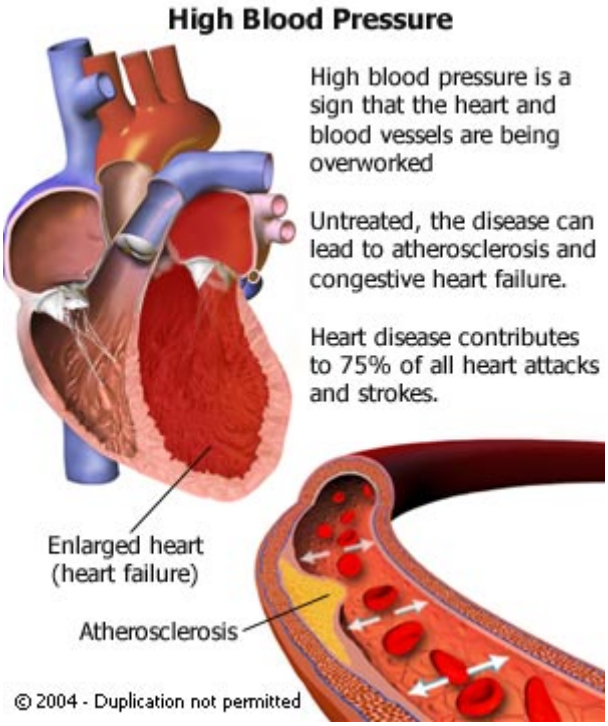
HIGH BLOOD PRESSURE
(Hypertension)

Summary
High **blood pressure** (hypertension), is a condition commonly associated with narrowing of the **arteries**. This causes blood to be pumped with excessive force against the artery walls. It is a sign that the heart and blood vessels are being overworked. Untreated, high blood pressure will cause the heart to eventually overwork itself to the point where serious damage can occur. For instance, the heart muscle can thicken (**hypertrophy**) and function abnormally, or dilate and contract less forcefully (**dilated cardiomyopathy**). High blood pressure can cause injury to the brain, the eyes (*retinopathy*) and/or the **kidneys** (*nephropathy*). Hypertensive patients are also at increased risk of **heart disease** and **stroke**. Most cases of high blood pressure have no cure, but the overwhelming majority can be managed and controlled with diet and medication.

High blood pressure is a major health problem in the United States, where more than 50 million people over age six (and 1 in 4 adults) have the condition, according to the U.S. Centers for Disease Control. It is especially common among African-Americans, who are one of the most likely ethnic groups in the world to be diagnosed with high blood pressure (see **High Blood Pressure & African Americans**). It has also been diagnosed in two-thirds of Americans over 65 and a growing number of young adults and children. Researchers report that supplementing infant formula with polyunsaturated **fatty acids** appears to have a beneficial impact on blood pressure later on in childhood. Previous studies already showed that breast milk contains such fatty acids, and that breast-fed children had lower blood pressures than those who were formula-fed. For more information, see **Hypertension in Children**).

According to the American Heart Association's *2004 Heart and Stroke Statistical Update*, less than one-third of Americans with high blood pressure are on "adequate therapy" (special diet or drugs). Approximately 26 percent are on some form of therapy, but do not have their blood pressure under control. Moreover, nearly 15 percent are on no therapy, and more than 30 percent are unaware that they even have this potentially life threatening condition.

About high blood pressure
High blood pressure (hypertension) is a condition in which a person's **blood pressure** is elevated. Blood pressure is the measure of the force of the blood pushing against the walls of the **arteries** – the blood vessels that carry blood from the heart to the rest of the body. When the heart contracts to pump out blood, the peak of contraction is called **systolic pressure**. After pumping, the heart relaxes and pressure drops to its lowest point just before a new beat. That lowest point is called the **diastolic pressure**.



The measurement of an individual's blood pressure is always expressed as systolic pressure over diastolic pressure. For example, normal blood pressure for adults is considered to be in the range of 120/80 millimeters of mercury. Generally, blood pressure above 140/90 is considered to be high for adults, and blood pressure under 90/60 is considered to be low for adults. A new category, **prehypertension**, is being used to refer to individuals with blood pressures between 120-139/80-89. Such individuals are typically not prescribed medication, but are advised to adopt lifestyle modifications where necessary to help keep blood pressure from rising. These include **weight loss**, **diet**, **exercise**, reducing **salt** intake and **quitting smoking**.

High blood pressure has been associated with a variety of significant health risks, including an increased risk of **heart disease**. It is also common in persons with obstructive **sleep apnea**.

According to the American Heart Association, the cause of about 90 to 95 percent of the cases of high blood pressure is unknown. However the condition is easily detected and usually controllable. Before age 55, a higher percentage of men than women have high blood pressure. The percentage of women with high blood pressure becomes slightly higher than men in the 55 to 74 age group. A higher percentage of women age 75 and older have high blood pressure compared to men in the same age group. High blood pressure is two to three times more common in women taking **birth control pills** than those not taking them, especially in women who are **overweight** or **obese**.

In 2000, high **blood pressure** a primary or contributing cause of death in 44,619 Americans, according to the **American Heart Association**, and was indirectly associated with another 210,000 deaths. Over the past 10 years, the actual number of deaths due to high blood pressure has increased by 40 percent. High blood pressure contributes to 75 percent of all **strokes** and **heart attacks**. According to data gathered from the **Framingham Heart Study**, 50 percent of people who have a first heart attack and two thirds of those who have a first stroke have blood pressures higher than 160/95.

The condition is especially deadly among African-Americans, who tend to be diagnosed

at younger ages and with higher blood pressures than other ethnic groups (see **High Blood Pressure & African Americans**). Unfortunately, many people with high blood pressure are unaware that they have the condition and do not seek treatment. Lack of access to medical care also contributes to undertreatment of high blood pressure. Because of this, the rate of high blood pressure among the poor or uninsured may be underestimated because these groups often do not achieve clinical recognition.

Left untreated, high blood pressure will gradually continue to rise even higher over the years, causing the heart to overwork itself to the point where serious damage can occur. Untreated high blood pressure also places other systems (e.g., circulation) and organs (e.g., the **kidneys**) at greater risk of damage that could lead to dysfunction or failure.

Hypertensive patients are at increased risk of the following:

- **Heart disease** (e.g., **heart failure**, **sudden cardiac death**, **cardiomyopathy**)
- Stroke
- Hardened **arteries** (**atherosclerosis**)
- **Aneurysm** (a weakness in the aortic wall where it balloons out to more than 1.5 times its normal size and is in danger of rupturing), often resulting in sudden cardiac death
- Kidney failure
- Retinopathy (loss of vision)

The risk of developing one or more of these serious health conditions increases as blood pressure rises. High blood pressure has often been called the “silent killer” because mild to moderate levels usually go unnoticed by patients until serious damage has already been done. To clarify the risk factors, high blood pressure measurements for adults have been ranked according to risk categories of increasing severity, ranging from “normal” to “stage 4.” The following categories apply to adults (age 18 and over) who are not taking medicine for high blood pressure and do not have a serious short-term illness:

Stage	Systolic Pressure		Diastolic Pressure
Optimal *	Under 120	AND	Under 80
Prehypertensive**	120-139	OR	80-89
1	140-159	OR	90-99
2	160-179	OR	100-109
3	180-209	OR	110-119
4	210 or over	OR	120 or over

Source: National High Blood Pressure Education Program

Note: Optimal levels are with respect to heart disease risk. Unusually low readings (below 90/60) can also negatively affect heart health should be reported to a physician. For more information, see **Low Blood Pressure**.

The U.S. National Heart, Lung, and Blood Institute (NHBLI, part of the U.S. National Institutes of Health) has proposed a new category, called **prehypertension. This refers to individuals who do not have high blood pressure, who do not take blood pressure medication (antihypertensives), but who are considered to be at risk for developing high b and its associated risk for coronary artery disease and stroke. Earlier, such individuals

may have been termed "high normal."

High blood pressure has been traditionally classified as 140/90 millimeters of mercury (mmHg) or above. Now, *prehypertension* describes systolic blood pressure of 120-139 mmHg or diastolic blood pressure of 80-89 mmHg; a desirable *normal* blood pressure remains at less than 120 systolic *and* less than 80 diastolic.

Researchers at the NHLBI report that the risk of developing coronary artery disease can begin at blood pressures little higher than 115/75 mmHg, and that risk doubles with each 20/10 mmHg increment.

Prehypertensive individuals are typically not given medication, but are recommended to adopt lifestyle modifications where necessary to help keep blood pressure from rising. These include weight loss, diet, exercise, reducing salt intake and stopping smoking. For persons having diabetes or kidney disease, the goal is to keep blood pressure under 130/80 mmHg, for which antihypertensive drugs may be advised.

An important exception to the information listed above is noted among patients with **diabetes** and/or kidney disease. These patients will require treatment if their blood pressure is above 130/80. Research has found success with a new drug, *indapamide*. For individuals with diabetes and high blood pressure, the drug was seen to lower blood pressure without affecting blood sugar levels.

Signs and symptoms of high blood pressure

The majority of people with mild to moderate high blood pressure cannot tell when their **blood pressure** is too high. In fact, about one-third of hypertensive people are not aware of their condition. Patients may experience chest pain (**angina**), **shortness of breath** or other symptoms related to **heart disease** or underlying damage. High blood pressure may cause any of the following:

- Fatigue
- Confusion
- Nausea or upset stomach
- Vision changes or problems
- Excessive sweating
- Paleness or redness of skin
- Nosebleeds
- Anxiety or nervousness
- **Palpitations** (strong, fast or obviously irregular heartbeat)
- Ringing or buzzing in ears
- Impotence
- Headache
- **Dizziness**

Diagnosis methods for high blood pressure

When diagnosing high blood pressure, a physician will get a patient's full **medical history**. For example, the physician will ask whether high **blood pressure** runs in the family and what the patient's dietary habits have been like (e.g., **salt** intake). The physician will also give the patient a complete **physical examination**, which will include checking the patient's blood pressure in both arms while standing and lying down. In some cases, the physician may ask the patient to take his or her own blood pressure at home and bring in a daily log of blood pressure measurements. This strategy will help establish the patient's normal blood pressure pattern and to rule out **white coat hypertension** (high blood pressure only while in a physician's office). It has also been shown that, in adults 65 years of age and older, blood pressure may drop somewhat in

the first two hours after eating. This may result in an inaccurate blood pressure reading if taken during that interval.

Blood pressure is measured by wrapping an arm cuff (attached to a **sphygmomanometer**) snugly around the patient's arm and then using a **stethoscope** to listen to the *brachial artery* located at the inside elbow on the same arm. The cuff is then pumped full of air until circulation is very briefly cut off. Then some air will be slowly let out of the device, loosening the cuff's grip on the arm and releasing the blood to flow freely again. As the air is let out, the examiner watches the numbers coming down on a simple monitor (sphygmomanometer) and waits until he or she first hears the heartbeat. The number at which that occurs is the **systolic pressure**. The examiner remembers this as the numbers continue to come down on the monitor and notes the number at which he or she last hears the heartbeat. The number at which that occurs is the **diastolic** pressure. Other blood pressure measurement devices may also be used. Some use mercury manometers to measure the pressure and others employ digital readouts.

Reliable blood pressure monitors are also available if people are interested in monitoring their own blood pressure and/or that of their family members. When purchasing these monitors, it is important to consult with a physician or a consumer product rating agency regarding the reliability of home monitors. Generally, arm cuff digital monitors are the easiest and most reliable to use but should be periodically checked with a mercury sphygmomanometer. Researchers are also testing 24-hour blood pressure monitors, with early studies focusing on patients with high blood pressure who are at increased risk for a heart attack.

Following the physical examination, a number of tests will often be ordered, which include the following:

- Urinalysis and various **blood tests** (e.g., **electrolytes** and **waste products**) tests to rule out **kidney** disease.
- **Electrocardiogram** (EKG), which measures the heart's electrical activity. By analyzing the EKG results, a physician can check for heart-related problems that could be associated with high blood pressure (e.g., left ventricular **hypertrophy**).
- **Echocardiogram**, which uses ultrasound waves to visualize the structures and functions of the heart. This test is also used to check for heart-related problems such as left ventricular hypertrophy.
- **Chest x-ray** to rule out an **enlarged heart**.

Once a diagnosis has been made and serious problems (e.g., kidney disease) have been ruled out, then treatment can begin (see next section). However, very high blood pressure may require additional testing to rule out an unusual cause. For example, a renal Doppler sonogram or scan may be ordered to evaluate for high blood pressure in the blood vessels of the kidneys (*renovascular hypertension*). Also, a 24-hour urine test may be needed to rule out an endocrine disorder, such as Cushing disease or **pheochromocytosis**.

High blood pressure may occur in either adults or children. Some people may also be diagnosed with the opposite condition: **Low blood pressure** (*hypotension*). Although some hypertensives do not need to take medication as long as they can control their risk factors (e.g., weight), most cases generally require long-term treatment with medications.

Treatment options for high blood pressure

Lifestyle changes can significantly improve a patient's **blood pressure**. Definite steps that can and should be taken to lower and control blood pressure include:

- **Quitting smoking**. This is perhaps the most important thing a smoker can do to promote his or her own health. Among many other side effects, smoking elevates blood pressure. For more information, see **Smoking Related Diseases**, **Smoking Addiction** and **Smoking Cessation**.

- **Losing weight**. Loss of weight in the abdominal area can immediately reduce blood pressure and helps to reduce the size of the heart. Weight loss accompanied by **salt** restriction may allow mild hypertensives to reduce or eliminate their need for medication. For more information, see **Obesity & Your Health** and **Weight Loss**.

- Following the **DASH diet**. Well-controlled studies have shown that people on the DASH diet for only eight weeks experienced a significant reduction in blood pressure. For more information or recipes, click on either of the following: **DASH Diet** or **Low-Salt Recipes**.

- Getting adequate amounts of: **vitamins and minerals**. Studies show that vitamin C protects normal levels of nitric oxide – the substance that keeps **arteries** flexible. Vitamin E and the B-vitamins may also be helpful. Also, adequate intake of minerals such as potassium, magnesium and calcium is thought by some experts to be even more helpful than reducing salt intake for reducing blood pressure. Individuals should consult with their physician before supplementing their diet. For more information, click on the following: **Vitamins & Minerals**.

- Engaging in regular aerobic **exercise**. Exercising at least three to four times per week is helpful for regulating high blood pressure, keeping in mind that the regularity of the exercise is more important than the intensity of the workout. For example, studies have shown that Tai Chi (an ancient Chinese workout involving slow relaxing movements) may lower blood pressure almost as well as moderately intense aerobics. Individuals should consult with their physician before starting an exercise program. For more information, see **Benefits of Exercise for Heart Patients**.

- Limiting **alcohol** use to one drink per day for women and two drinks per day for men. One drink is defined as one 6-ounce glass of wine per day, one 12-ounce beer or one 1-ounce shot of distilled spirits. For more information, see **Alcohol & Heart Disease**.

- Limiting **salt** intake to 2,000 milligrams (2 grams) of sodium per day.

- Using **stress management** techniques. Emotional factors may play important roles in the development of hypertension. Studies have shown that cognitive-behavioral therapy, transcendental meditation, active religious faith and participation in church-related activities have all been associated with reducing blood pressure to healthy levels. (Watching or listening to religious services on radio or TV had no effect.)

- Having a pet may also lower blood pressure.

Women are also encouraged to discuss with their physicians the increased risk of high blood pressure that results from taking **birth control pills**, particularly if they are over the age of 35. According to the **American Heart Association**, high blood pressure is

two to three times more common in women taking birth control pills than those not taking them, especially in women who are **overweight** or **obese**.

As hypertensive patients make these changes, they are often encouraged to monitor their blood pressure at home, under the guidance of their physician. In addition to these lifestyle changes, patients are often prescribed blood pressure-reducing medications. These medications include the following:

- **Diuretics**. Medications that promote the formation of urine in the **kidneys**, causing the body to flush out excess fluids and minerals, especially sodium. These are often the first medications given to reduce high blood pressure. Though commonly used, they may have unwanted side effects, such as low potassium levels (*hypokalemia*).

- **Alpha blockers** and **beta blockers**. Medications that inhibit alpha and beta receptors in various parts of the nervous system. This helps arteries to relax, decreases the force of the heartbeat and reduces blood pressure. Beta blockers are especially useful in patients with **heart disease**.

- **ACE inhibitors**. These medications are types of **vasodilators** that help to reduce blood pressure by inhibiting the substances in the blood that cause blood vessels to constrict. Recent studies suggest that this class of drugs may be superior to others in preventing **stroke**, heart disease and kidney disease in patients (especially diabetics) with risk factors for vascular disease. They are also very useful in patients with established heart disease.

- **Angiotensin II receptor blockers** (ARBs). This new class of drugs is showing good results and great promise in reducing complications related to high blood pressure. Although beta blockers, ACE inhibitors and diuretics are currently used most often in the treatment of high blood pressure, ARBs may be prescribed more often in the future.

- **Calcium channel blockers**. These are types of vasodilators that inhibit the flow of calcium into heart and blood vessel tissues, which reduces tension in the heart, relaxes blood vessels and lowers blood pressure. Unfortunately, most studies have not shown that these agents reduce the risk of death from high blood pressure, and some of these medications may increase the risk of death from high blood pressure.

While some newer medications have shown to lower both blood pressure and the risks of heart disease, they had not been tested against each other until recently. This was addressed with the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). Begun in 1994, involving over 42,000 individuals and the largest such trial to date, this important study showed that “traditional” diuretics were more effective in treating high blood pressure. Participants with high blood pressure were randomly given diuretics, calcium channel blockers, ACE inhibitors or alpha blockers.

Results five years later revealed that, compared to the other classes of drugs in the study, diuretics were not only significantly more effective in lowering high blood pressure, but also in lowering the risk of cardiovascular events (e.g., stroke, **angina**, **heart failure**). In fact, the alpha blocker category was terminated in March 2000 due to a higher rate of cardiovascular events and hospitalization compared to diuretics. Based on these findings, the ALLHAT researchers concluded that drug therapy to lower blood pressure should be initiated with diuretics (*Journal of the American Medical Association*; December 18, 2002).

The ALLHAT researchers did recognize some limitations to the study. Commenting on the

significantly lower blood pressure attained with the diuretic-controlled group (compared to calcium channel blockers and ACE inhibitors), the benefit may have been secondary to overall better blood pressure control in that group, and perhaps not just from the diuretic itself. Indeed, other studies have shown a marked and significant benefit from ACE inhibitors, specifically *ramipril*, in reducing the progression of atherosclerosis, preventing strokes and heart attacks, and prolonging life in patients with vascular disease, high blood pressure, diabetes and heart failure.

The majority of patients with high blood pressure will need to take medications for the rest of their lives in order to control the condition. In some cases, two or three **antihypertensives** may be given. Recent studies have shown that such a combination of drugs not only lowers blood pressure, but also may reduce the risk of **stroke** and **ischemic heart disease**. Other research has suggested that some patients with only slightly elevated blood pressures may eventually be able to stop taking medications and control their condition through lifestyle changes alone. The two most important lifestyle changes tracked by the study were weight loss and maintaining a low-salt diet. Strategies such as exercise, diet plans and, especially, changes in drugs should not be undertaken on one's own, but first discussed with one's physician.

Researchers have also been exploring the genetic roots of high blood pressure. Identifying genes that cause high blood pressure in a particular patient could help physicians to prescribe the most effective antihypertensive drug.

Lifestyle considerations with high blood pressure

People with high blood pressure should avoid certain activities and situations that may raise their heart rates and **blood pressure** to dangerous levels. These include the following:

- Saunas
- Steam baths
- Steam rooms
- Heated whirlpools
- Hot tubs
- Very warmly heated swimming pools

It is very important for hypertensives to limit the amount of time spent in these activities to less than 10 minutes, after which they should sit down out of the heat for a few minutes before standing to minimize the risk of **dizziness** or passing out (**syncope**).

Hypertensives must also be careful about using certain over-the-counter (OTC) medications that contain **vasoconstrictors**, which can elevate blood pressure. Such medications include:

- Eyedrops
- Cold, flu, sinus and cough medications (especially those containing decongestants)
- Antihistamines

Hypertensives are also encouraged to follow all of their physician’s orders regarding treatment, in order to prevent serious health consequences. However, patients are encouraged to discuss with their physicians any side effects or other concerns that they may have about their treatment.

Women's issues with high blood pressure

Once thought of as a “male disease,” high **blood pressure** affects an equal number of women and men. According to the **American Heart Association**, high **blood pressure**

was directly related to the deaths of 26,685 American women in 1998, more than 58 percent of total deaths from high blood pressure that year. As with men, high blood pressure in women usually develops without symptoms, and, while treatable, generally has no cure. All women are encouraged to learn about their risks for high blood pressure and what can be done to prevent it.

Below are some facts about women and high blood pressure:

- One in three cases of **heart failure** in women results from high blood pressure.

- Blood pressure tends to get higher as we age. More than half of women over age 50 suffer from high blood pressure. Before age 55, a higher percentage of men have high blood pressure than women. The percentage of women with high blood pressure becomes slightly higher than men in the 55 to 74 age group. A higher percentage of women age 75 and older have high blood pressure than men in the same age group (AHA's *2003 Heart and Stroke Statistical Update*).

- As noted previously, high blood pressure is two to three times more common in women taking **birth control pills** than those not taking them, especially in women who are **overweight** or **obese**.

- Women who have had a **heart attack** are less likely to experience a second one if they lower their blood pressure.

- High blood pressure is more prevalent among black women than in the general female population.

- During **pregnancy**, some women develop high blood pressure for the first time. Known as *gestational hypertension*, this has been shown to increase the risk of developing high blood pressure and **stroke** later on in life. Others who already have the condition see it worsen during pregnancy. Please see **Pregnancy and Heart Disease** for more information.

- Sexual dysfunction in women may be linked to high blood pressure. Female patients are encouraged to discuss any sexual difficulties with their physicians.