Can Thalassaemia be prevented

The answer is YES

GET INFORMED AND BE TESTED

An information booklet from the Thalassaemia Laboratory, Thalassaemia Centre, Arch. Makarios III Hospital, Nicosia, Medical and Public Health Services, Ministry of Health
**EPIDEMIOLOGY**

What is thalassaemia?
It’s also called Cooley’s anaemia. Thalassaemia is a hereditary hemoglobinopathy that lowers, alters or stops the production of hemoglobin in the red blood cells. This results in severe anaemia. People with thalassaemia cannot produce enough hemoglobin in their bone marrow. Hemoglobin is the protein in the red blood cells that is responsible for the oxygen transfer from the lungs to the tissues. Thalassaemia is otherwise known as Mediterranean Anaemia for the first patients to be diagnosed were from the countries of the Mediterranean. In reality it is found in a variety of countries worldwide and more specific:

- a) In high prevalence in Mediterranean countries, Middle and Far East
- b) In less percentages in areas of East Europe
- c) In even lower percentages in north coast of Africa and South America

**MISSION OF THE THALASSAEMIA PREVENTION PROGRAM**

The thalassaemia prevention program was implemented formally by the Cyprus Government in 1978 with the establishment of the Thalassaemia Laboratory of the Thalassaemia Centre. The laboratory is recognized as a collaborative center and a reference laboratory of the World Health Organization (WHO).

Since the launch of the thalassaemia prevention program hundreds of births of thalassaemia children have been prevented

**Targets of the program were and are:**

a) detecting and informing carriers
b) identification of couples with risk of having children with hemoglobinopathies
c) prenatal testing with high success rate

It is important to note that in collaboration with the Greek Orthodox Church the Thalassaemia Laboratory is responsible of issuing a premarital certificate to confirm the testing for thalassaemia so that to ensure that all couples are provided with genetic information.

**Types of Thalassaemia**

In Cyprus there is a variety of thalassaemia types from which the most prevalent are the β-thalassaemia (percentage of carriers is 12.5%) and α-thalassaemia (carrier’s percentage is 21%)

**Included in β-thalassaemia are:**

- a) Homozygotes (patients) of β-thalassaemia

**Included in α-thalassaemia are:**

- a) Hemoglobinopathy H
- b) Hydrops Fetalis

The population percentage prevalence of thalassaemia is in such high rate that a prevention screening program is required
**WHAT IS \(\beta\)-THALASSAEMIA AND HOW IS INHERITED**

\(\beta\)-thalassaemia is characterized from lack or reduced production of \(\beta\) hemoglobin chains in the red blood cells

**What is carrier or heterozygote of \(\beta\)-thalassaemia?**

Heterozygotes are the individuals who have inherited one pathological \(\beta\) gene from one of their parents (they therefore have one genetic mutation). \(\beta\) - thalassaemia carrier is therefore a perfectly healthy person with a possibility of having a light anaemia with no serious consequences in their health.

**What is homozygous \(\beta\)-thalassaemia?**

A homozygous patient of \(\beta\)-thalassaemia has inherited 2 pathological \(\beta\) genes, one from each parent

**Inheritance of \(\beta\)-thalassaemia**

1. In the case that one of the parents is a \(\beta\)-thalassaemia carrier:
2. In the case that both parents are carriers of β-thalassaemia

Both parents are carriers of β-thalassaemia

- 25% ομόζυγος (Patient homozygous for β-thalassaemia)
- 25% (Healthy person)
- 50% Carriers of β-Thalassaemia (heterozygote-Healthy person)

3. In the case that one of the parents is a homozygote (patient with β-Thalassaemia) and the other is a carrier of β-thalassaemia:

One of the parents is a homozygote and the other is a carrier of β-thalassaemia

- 50% of children are homozygotes (patients with β-thalassaemia)
- 50% Carriers of β-Thalassaemia (heterozygote-Healthy person)
SYMPTOMS OF THE DISEASE
Children who are born with β-thalassaemia usually exhibit symptoms of severe anaemia in the first years of their lives and they start to develop skeletal abnormalities, abdomen and spleen swelling.

TREATMENT OF β-THALASSAEMIA
Although many efforts are made in a variety of fields for an effective radical treatment, thalassaemia today is treated as follows:

- With regular blood transfusions, every 20-30 days and with daily iron chelation. This is accomplished by the intramuscular administration of a chelating agent with the use of specific pumps for the removal of the iron overload that is deposited on various organs such as lungs, heart and liver.
- A definite effective therapy is the bone marrow transplantation which is a complex procedure and requires a compatible donor
- A future therapy is the restoration of the gene anomaly, that is the replacement of a pathological gene with the corresponding normal one, something that has not yet been accomplished. Progress made lately in the Genetic engineering of Thalassaemia gives hope for future gene therapy.

WHAT IS α–THALASSAEMIA AND HOW IS INHERITED
α-Thalassaemia causes a reduction in the amount of α-globin chains. A total of 4 genes are responsible for the production of α-globin chains. Two of the genes are inherited from the father and two from the mother.

What is a carrier or heterozygote of α-Thalassaemia?
There are two types of α-thalassaemia mutations, the α⁺(light) και η α⁰(severe), depending on the number of the affected genes.

1) α⁺-thalassaemia carrier or silent carrier of α-thalassaemia: A healthy individual that has inherited one mutated gene from one of his parents while the other 3 genes function normally and are capable of producing normal levels of α-globin chains.

2) α⁰-thalassaemia carrier: A person that inherited two mutated genes from his parents while the rest two function normally and are producing normal levels of α-globin chains.

(both types of carriers are normal healthy persons)
Types of α-thalassaemia

1) Haemoglobinopathy-H: this is a haemoglobinopathy observed when a person has inherited an α+ mutation from one of his parents and an α0 mutation from the other parent (α+/α0). In such case the individual has only one functional normal gene out of 4. This situation is characterised as moderate hemolytic anaemia that does not require regular transfusions.

2) Hydrops fetalis: The embryo inherits two α0 mutations, one from each parent, the embryo does not have any functional α-genes and is not capable of producing hemoglobin. This situation is incompatible with life.

How is the (α+/α+) gene of α–thalassaemia inherited:

1. When both parents are carriers of the α+ gene of α-thalassaemia
2) When one of the parents is a carrier of the $\alpha^+$ gene and the other is a carrier of the $\alpha^0$ gene of $\alpha$-thalassaemia:

One of the parents is a carrier of the $\alpha^+$ gene and the other is a carrier of the $\alpha^0$ gene of $\alpha$–Thalassemia

25% (Healthy person) 25% carrier of $\alpha^+$ gene 25% Haemoglobinopathy H ($\alpha^+/\alpha^0$) genes

3) When both parents are carriers of the $\alpha^0$ gene of $\alpha$-thalassaemia

Both parents are carriers of the $\alpha^0$ gene of $\alpha$-thalassaemia

25% (Healthy person) 50% carriers of $\alpha^0$ gene

Sickle cell anaemia

It is a hereditary disorder that is due to the production of a pathological hemoglobin (Hemoglobin S) that gives a sickle shape to the red blood cells. In Cyprus the percentage of the carriers is 0.2%. It is inherited in the same way as $\beta$-thalassaemia.
Ways of preventing Thalassaemia

- Carriers detection – population screening (most important way)
- Genetic information
- Prenatal diagnosis (CVS) before the 12th week of pregnancy
- Pre implantation genetic diagnosis (PGD)

Detection of carriers is done with a simple hematological testing.

- Blood collection
- Hematological analysis
- Microscopic examination
- Hemoglobin separation and identification with electrophoresis.
- Molecular testing when is required

Genetic information

If Couples have been diagnosed as carriers of $\alpha^0$ or $\beta$–Thalassaemia after testing at the Thalassaemia Laboratory they will be notified by the specialized scientific personnel of the laboratory and will be referred to one of the doctors of the Thalassaemia Clinics in the corresponding towns. The doctor will provide the couple with the appropriate genetic information regarding the following:

1) A family study (testing of both the couple and parents) it is done at the Thalassaemia Centre in Nicosia during the 9th-10th week of pregnancy.

2) Prenatal testing carried out by specialized gynecologists at the Ultra Sound department of the Arch. Makarios III Hospital, in Nicosia.

3) description of the clinical picture and characteristics of the disease and the treatments available.

4) the alternative choices that a couple has so as to have healthy children

When is prenatal testing offered

- When both parents are carriers of $\beta$-Thalassaemia
- When both parents are carriers of $\alpha^0$-Thalassaemia
**Can we have a healthy child when we are both carriers of Thalassaemia?**

YES!!

**How can we find out?**

- Prompt diagnosis
- Prenatal testing

**Prenatal testing**

It is an invasive procedure carried out by a specialised gynecologist in the cases where a couple has a risk of having a child with thalassaemia.

*(PGD= pre-implantation genetic diagnosis)*

It is an in vitro fertilisation for the diagnosis of thalassaemia in embryo before their implantation into the uterus.

**Who should be tested for thalassaemia?**

All the persons planning to get married and have children. More specific testing must be undertaken in the cases of:

α) Pregnant women up until the second month of their pregnancy (8-9 weeks)
β) Couples planning to get married
γ) Patients/individuals for diagnostic medical purposes.

**Where and how is the thalassaemia testing carried out?**

The analysis can be done in all the Thalassaemia Centres that operate in the Public General Hospitals (Nicosia, Limassol, Larnaca, Ammohostos, Paphos)  
A small amount of blood is required and this sample is tested with Hematological, microscopic and electrophoretic techniques. In cases where indicated a DNA testing is carried out.

**TESTING FOR THALASSAEMIA IS FREE OF CHARGE**

<table>
<thead>
<tr>
<th>Useful information/instructions for Thalassaemia analysis</th>
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<tbody>
<tr>
<td>1. Analysis is booked by telephone or personal appointment</td>
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<td>2. Registration for the analysis costs €4 (four euros). This amount covers administrative costs and is paid at the Hospital’s cashiers.</td>
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<tr>
<td>3. On the day of the analysis you must bring your Identification card or passport or aliens card.</td>
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4. Breakfast does not influence the result of the analysis
5. Persons under 18 yrs old have to be escorted by their parents

### Telephones to book an appointment

1. Thalassaemia Centre, Arch. Makarios III Hospital, Nicosia
tel: 22405487
2. Thalassaemia unit, Basement, Limassol General Hospital
tel: 25801276
3. Pancyprian Thalassaemia Association, Larnaca General Hospital,
   6th Floor
tel: 24800462
4. Health Visitors, Basement, Pafos General Hospital
tel: 26803370
5. Clinical Laboratory Reception, Famagusta General Hospital
tel: 23200175

### Timetable: Monday – Friday 7:30 am -2:30 pm