious illness. Unless these defects are corrected the child will die of opportunistic infections before their first or second birthday. SCID can be caused by several different genetic defects, most of which are hereditary.

Although considered a rare disease, SCID is best known to the public from media accounts and a made-for-TV movie about David Vetter, the 'Boy in the Bubble,' a child from Texas who spent his entire life in a germ-free environment, ultimately dying after a failed bone marrow transplant in early adolescence. In the past, children with this disorder were kept in strict isolation, sometimes in a plastic isolator or "bubble." Bubbles are no longer used, but the name remains a part of the history of SCID.

Children with SCID lack immune protection against bacteria, viruses, and fungi and are prone to repeated and persistent infections that would not normally cause illness in a person with a normal immune system. In someone with SCID, these infections can be extremely serious or life threatening. SCID can affect either boys or girls, but the most common type occurs only in males (X-linked). Females can carry the X-linked trait and have a 1 in 2 chance of passing it on to each son.

There are currently 17 known genetic causes of SCID, making it possible to identify an underlying genetic defect in about 90 percent of cases. Although they vary with respect to the specific defect that causes the specific immunodeficiency, all have severe deficiencies in both T-cell and B-cell function.

SCID is estimated to occur in approximately 1 out of every 50,000 to 100,000 births, although experts suspect that many children with SCID die from infections before being diagnosed. The 1 in 100,000 rate indicates SCID may be as common as some of the inherited illnesses – PKU, biotinidase deficiency or certain metabolic disorders - for which states currently screen all newborns.

SCID screening in newborns could potentially reveal the true incidence of children born with severe combined immunodeficiency disease.

The Immune Deficiency Foundation (IDF) applauds the Secretary of Health and Human Service's inclusion of SCID on the Recommended Uniform Screening Panel.

IDF asks every state to include SCID Newborn Screening on their newborn screening panel immediately to save lives.

Facts about Severe Combined Immunodeficiency Disease and Newborn Screening

- SCID, or severe combined immunodeficiency disease, is a treatable illness in which an infant fails to develop a normal immune system. After successful treatment, people with SCID lead normal lives.
- SCID is a pediatric emergency, and newborn screening offers an opportunity to catch the disease early when treatment is most effective and cost efficient.
- A wide range of viruses, bacteria and fungi that are normally controlled by a healthy baby's immune system can cause serious infections in SCID babies.
- If undetected and untreated, SCID typically leads to death before the baby's first birthday.
- SCID can now be cured with a bone marrow transplant if diagnosed and treated in the first weeks or months of life. One form of the disease can be treated with an injectable medication.
- Newborn screening would provide a rapid indication of a possible immune problem soon after birth while the infant is still protected by the mother's antibodies.
- Research shows that bone marrow transplants in the first three months of life have a higher rate of efficacy than transplants at a later age.
- Early treatment for SCID can also reduce medical costs – the cost of a transplant in the first three months of life can be measured in tens of thousands, but the cost of delayed care can reach into the millions for seriously ill patients with less guarantee of success.
- The poor quality of life in late-diagnosed SCID patients, often caused by complications of infections that started before diagnosis, can eventually lead to disability or even death.

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Questions about Newborn Screening for Severe Combined Immunodeficiency (SCID)

What is SCID screening in Newborns?

SCID screening in newborns became possible just a few years ago with the development of a test that can detect SCID in the dried blood spot filter cards that are currently collected from all babies to screen for a variety of inborn conditions. Prominent immunologists contend that this simple blood test could allow doctors to treat, and most likely cure, SCID in an infant at a reasonable cost, as opposed to endless, less-effective diagnostic procedures and treatments that could lead to enormous medical expenses after a child has developed an infection.

Has SCID screening in Newborns Been Supported by Public Policy?

In January 2010, the Advisory Committee on Heritable Disorders in Newborns and Children (ACHDNC) recommended to the Secretary of the Department of Health and Human Services, Kathleen Sebelius, that the Federal government recommend to the States that they include SCID in their newborn screening protocols. The ACHDNC adopted a list of 29 recommended conditions for screening in September 2005. Since that time, SCID is the first condition to be added to this list for inclusion into mandatory newborn screening conducted by state public health programs. On May 21, 2010, Kathleen Sebelius, Secretary of Health and Human Services (HHS) announced her decision to concur with the committee and add SCID to the core panel of disorders for newborn screenings."

What is the ACHDNC?

The Advisory Committee on Heritable Disorders in Newborns and Children (ACHDNC), an evidence-based committee, was chartered in February 2003 to advise the Secretary regarding the most appropriate application of universal newborn screening tests, technologies, policies, guidelines and standards for effectively reducing morbidity and mortality in newborns and children having, or at risk for, heritable disorders. The committee unanimously voted to recommend adding SCID to the core newborn screening panel.

Do Any States Currently Screen Newborns for SCID?

In 2007, Wisconsin became the first state to screen for SCID, beginning a four-year pilot program to evaluate statewide newborn screening for SCID. State officials have concluded that screening costs are reasonable and that cost-effective treatment is available for newborns diagnosed early in life with SCID. These conclusions have been published in peer-reviewed papers in the December 2009 Journal of the American Medical Association (JAMA) and the April 2009 Journal of Allergy and Clinical Immunology (JACI). Currently, California, Colorado, Connecticut, Delaware, Florida, Iowa, Massachusetts, Michigan, Minnesota, Mississippi, New York, Ohio, Pennsylvania, Texas, Utah and Wisconsin screen statewide for SCID in addition to the Navajo Nation.

What kind of test is used to screen for SCID?

The SCID-screening test currently utilized uses the same dried blood samples already collected from newborns. The TREC test is an assay that detects the number of T-cell Receptor Gene Excision Circles, or TRECs, that are produced during normal T-cell maturation, but that are absent or severely reduced in infants with SCID. The TREC test, which is performed on newborn dried blood samples, is very sensitive and has a false positive rate well below 1%.

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Questions about Severe Combined Immunodeficiency Disease

Why have medical professionals called Severe Combined Immunodeficiency Disease (SCID) a pediatric emergency?

SCID is a group of inborn disorders, all of which result in failure of affected infants to develop T-cells, a critical component of the immune system. As a result, the condition is fatal in infancy unless treated with bone marrow transplantation, or in some cases enzyme replacement or gene therapy. If diagnosed within the first 3 1/2 months of life before infections develop, the cost of this treatment can be as low as $50,000 for each infant. By contrast, treatment costs can exceed $1,000,000 for each infant diagnosed late, primarily due to costs of treating infections that can leave the child with long-term medical complications. Without a bone marrow transplant in those crucial 3 1/2 months, many of these infants die of infection even if a bone marrow transplant is attempted later. The diagnosis of SCID very early in life is a true pediatric emergency.

How common is SCID?

There is no central record of how many babies are diagnosed with SCID in the United States each year, but the best estimate is somewhere around 40 -100. SCID is a rare condition, but is as frequent as some conditions that newborns are currently tested for such as biotinidase deficiency or certain metabolic disorders. On the other hand, researchers have no clear idea of how many babies are not diagnosed and die of SCID- related infections each year. The actual number of cases is most likely higher.

How is SCID diagnosed?

Fewer than 20% of infants with SCID have a family member with the condition that allows doctors to suspect it and test at birth. Early diagnosis of SCID is rare because doctors do not routinely count each type of white blood cell in newborns. As a result, the average age at which babies are diagnosed with SCID is just over six months and some are diagnosed much later, usually because of recurrent infections and failure to thrive. Blood tests for SCID typically reveal significantly lower-than-normal levels of T cells and a lack of germ-fighting antibodies. Even if B cells are present in the blood of SCID patients, they do a poor job of producing antibodies. Low antibody levels and lack of specific antibodies after vaccination or a natural infection are characteristic features of SCID.

Is there effective treatment for SCID?

The most effective treatment for SCID is transplantation of blood-forming stem cells from the bone marrow of a healthy person. Bone marrow stem cells can live for a long time by renewing themselves as needed and also can produce a continuous supply of healthy immune cells. A bone marrow transplant from a tissue-matched sister or brother offers the greatest chance for curing SCID. However, most patients do not have a matched sibling donor, so transplants from a parent or unrelated matched donor are often performed. All transplants done in the first three months of life have the highest success rate.

Can SCID be detected before birth (prenatally)?

If the presence of SCID in the family's history is known, and the type of SCID has been identified, sequencing DNA from the fetus can test an at-risk pregnancy. SCID can be identified before the baby is born by removing and testing cells from the placenta (chorionic villus sampling or CVS), or by removing and testing a sample of the fluid surrounding the baby (amniocentesis). However, prenatal testing is only available when a previous family member with SCID has been recognized and had their gene mutation determined.

How Effective is Early Diagnosis?

The sooner a child is diagnosed, the sooner treatment can begin and the more likely it is to be effective. Some babies develop fatal infections before their condition is recognized. Pediatricians are now encouraged to give infants as young as 6 weeks old the live rotavirus vaccine to prevent rotavirus infection; however, if this vaccine is given to an infant with SCID, the infant can contract serious diarrheal illness from the attenuated virus in the vaccine. The need for a way to recognize those infants who would be at risk if given an otherwise beneficial vaccine is crucial. Recent research shows that bone marrow transplants in the first three months of life work better than transplants at a later age. So it is critical to identify affected children immediately after birth. A survey of more than 150 patients commissioned by the Immune Deficiency Foundation found that SCID patients who were diagnosed early and treated by 3.5 months had a 91% survival rate; those treated after 3.5 months had a 76% survival rate.

Does Late Diagnosis Affect a Surviving SCID Patient's Quality of Life?

If diagnosis is late, even a successful bone marrow transplant can still leave a patient with persistent health problems, such as the need for procedures as drastic as lung transplants because of the damage suffered before diagnosis. Most parents and physicians agree that ongoing health issues are not a result of the child having SCID, but because of the delay in diagnosis that leaves the infant critically ill with multiple infections. The poor quality of life in late-diagnosed SCID patients can eventually lead to disability or even death.

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