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**Information for Behavioral Health Providers in Primary Care**

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## **Hyperthyroidism**

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### **What is Hyperthyroidism?**

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The thyroid is a butterfly-shaped gland located in the front of the neck just below the Adams apple. The gland wraps around the windpipe (trachea) and has a shape that is similar to a butterfly formed by two wings (lobes) and attached by a middle part (isthmus).

The thyroid gland works like a tiny factory that uses iodine (mostly from the diet in foods such as seafood and salt) to produce thyroid hormones. These hormones help to regulate the body's metabolism and effects processes, such as growth and other important functions of the body.

The two most important thyroid hormones are thyroxine (T4) and triiodothyronine (T3), representing 99.9% and 0.1% of thyroid hormones respectively. The hormone with the most biological power is actually T3. Once released from the thyroid gland into the blood, a large amount of T4 is converted to T3 - the active hormone that affects the metabolism of cells throughout our body

Hyperthyroidism is a condition in which an overactive thyroid gland is producing an excessive amount of [thyroid hormones](#) that circulate in the blood. ("Hyper" means "over" in Greek). Thyrotoxicosis is a toxic condition that is caused by an excess of thyroid hormones from any cause. Thyrotoxicosis can be caused by an excessive intake of thyroid hormone or by overproduction of thyroid hormones by the [thyroid gland](#).

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### **What are Thyroid Hormones?**

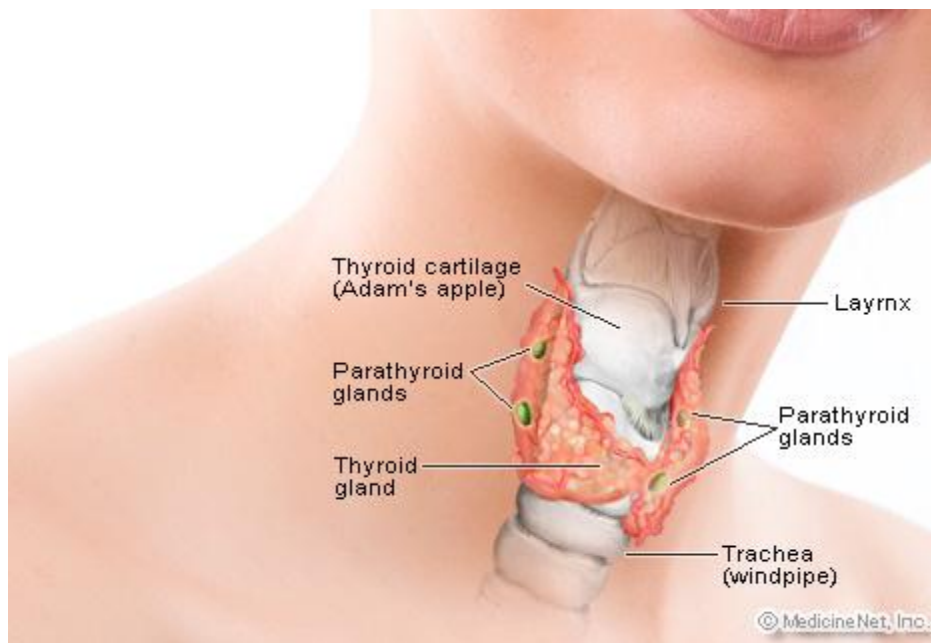
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Thyroid hormones stimulate the metabolism of cells. They are produced by the thyroid gland. The thyroid gland is located in the lower part of the neck, below the [Adam's apple](#). The gland wraps around the [windpipe](#) (trachea) and has a shape

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that is similar to a butterfly formed by two wings (lobes) and attached by a middle part (isthmus).

The thyroid gland removes iodine from the blood (which comes mostly from a diet of foods such as seafood, bread, and salt) and uses it to produce thyroid hormones. The two most important thyroid hormones are [thyroxine](#) (T4) and [triiodothyronine](#) (T3) representing 99.9% and 0.1% of thyroid hormones respectively. The hormone with the most biological activity (for example, the greatest effect on the body) is actually T3. Once released from the thyroid gland into the blood, a large amount of T4 is converted to T3 - the more active hormone that affects the metabolism of cells.

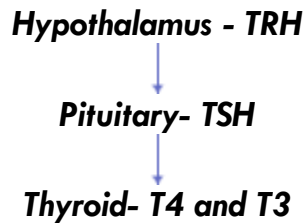


### Thyroid Hormone Regulation--the Chain of Command

The thyroid itself is regulated by another gland located in the brain, called the pituitary. In turn, the pituitary is regulated in part by thyroid hormone that is circulating in the blood (a "feedback" effect of thyroid hormone on the [pituitary gland](#)) and in part by another gland called the [hypothalamus](#), also a part of the brain.

The hypothalamus releases a hormone called thyrotropin releasing hormone (TRH), which sends a signal to the pituitary to release thyroid stimulating hormone ([TSH](#)). In turn, TSH sends a signal to the thyroid to release thyroid hormones. If over activity of any of these three glands occurs, an excessive amount of thyroid hormones can be produced, thereby resulting in hyperthyroidism.

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The rate of thyroid hormone production is controlled by the pituitary gland. If there is an insufficient amount of thyroid hormone circulating in the body to allow for normal functioning, the release of TSH is increased by the pituitary in an attempt to stimulate the thyroid to produce more thyroid hormone. In contrast, when there is an excessive amount of circulating thyroid hormone, the release of TSH is reduced as the pituitary attempts to decrease the production of thyroid hormone.

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### What Causes Hyperthyroidism?

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#### **Graves' Disease (Diffuse Toxic Goiter)**

Graves' disease, which is caused by a generalized over activity of the thyroid gland, is the most common cause of hyperthyroidism. In this condition, the thyroid gland usually is renegade, which means it has lost the ability to respond to the normal control by the pituitary gland via TSH. Graves' disease is hereditary and is up to five times more common among women than men. Graves' disease is thought to be an [autoimmune disease](#), and antibodies that are characteristic of the illness may be found in the blood. These antibodies include [thyroid stimulating immunoglobulin](#) (TSI antibodies), thyroid peroxidase antibodies (TPO), and TSH receptor antibodies. The triggers for Grave's disease include:

- [stress](#),
- [smoking](#),
- radiation to the neck,
- medications, and
- infectious organisms such as viruses.

Graves' disease can be diagnosed by a standard, nuclear medicine [thyroid scan](#) which shows diffusely increased uptake of a radioactively-labeled iodine. In addition, a blood test may reveal elevated TSI levels.

Grave's disease may be associated with eye disease (Graves' ophthalmopathy) and skin lesions ([dermopathy](#) ). Ophthalmopathy can occur before, after, or at the

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same time as the hyperthyroidism. Early on, it may cause sensitivity to light and a feeling of "sand in the eyes." The eyes may protrude and double vision can occur. The degree of ophthalmopathy is worsened in those who smoke. The course of the eye disease is often independent of the thyroid disease, and steroid therapy may be necessary to control the inflammation that causes the ophthalmopathy. In addition, surgical intervention may be required. The skin condition (dermopathy) is rare and causes a painless, red, lumpy skin [rash](#) that appears on the front of the legs.

### **Toxic Nodular Goiter (Also called Multinodular Goiter)**

Hyperthyroidism caused by toxic nodular goiter is a condition in which one or more nodules of the thyroid become overactive. The overactive nodules actually act as benign thyroid tumors. Symptoms of toxic nodular goiter do not include bulging eyes or skin problems, as in Graves' disease.

### **Thyroiditis**

Thyroiditis causes temporary hyperthyroidism, usually followed with hypothyroidism (an under active thyroid). Thyroiditis is an inflammation of the thyroid gland. There are three types of thyroiditis:

- Hashimoto's Thyroiditis
- Subacute Granulomatous Thyroiditis
- Silent Lymphocytic Thyroiditis
- If a person takes too many thyroid hormone tablets, hyperthyroidism may occur.

### **Functioning Adenoma and Toxic Multinodular Goiter**

The thyroid gland (like many other areas of the body) becomes lumpier as we get older. In the majority of cases, these lumps do not produce thyroid hormones and require no treatment. Occasionally, a nodule may become "autonomous," which means that it does not respond to pituitary regulation via TSH and produces thyroid hormones independently. This becomes more likely if the nodule is larger than 3 cm. When there is a single nodule that is independently producing thyroid hormones, it is called a functioning nodule. If there is more than one functioning nodule, the term toxic, multinodular goiter is used. Functioning nodules may be readily detected with a thyroid scan.

### **Excessive Intake of Thyroid Hormones**

Taking too much thyroid hormone medication is actually quite common. Excessive doses of thyroid hormones frequently go undetected due to the lack of follow-up of patients taking their thyroid medicine. Other persons may be abusing the drug in an attempt to achieve other goals such as weight loss. These patients can be identified

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by having a low uptake of radioactively-labeled iodine ([radioiodine](#)) on a thyroid scan.

### Abnormal secretion of TSH

A tumor in the pituitary gland may produce an abnormally high secretion of TSH (the [thyroid stimulating hormone](#)). This leads to excessive signaling to the thyroid gland to produce thyroid hormones. This condition is very rare and can be associated with other abnormalities of the pituitary gland. To identify this disorder, an endocrinologist performs elaborate tests to assess the release of TSH.

### Thyroiditis (inflammation of the thyroid)

Inflammation of the thyroid gland may occur after a viral illness (subacute [thyroiditis](#)). This condition is associated with a fever and a [sore throat](#) that is often painful on swallowing. The thyroid gland is also tender to touch. There may be generalized neck aches and pains. Inflammation of the gland with an accumulation of white blood cells known as lymphocytes (lymphocytic thyroiditis) may also occur. In both of these conditions, the inflammation leaves the thyroid gland "leaky," so that the amount of thyroid hormone entering the blood is increased. Lymphocytic thyroiditis is most common after a [pregnancy](#) and can actually occur in up to 8% of women after delivery. In these cases, the [hyperthyroid](#) phase can last from 4 to 12 weeks and is often followed by a hypothyroid (low thyroid output) phase that can last for up to 6 months. The majority of affected women return to a state of normal thyroid function. Thyroiditis can be diagnosed by a thyroid scan.

### Excessive Iodine Intake

The thyroid gland uses iodine to make thyroid hormones. An excess of iodine may cause hyperthyroidism. Iodine-induced hyperthyroidism is usually seen in patients who already have an underlying abnormal thyroid gland. Certain medications, such as [amiodarone](#) (Cordarone), which is used in the treatment of heart problems, contain a large amount of iodine and may be associated with thyroid function abnormalities.

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## What are the Symptoms of Hyperthyroidism?

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Hyperthyroidism is suggested by several signs and symptoms; however, patients with mild disease usually experience no symptoms. In patients older than 70 years, the typical signs and symptoms also may be absent. In general, the symptoms become more obvious as the degree of hyperthyroidism increases. The symptoms usually are related to an increase in the metabolic rate of the body.

- Excessive Sweating
- Heat Intolerance
- Increased Bowel Movements
- Tremor (Usually Fine Shaking)
- Nervousness / Agitation
- Rapid Heart Rate / Palpitations
- Insomnia
- Breathlessness
- Irregular or Scant Menstrual Periods
- Fatigue
- Weight Loss
- Muscle Weakness
- Hair Loss

In older patients, irregular heart rhythms and [heart failure](#) can occur. In its most severe form, untreated hyperthyroidism may result in "[thyroid storm](#)," a condition involving [high blood pressure](#), fever, and heart failure. Mental changes, such as confusion and [delirium](#), also may occur.

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## How is Hyperthyroidism Diagnosed?

Hyperthyroidism can be suspected in patients with:

- tremors,
- excessive sweating,
- smooth velvety skin,
- fine hair,
- a rapid heart rate, and
- an enlarged thyroid gland.

There may be puffiness around the eyes and a characteristic stare due to the elevation of the upper eyelids. Advanced symptoms are easily detected, but early symptoms, especially in the elderly, may be quite inconspicuous. In all cases, a blood test is needed to confirm the diagnosis.

The blood levels of thyroid hormones can be measured directly and usually are elevated with hyperthyroidism. However, the main tool for detection of hyperthyroidism is measurement of the blood TSH level. As mentioned earlier, TSH is secreted by the pituitary gland. If an excess amount of thyroid hormone is present, TSH is "down-regulated" and the level of TSH falls in an attempt to reduce production of thyroid hormone. Thus, the measurement of TSH should result in low or undetectable levels in cases of hyperthyroidism. However, there is one exception. If the excessive amount of thyroid hormone is due to a TSH-secreting pituitary tumor, then the levels of TSH will be abnormally high. This uncommon disease is known as "secondary hyperthyroidism."

Although the blood tests mentioned previously can confirm the presence of excessive thyroid hormone, they do not point to a specific cause. If there is obvious involvement of the eyes, a diagnosis of Graves' disease is almost certain. A

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combination of [antibody](#) screening (for Graves' disease) and a thyroid scan using radioactively-labeled iodine (which concentrates in the thyroid gland) can help diagnose the underlying [thyroid disease](#). These investigations are chosen on a case-by-case basis.

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### How does Hyperthyroidism Overlap with Psychiatric Symptoms?

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Patients with Graves' disease often have symptoms of anxiety, nervousness, fluctuating moods and irritability that resolve when thyroid hormone levels return to the normal range.

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### How is Hyperthyroidism Treated?

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The options for treating hyperthyroidism include:

- **Treating the Symptoms**

There are medications available to immediately treat the symptoms caused by excessive thyroid hormones, such as a rapid heart rate. One of the main classes of drugs used to treat these symptoms is the [beta-blockers](#) [for example, [propranolol](#) (Inderal), [atenolol](#) (Tenormin), [metoprolol](#) (Lopressor)]. These medications counteract the effect of thyroid hormone to increase metabolism, but they do not alter the levels of thyroid hormones in the blood. A doctor determines which patients to treat based on a number of variables including the underlying cause of hyperthyroidism, the age of the patient, the size of the thyroid gland, and the presence of coexisting medical illnesses.

- **Anti-thyroid Drugs**

There are two main antithyroid drugs available for use in the United States, [methimazole](#) (Tapazole) and [propylthiouracil](#) (PTU). These drugs accumulate in the thyroid tissue and block production of thyroid hormones. PTU also blocks the conversion of T4 hormone to the more metabolically active T3 hormone. The major risk of these medications is occasional suppression of production of white blood cells by the [bone marrow](#) (agranulocytosis). (White cells are needed to fight infection.) It is impossible to tell if and when this side effect is going to occur, so regular determination of white blood cells in the blood is not useful.

It is important for patients to know that if they develop a fever, a sore throat, or any signs of infection while taking methimazole or propylthiouracil, they should see a doctor immediately. While a concern, the actual risk of developing agranulocytosis is less than 1%. In general, patients should be seen by the doctor at monthly intervals while taking antithyroid medication.



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The dose is adjusted to maintain the patient in as close to a normal thyroid state as possible ([euthyroid](#)). Once the dosing is stable, patients can be seen at three month intervals if long-term therapy is planned.

Usually, long-term antithyroid therapy is only used for patients with Graves' disease, since this disease may actually go into [remission](#) under treatment without requiring treatment with thyroid radiation or surgery. If treated from one to two years, the data shows remission rates of 40%-70%. When the disease is in remission, the gland is no longer overactive, and antithyroid medication is not needed.

Recent studies also have shown that adding a pill of thyroid hormone to the antithyroid medication actually results in higher remission rates. The rationale for this may be that by providing an external source for thyroid hormone, higher doses of antithyroid medications can be given, which may suppress the overactive [immune system](#) in persons with Graves' disease. This type of therapy remains controversial, however. When long-term therapy is withdrawn, patients should continue to be seen by the doctor every three months for the first year, since a [relapse](#) of Graves' disease is most likely in this time period. If a patient does relapse, [antithyroid drug](#) therapy can be restarted, or [radioactive](#) iodine or surgery may be considered.

- **Radioactive Iodine**

Radioactive iodine is given orally (either by pill or liquid) on a one-time basis to ablate a hyperactive gland. The iodine given for ablative treatment is different from the iodine used in a scan. (For treatment, the [isotope](#) iodine 131 is used, while for a routine scan, iodine 123 is used.) Radioactive iodine is given after a routine iodine scan, and uptake of the iodine is determined to confirm hyperthyroidism. The radioactive iodine is picked up by the active cells in the thyroid and destroys them. Since iodine is only picked up by thyroid cells, the destruction is local, and there are no widespread side effects with this therapy.

Radioactive iodine ablation has been safely used for over 50 years, and the only major reasons for not using it are pregnancy and [breast-feeding](#). This form of therapy is the treatment of choice for recurring Graves' disease, patients with severe cardiac involvement, those with multinodular goiter or toxic adenomas, and patients who cannot tolerate antithyroid drugs. Radioactive iodine must be used with caution in patients with Graves' related eye disease since recent studies have shown that the eye disease may worsen



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after therapy. If a woman chooses to become pregnant after ablation, it is recommended she wait 8–12 months after treatment before conceiving.

In general, more than 80% of patients are cured with a single dose of radioactive iodine. It takes between 8 to 12 weeks for the thyroid to become normal after therapy. Permanent [hypothyroidism](#) is the major complication of this form of treatment. While a temporary hypothyroid state may be seen up to six months after treatment with radioactive iodine, if it persists longer than six months, thyroid replacement therapy (with T4 or T3) usually is begun.

- **Surgery**

Surgery to partially remove the thyroid gland (partial [thyroidectomy](#)) was once a common form of treatment for hyperthyroidism. The goal is to remove the thyroid tissue that was producing the excessive thyroid hormone. However, if too much tissue is removed, an inadequate production of thyroid hormone (hypothyroidism) may result. In this case, thyroid replacement therapy is begun. The major complication of surgery is disruption of the surrounding tissue, including the nerves supplying the vocal cords and the four tiny glands in the neck that regulate calcium levels in the body (the parathyroid glands). Accidental removal of these glands may result in low calcium levels and require calcium replacement therapy.

With the introduction of radioactive iodine therapy and antithyroid drugs, surgery for hyperthyroidism is not as common as it used to be. Surgery is appropriate for:

- pregnant patients and children who have major adverse reactions to antithyroid medications.
- patients with very large thyroid glands and in those who have symptoms stemming from compression of tissues adjacent to the thyroid, such as difficulty swallowing, hoarseness, and shortness of breath.

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### References and Further Information

<http://www.endocrineweb.com/hyper1.html>

<http://www.mayoclinic.com/health/hyperthyroidism/DS00344>

## Hyperthyroidism Information Sheet (continued)

These Information Sheets are designed to provide a brief overview of various medical conditions. Referring to the Information Sheets may help you communicate more effectively with other members of the Primary Care Team. The Information Sheets are by no means an exhaustive description of the disorders. If you need additional information, please engage in a more detailed search. Don't forget to consult with other members of the Primary Care Team. They are an invaluable source of information!