

California Health Care Provider Fact Sheet: Thalassemias

Thalassemias are a group of inherited hemoglobin disorders screened for at birth in California and highly prevalent among many immigrant groups in the state.

While there are many different types of thalassemia, alpha thalassemia and beta thalassemia are the most important because of their potential adverse effects on health. These effects range from clinically insignificant or mild to life-threatening and many affected individuals require regular blood transfusions to maintain their health. Individuals born outside of California and adults born prior to the beginning of newborn screening for these disorders (1999 for all disorders, although screening for some disorders began in 1990) may have undiagnosed thalassemias.



Types of Thalassemia

Alpha Thalassemia is a deletion of one or more of the four genes that produce alpha globin chains. Clinical presentation ranges from benign to severe or incompatible with life, depending on the number of genes affected. In California these disorders are most common among Laotian (1 in every 240 live births) and Cambodian populations (1 in every 600 live births), but are seen in other Asian (including East Indian), Black/African American, Middle Eastern, Caucasian and Hispanic populations as well. On average, one alpha thalassemia case is identified out of every 11,000 live births in California, or about 45 new cases per year. Genetic testing of partner(s) is recommended for anyone with alpha thalassemia or alpha thalassemia trait.

- **Silent Carriers** have only one deleted gene. If an individual knows that she or he is a silent carrier, partners should be tested to determine if there is a risk of having a child with a clinically significant form of the disease.
- **Alpha Thalassemia Trait and Hemoglobin Constant Spring Trait** are typically benign conditions indicating deletion or dysfunction of two alpha globin genes. Mild microcytic anemia is often seen, sometimes mild hemolytic anemia.
- **Hemoglobin H Disease** is due to three missing or dysfunctional alpha globin genes, and typically causes moderate hemolytic anemia and splenomegaly. Patients with Hemoglobin H should be followed periodically by a hematologist in addition to a primary care provider.
- **Hemoglobin H/Constant Spring Disease** is typically a more severe thalassemia due to the Constant Spring gene mutation. As with Hemoglobin H, there may be moderate hemolytic anemia and/or splenomegaly; patients may become transfusion dependent. These individuals should be followed by a hematologist in addition to a primary care provider.
- **Alpha Thalassemia Major (Hydrops Fetalis or Hb Bart Syndrome)** manifests as fetal death or very severe hemolytic anemia in utero. All four genes are deleted or dysfunctional and normal hemoglobin cannot be produced. In-utero transfusions may be required to sustain the fetus, and on-going transfusions or bone marrow transplant thereafter.

Beta Thalassemia results from mutations in the HBB gene, which holds instructions for making beta-globin, an essential part of hemoglobin. Depending on the mutation, affected individuals have either a reduction in (beta thalassemia intermedia) or complete absence of (beta thalassemia major, the more severe form) beta-globin. In California these disorders are most common among Laotian (1 in every 1,300 live births) and Cambodian populations (1 in every 2,800 live births), but are seen in other Asian (including East Indian), Black/African American, Middle Eastern and Mediterranean populations as well. Genetic testing of partner(s) is recommended for anyone with beta thalassemia or beta thalassemia trait.

- **Beta Thalassemia Trait** does not cause significant health problems. Persons with trait may have mild microcytic anemia which, in the absence of other indications of iron deficiency, should not be treated with iron supplements. Persons with beta thalassemia trait are at risk for having a child with a more severe form of thalassemia or sickle cell disease if the other parent also has beta thalassemia or sickle cell trait or disease.

- **Beta Thalassemia Intermedia** is caused by mutations resulting in a less severe disorder that does not require chronic transfusion. However, individuals with this thalassemia may require intermittent transfusions and may have moderate to severe complications. These individuals should be followed by a hematologist in addition to a primary care provider.
- **Beta Thalassemia Major (Cooley's Anemia)** is the most severe form of beta thalassemia, and requires frequent chronic transfusions to survive along with iron chelation therapy to avoid iron overload complications. These individuals must be followed by a hematologist in conjunction with a primary care provider.

Hemoglobin E is a variant of normal (A) hemoglobin screened for at birth since 2005 in California. In conjunction with certain genetic globin mutations, Hemoglobin E may cause serious disease. Individuals born outside of California or born prior to 2005 may be unaware that they carry one or more genes for making hemoglobin E. Hb E is very common in Southeast Asian populations in California; benign (Hb E/E) and significant forms (Hb E/beta thalassemia) are seen in 1 of every 80 Laotian live births, 1 in every 100 Cambodian live births and 1 in every 700 other Southeast Asian live births, less frequently in other Asian populations, and occasionally in people of other races or ethnicities. Genetic testing of partners of anyone with Hb E trait or condition who is considering having children is recommended.

- **Hemoglobin E Trait** carriers have one gene for this variant and one for Hb A. These individuals do not have any symptoms other than mild microcytic anemia in some cases.
- **Hemoglobin EE** was added to California's Newborn Screening Hemoglobin Registry in 2005, and pediatricians of infants identified as having EE are notified. Persons with Hb EE make only E hemoglobin, but there are generally no significant clinical implications. Mild microcytic anemia and/or splenomegaly can occur. The microcytic anemia can be misdiagnosed as iron deficiency; however, iron supplementation should be avoided. Consequently, individuals of Southeast Asian origin with this form of anemia should be tested for a hemoglobinopathy.
- **Hemoglobin E/Beta Thalassemia** is caused by the pairing of genes for hemoglobin E and beta thalassemia, and may result in a more severe form of thalassemia that may require intermittent or chronic transfusions. Persons with Hb E/beta thalassemia should be followed by a hematologist along with a primary care provider.



What are symptoms of thalassemias?

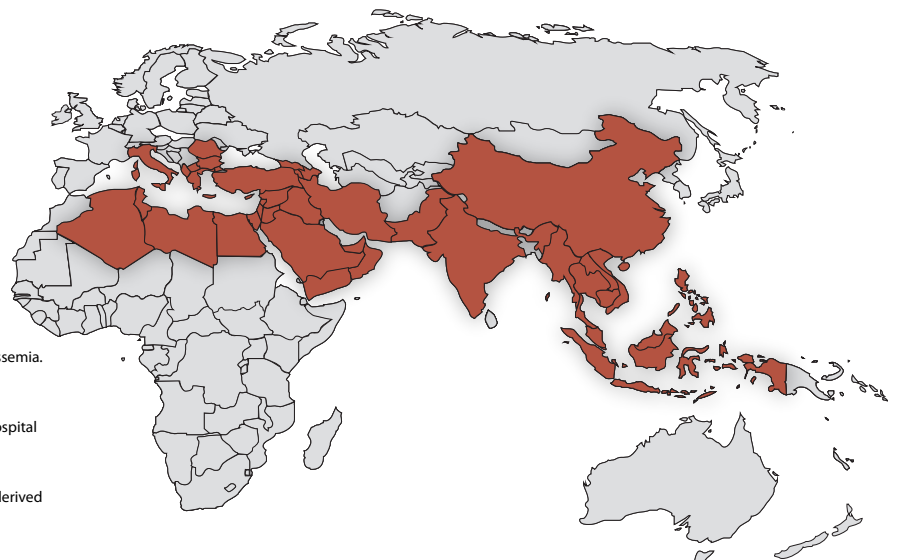
Mild to moderate anemia, brittle bones or other bone problems, and/or an enlarged spleen are characteristic of milder forms of thalassemia, and a pale and listless appearance, dark urine, jaundice or slowed growth can be indicative of a more severe form. Many forms of thalassemia can cause chronic iron overload even in non-transfused patients. The symptoms of iron overload (such as liver or heart disease, hypogonadism, hypothyroidism, diabetes or metabolic syndrome, osteoarthritis, and osteoporosis) are insidious and can result in serious problems later in life that are preventable with early diagnosis and treatment.



Who is at risk for thalassemias?

People born in or with ancestry in Asia (especially Southeast Asia, India and China), the Middle East, Northern Africa, or Mediterranean regions are more likely to have thalassemia, but anyone of any race can have one of these disorders.

Global Areas of Higher Risk for Thalassemias



Weatherall DJ. The definition and epidemiology of non-transfusion-dependent thalassemia. *Blood Rev.* 2012;26(Suppl 1):S3-S6.

Northern California Comprehensive Thalassemia Center at UCSF Benioff Children's Hospital Oakland, <http://thalassemia.com/demographics.aspx>, accessed June 30, 2014.

Modell, B; Darlison, MW; (2008) Global epidemiology of haemoglobin disorders and derived service indicators. *Bulletin of the World Health Organization*, 86 (6) 480 - 487.



Where are thalassemias most likely to be found in California?

Thalassemias are most common in the most densely populated parts of the state and those with the largest populations of people from affected regions. But people with thalassemias and trait are found in every part of the state.



Why are thalassemias and thalassemia trait important to screen for and understand?

Patients with undiagnosed milder forms of thalassemia may present with microcytic anemia that can be mistaken for iron deficiency anemia, however, treatment with iron supplements is harmful to such patients. These patients and suspected patients with severe symptoms should be referred to a hematologist for diagnosis and care.

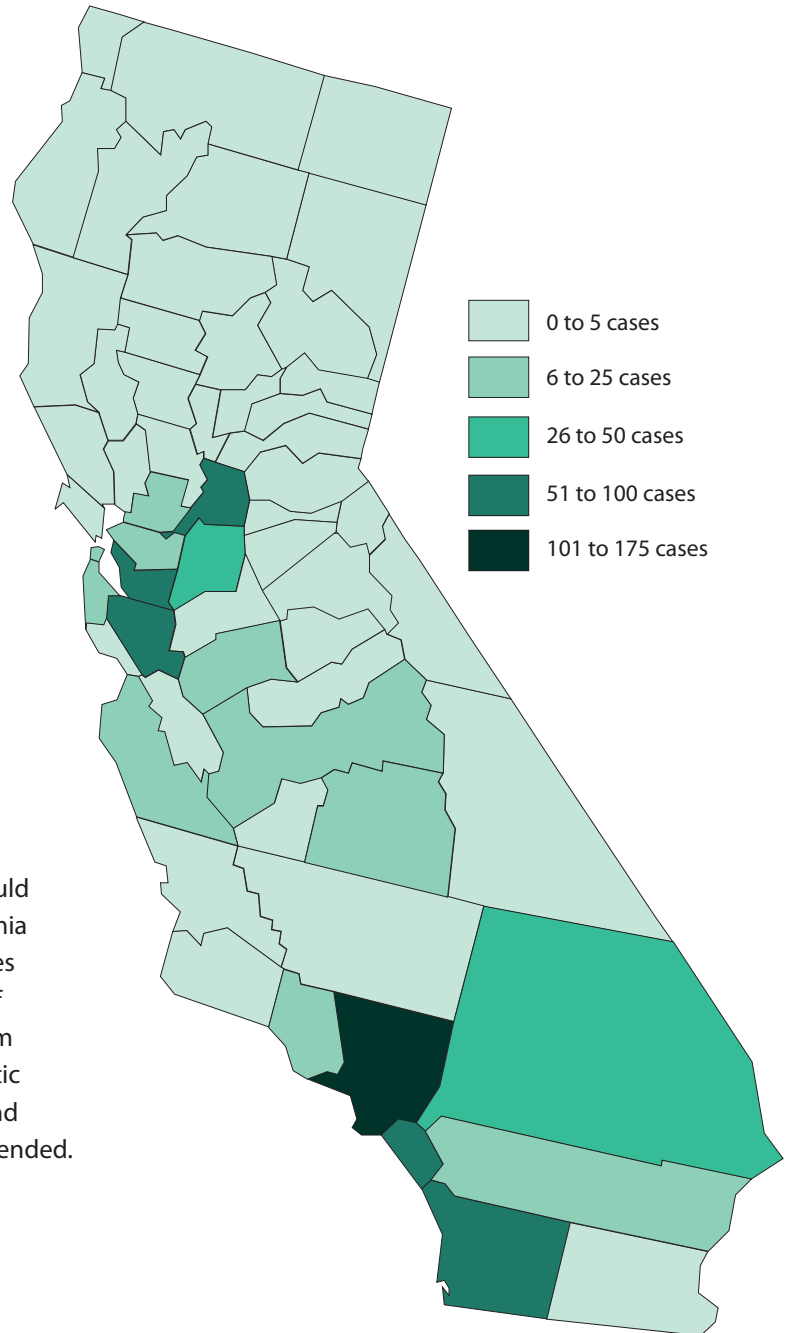
Individuals with ancestry in affected regions who are considering having children should be aware of their thalassemia and sickle cell trait status and that of their partners. Children born to two parents with these traits may inherit severe forms of thalassemia or sickle cell/thalassemia and may have significant health problems and shortened life expectancy.



What steps should I take if I suspect thalassemia or thalassemia trait in a patient?

Patients with unexplained microcytic red cell indices should be referred to a hematologist experienced with thalassemia for diagnosis. The proper diagnosis of thalassemia requires DNA analysis of the patient's blood. If there is a history of thalassemia in the extended family or if the patient is from one of the highly affected ethnic groups, advice on genetic testing prior to pregnancy or birth should be provided and testing for all related family members should be recommended.

California Newborn Screening (NBS)
Thalassemia Cases 2000-2013



California Genetic Disease Screening Program Data



Resources

**UCSF Benioff Children's Hospital Oakland
Northern California Comprehensive Thalassemia Center**
www.thalassemia.com

Cooley's Anemia Foundation
www.thalassemia.org

Thalassemia Support Foundation
www.helpthals.org

California Genetic Disease Screening Program
<http://www.cdph.ca.gov/programs/GDSP/Pages/default.aspx>

National Institutes of Health Genetics Home Reference
<http://ghr.nlm.nih.gov/condition/beta-thalassemia>

California Children's Services Approved Hemoglobinopathy Centers

NORTHERN CALIFORNIA

UC Davis Medical Center
2315 Stockton Boulevard
Sacramento, CA 95817
(916) 734-2781

UCSF Benioff Children's Hospital Oakland
747 52nd Street
Oakland, CA 94609
(510) 428-3376

Kaiser Permanente Oakland Medical Center
3779 Piedmont Avenue
Oakland, CA 94611
(510) 752-6592

UC San Francisco Medical Center
505 Parnassus Avenue, Box 0106
San Francisco, CA 94143
(415) 502-8034

Lucile S. Packard Children's Hospital at Stanford
725 Welch Road, Clinic E
Palo Alto, CA 94304
(650) 497-8953

Children's Hospital of Central California
9300 Valley Children's Place
Madera, CA 93638
(559) 353-5460

SOUTHERN CALIFORNIA

City of Hope Medical Center
1500 East Duarte Road
Duarte, CA 91010
(626) 301-8426

Children's Hospital Los Angeles
4650 Sunset Boulevard, MS54
Los Angeles, CA 90027
(323) 361-2352

LAC/USC Medical Center (Adults Only)
1240 North State Street
Los Angeles, CA 90033
(323) 226-3853

**Kaiser Permanente West Los Angeles
Medical Group Southern California Regional
Hemoglobinopathy Center**
6041 Cadillac Avenue
Los Angeles, CA 90034
(800) 734-5155 (323) 857-4462

**Mattel Children's Hospital at UCLA Medical
Center**
10833 Le Conte Avenue
Los Angeles, CA 90095
(310) 825-6708

Cedars-Sinai Medical Center
8700 Beverly Blvd.
Los Angeles, CA 90048
(310) 423-4423

Children's Hospital of Orange County
455 South Main Street
Orange, CA 92868
(714) 532-8459

Harbor-UCLA Medical Center
1124 West Carson Street
Torrance, CA 90502
(310) 222-4154

Loma Linda University Medical Center
11234 Anderson Street
Loma Linda, CA 92354
(909) 651-1910

**Miller Children's Hospital
Long Beach Memorial Medical Center**
2801 Atlantic Avenue
Long Beach, CA 90806
(562) 728-5000

Rady Children's Hospital San Diego
3020 Children's Way
San Diego, CA 92123-4282
(858) 966-5811

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