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## Patient information: High cholesterol treatment options (Beyond the Basics)

### INTRODUCTION

High cholesterol and lipid levels can significantly increase a person's risk of developing chest pain, heart attack, and stroke. Fortunately, a number of effective treatment options are available.

Lipid levels can almost always be lowered with a combination of diet, weight loss, exercise, and medications. As lipid levels fall, so does the risk of developing coronary heart disease (CHD), as well as the risk of suffering a heart attack. It is not too late if CHD is already present; lipid-lowering treatment can be lifesaving.

An explanation of what cholesterol and lipids are, how they affect health, and when levels should be measured is available in a separate topic. (See ["Patient information: High cholesterol and lipids \(hyperlipidemia\) \(Beyond the Basics\)"](#).) This topic will review when treatment is recommended, the available treatment options, and the risks, benefits, and effectiveness of each treatment.

### WHO NEEDS TREATMENT FOR HIGH CHOLESTEROL?

The decision to start lipid-lowering treatment is made on a case-by-case basis. Clinicians consider current lipid levels, the presence or absence of CHD, and other risk factors for CHD.

People with CHD — Several large trials have demonstrated that aggressive lipid lowering is beneficial in people with CHD. Independent of the following goals, many clinicians recommend treating all patients with CHD with a statin.

- A target LDL cholesterol level below 70 to 80 mg/dL (1.81 to 2.07 mmol/L) is recommended for people who have CHD **and** have multiple major risk factors (eg, people with diabetes or who smoke).
- People who have a heart attack (myocardial infarction or MI) are started on cholesterol-lowering medication while **in** the hospital and are advised to make lifestyle changes, regardless of their LDL level. (See ["Patient information: Heart attack recovery \(Beyond the Basics\)"](#).)
- A target LDL cholesterol level less than 100 mg/dL (2.59 mmol/L) is recommended for people who have CHD but do not have many additional risk factors. Lifestyle changes as well as medications may be recommended when LDL cholesterol levels are greater than 100 mg/dL (2.59 mmol/L).

These general guidelines may be modified by other individual factors.

**People without CHD** — People without a history of CHD also appear to benefit from lipid lowering therapy, although the treatments are not as aggressive as in patients with CHD. Guidelines from the United States National Cholesterol Education Program make the following recommendations:

- A target LDL cholesterol less than 130 mg/dL (3.36 mmol/L) is recommended for people with two or more risk factors for CHD and a 10-year risk of CHD between 10 and 20 percent. The 10-year risk can be calculated for women ([calculator 1](#)) and for men ([calculator 2](#)). Lifestyle changes **AND** medication are generally recommended when the LDL cholesterol is above 130 mg/dL (3.36 mmol/L).
- A target LDL cholesterol less than 130 mg/dL (3.36 mmol/L) is recommended for patients with two or more risk factors for CHD and a 10-year risk of CHD less than 10 percent. The 10-year risk can be calculated for women ([calculator 1](#)) and for men ([calculator 2](#)). Lifestyle changes are generally recommended when the LDL cholesterol is above 130 mg/dL, although medication is not generally recommended until levels are above 160 mg/dL (4.14 mmol/L).
- A target LDL cholesterol less than 160 mg/dL (4.14 mmol/L) is recommended for patients with zero to one risk factor for CHD. Lifestyle changes are generally recommended when the LDL cholesterol level is above 160 mg/dL, although medication is not generally recommended until levels are above 190 mg/dL (4.91 mmol/L).
- Additionally, in some patients the guidelines suggest using the level of non-HDL cholesterol (calculated by subtracting HDL cholesterol from total cholesterol) as a target.

Other experts make alternative recommendations, including global risk-based approaches to therapy. (See ["Treatment of lipids \(including hypercholesterolemia\) in primary prevention"](#).)

**Other special groups**

**Hypertriglyceridemia** — High triglycerides have not generally been thought to pose the same risk of CHD as LDL cholesterol. However, healthcare providers often recommend treatment for people with elevated triglyceride levels if they:

- Have very high levels (>500-1000 mg/dL or 5.65-11.3 mmol/L)
- Also have high LDL cholesterol or low HDL cholesterol levels
- Have a strong family history of CHD
- Have other risk factors for CHD

**Diabetes mellitus** — People with diabetes (type 1 or 2) are at high risk of heart disease. Thus, an LDL level below 100 mg/dL (2.59 mmol/L) is recommended in many people with diabetes. (See ["Patient information: Diabetes mellitus type 2: Overview \(Beyond the Basics\)"](#).)

**Elderly** — The decision to treat high cholesterol levels in an elderly person depends upon the individual's chronologic age (age in years) and physiologic age (health, fitness). A person with a limited life span and underlying illness is probably not a good candidate for drug therapy. On the other hand, an otherwise healthy elderly person should not be denied drug therapy simply on the basis of age alone. In general, the treatment goals discussed above are followed for elderly people.

**HIGH CHOLESTEROL TREATMENT OPTIONS**

Lipid levels can be lowered with lifestyle changes, medications, or a combination of these approaches. In certain cases, a clinician will recommend a trial of lifestyle changes before recommending a medication.

**Lifestyle changes** — All patients with high LDL cholesterol should try to make some changes in their day-to-day habits, by reducing total and saturated fat in the diet, losing weight (if overweight or obese), performing aerobic exercise, and eating a diet rich in fruits and vegetables. (See ["Patient information: Exercise \(Beyond the Basics\)"](#) and ["Patient information: Diet and health \(Beyond the Basics\)"](#).)

The benefits of such lifestyle modifications may be evident within 6 to 12 months. However, the success of lipid lowering with lifestyle modification varies widely, and clinicians may elect to begin drug therapy before this time period is over.

**Medications** — There are many medications available to help lower elevated levels of LDL cholesterol and triglycerides, but only a few for increasing HDL cholesterol. Each category of medication targets a specific lipid and varies in how it works, how effective it is, and how much it costs. Your healthcare provider will recommend a medication or combination of medications based on blood lipid levels and other individual factors.

**Statins** — Statins are the most powerful drugs for lowering LDL cholesterol and are the most effective drug for prevention of coronary heart disease, heart attack, stroke, and death. Statins include lovastatin, pravastatin, simvastatin, fluvastatin, atorvastatin, and rosuvastatin ([table 1](#)). These medications decrease the body's synthesis of cholesterol and can reduce LDL levels by as much as 20 to 60 percent. In addition, statins can lower triglycerides and slightly raise HDL cholesterol levels.

It is important to closely follow the dosing instructions for when to take statins; some are more effective when taken before bedtime while others should be taken with a meal.

In addition, some foods, such as grapefruit or grapefruit juice, can increase the risk of side effects of statins. Most manufacturers recommend that people who take lovastatin, simvastatin, or atorvastatin consume no more than one-half of a grapefruit or 8 ounces of grapefruit juice per day.

**Ezetimibe** — Ezetimibe (Zetia®) impairs the body's ability to absorb cholesterol from food as well as cholesterol that the body produces internally. It lowers LDL levels when used alone. It has relatively few side effects when used alone.

However, there are no studies that demonstrate better outcomes in patients who take ezetimibe, either alone or in combination with other cholesterol-lowering medications. Further study is needed before ezetimibe is recommended as a first-line treatment.

**Bile acid sequestrants** — The bile acid sequestrants include cholestyramine, colestipol, and colesevelam ([table 1](#)). These medications bind (combine with) bile acids in the intestine, reducing the amount of cholesterol absorbed from foods.

Bile acid sequestrants may be recommended to treat mild to moderately elevated LDL cholesterol levels. However, side effects can be bothersome, and may include nausea, bloating,

cramping, and liver injury. Taking psyllium (a fiber supplement, such as Metamucil®) can sometimes reduce the dose required and the side effects.

Bile acid sequestrants can interact with some medications, including as digoxin (Lanoxin®) and warfarin (Coumadin®), and with the absorption of fat-soluble vitamins (including vitamins A, D, K, and E). Taking these medications at different times of day can solve these problems in some cases.

Nicotinic acid (Niacin) — Nicotinic acid is a vitamin that is available in immediate-release, sustained-release, and extended-release formulations ([table 1](#)). Nicotinic acid may be recommended for people with elevated cholesterol levels and some types of familial hyperlipidemia.

- Side effects — Nicotinic acid has several possible side effects, including flushing (when the face or body turns red and becomes warm), itching, nausea, and numbness and tingling. This medication can also injure the liver; patients who use it require regular monitoring of liver function.

Taking nicotinic acid with food and taking aspirin (325 to 650 mg) 30 minutes before can decrease the side effects. Side effects often improve after 7 to 10 days. The immediate-release formulation is more likely to produce side effects, but is also more effective at lowering cholesterol levels and less likely to injure the liver than certain sustained-release formulations. The sustained-release and extended-release formulations have fewer side effects and are usually taken at night with a meal or snack.

Nicotinic acid can produce other side effects in some people, including insulin resistance, which can increase blood glucose levels in diabetics. It can increase uric acid levels in people with gout and is not recommended for this group. Nicotinic acid can also produce low blood pressure in people taking vasodilator medications such as nitroglycerin, and it can sometimes worsen angina pectoris (chest pain).

Fibrates — Fibrate medications (gemfibrozil, fenofibrate and fenofibric acid) can lower triglyceride levels and raise HDL cholesterol levels ([table 1](#)).

Fibrates may be recommended for people with elevated triglyceride levels and hyperlipidemia. Fibrates have been associated with muscle toxicity (causing muscle pain or weakness), especially when used by people with kidney insufficiency or when used in combination with a statin medication. Fenofibrate/fenofibric acid (Tricor®, Triglide®, Trilipex®) are less likely to interact with statins than gemfibrozil, and are safer in people who must use both medications.

## Nutritional supplements

Fish oil — Oily fish, such as anchovies and tuna, contain two important fatty acids, called DHA and EPA. Eating a diet that includes one to two servings of oily fish per week can reduce triglyceride levels and reduce the risk of death from coronary heart disease. Fish oil supplements are believed to have the same benefit. A daily 1 gram fish oil supplement may be recommended if you do not eat enough fish.

Soy protein — Soy protein contains isoflavones, which mimic the action of estrogen. A diet high in soy protein can slightly lower levels of total cholesterol, LDL cholesterol, and triglycerides,

and raise levels of HDL cholesterol. However, normal protein should not be replaced with soy protein or isoflavone supplements in an effort to lower cholesterol levels.

Soy foods and food products (eg, tofu, soy butter, edamame, some soy burgers, etc.) are likely to have beneficial effects on lipids and cardiovascular health because they are low in saturated fats and high in unsaturated fats.

Garlic — A large trial showed that garlic is not effective in lowering cholesterol [1]. In this study, participants with an elevated LDL took one of several types of garlic extract (raw, powdered, aged) or a placebo (inactive pill) six days per week for six months. At the end of the study, the LDL levels were not improved in the garlic group compared to the group that took the placebo. We do not recommend garlic to lower cholesterol.

Plant stanols and sterols — Plant stanols and sterols may act by blocking the absorption of cholesterol in the intestine. They are naturally found in some fruits, vegetables, vegetable oils, nuts, seeds, and legumes. They are also available in commercially prepared products such as margarine (Promise Active™ and Benecol®), orange juice (Minute Maid Premium Heart Wise®), rice milk (Rice Dream Heart Wise™), as well as dietary supplements (Benecol SoftGels® and Cholest-Off®). The margarines cost about five times what ordinary margarines cost.

Despite lowering cholesterol levels, there are no studies demonstrating a reduced risk of coronary heart disease in people who consume supplemental plant stanols and sterols. There is some evidence that these supplements might actually increase risk.

## STICKING WITH TREATMENT

The treatment of high cholesterol and/or triglycerides is a lifelong process. Although medications can rapidly lower your levels, it often takes 6 to 12 months before the effects of lifestyle modifications are noticeable. Once you have an effective treatment plan and you begin to see results, it is important to stick with the plan. Stopping treatment usually allows lipid levels to rise again.

Most people who stop treatment do so because of side effects. However, there are a wide variety of medications available today, which should make it possible for most people to find an option that works for them. Talk with a healthcare provider if a specific medication is not working; he or she can recommend alternatives that are compatible with your lifestyle and beliefs.

## WHERE TO GET MORE INFORMATION

Your healthcare provider is the best source of information for questions and concerns related to your medical problem.

This article will be updated as needed on our web site ([www.uptodate.com/patients](http://www.uptodate.com/patients)). Related topics for patients, as well as selected articles written for healthcare professionals, are also available. Some of the most relevant are listed below.

Patient level information — UpToDate offers two types of patient education materials.

The Basics — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

[Patient information: High cholesterol \(The Basics\)](#)

[Patient information: High triglycerides \(The Basics\)](#)

[Patient information: Can foods or supplements lower cholesterol? \(The Basics\)](#)

Beyond the Basics — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

[Patient information: High cholesterol and lipids \(hyperlipidemia\) \(Beyond the Basics\)](#)

[Patient information: Heart attack recovery \(Beyond the Basics\)](#)

[Patient information: Diabetes mellitus type 2: Overview \(Beyond the Basics\)](#)

[Patient information: Exercise \(Beyond the Basics\)](#)

[Patient information: Diet and health \(Beyond the Basics\)](#)

Professional level information — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

[Approach to the patient with hypertriglyceridemia](#)

[Cholesterol lowering after an acute coronary syndrome](#)

[HDL metabolism and approach to the patient with abnormal HDL-cholesterol levels](#)

[Intensity of lipid lowering therapy in secondary prevention of coronary heart disease](#)

[Lipid abnormalities after cardiac transplantation](#)

[Lipid abnormalities after renal transplantation](#)

[Lipid abnormalities in thyroid disease](#)

[Lipid lowering with diet or dietary supplements](#)

[Lipid lowering with drugs other than statins and fibrates](#)

[Lipid lowering with fibric acid derivatives](#)

[Lipoprotein classification; metabolism; and role in atherosclerosis](#)

[Lipoprotein\(a\) and cardiovascular disease](#)

[Management of dyslipidemia and cardiovascular risk in the HIV-infected patient](#)

[Measurement of serum lipids and lipoproteins](#)

[Mechanisms of benefit of lipid-lowering drugs in patients with coronary heart disease](#)

[Screening for lipid disorders](#)

[Statins: Actions, side effects, and administration](#)

[Treatment of drug-resistant hypercholesterolemia](#)

[Treatment of dyslipidemia in the older adult](#)

[Treatment of lipids \(including hypercholesterolemia\) in primary prevention](#)

[Treatment of lipids \(including hypercholesterolemia\) in secondary prevention](#)

The following organizations also provide reliable health information.

- National Library of Medicine

([www.nlm.nih.gov/medlineplus/healthtopics.html](http://www.nlm.nih.gov/medlineplus/healthtopics.html))

- National Cholesterol Education Program of the National Heart, Lung, and Blood Institute of the NIH

([www.nhlbi.nih.gov/chd](http://www.nhlbi.nih.gov/chd))

- American Heart Association

([www.americanheart.org](http://www.americanheart.org))

- The Hormone Foundation

([www.hormone.org/public/other.cfm](http://www.hormone.org/public/other.cfm), available in English, Spanish, and Portuguese)

- The Framingham Heart Study

([www.framingham.com/heart/](http://www.framingham.com/heart/))

[1-3]

Literature review current through: Oct 2013. | This topic last updated: May 24, 2013.

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References

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1. [Gardner CD, Lawson LD, Block E, et al. Effect of raw garlic vs commercial garlic supplements on plasma lipid concentrations in adults with moderate hypercholesterolemia: a randomized clinical trial. Arch Intern Med 2007; 167:346.](#)
2. [Fedder DO, Koro CE, L'Italien GJ. New National Cholesterol Education Program III guidelines for primary prevention lipid-lowering drug therapy: projected impact on the size, sex, and age distribution of the treatment-eligible population. Circulation 2002; 105:152.](#)
3. [Grundey SM, Cleeman JJ, Merz CN, et al. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. Circulation 2004; 110:227.](#)