Stroke

- Someone in the US has a stroke about once every 40 seconds.
- Stroke accounts for 1 of every 19 deaths in the US.
- Stroke kills someone in the US about every 3 minutes 45 seconds.
- When considered separately from other cardiovascular diseases, stroke ranks No. 5 among all cause of death in the US, killing nearly 133,000 people a year.
- From 2005 to 2015, the age-adjusted stroke death rate decreased 21.7 percent, and the actual number of stroke deaths declined 2.3 percent.
- Each year, about 795,000 people experience a new or recurrent stroke. Approximately 610,000 of these are first attacks, and 185,000 are recurrent attacks.
- Stroke is a leading cause of serious long-term disability in the US.
- In 2015, stroke deaths accounted for 11.8% of total deaths worldwide, making stroke the second leading global cause of death behind heart disease.
Stroke is a Medical Emergency. Call 911 immediately! Ask to be transported to a Certified Stroke Center.
Ischemic Stroke Occurrence Rates for Hospitalized Patients per 10,000 Adults (Median Rate = 25.10)

- **Very High** (29.12 - 40.00)
- **High** (25.11 - 29.11)
- **Low to Average** (0.01 - 25.10)
- **No rate**
MECHANISMS OF STROKE

LARGE ARTERY Atherosclerosis: 20%
Lacunes: 25%
Cryptogenic: 30%
Others: 5%
Cardioembolism: 20%

2020 Ways to Live Longer and Better with Right Care Initiative

Blood Pressure <130, Waist/height < 0.5, hs CRP < 2.0, LDL<70-100, Stop Smoking
A1c<6, health insurance, Dental Care, Floss, Colonoscopy, Mammogram, Hep C, Skin and Prostate CA, Sleep 7-10 hours, Muscle Strength, Higher Bone Density, EXERCISE(aerobic and weight bearing), Flexibility, Team, Squats and Lunges, Balance, High Intensity Training, Tai chi, Fiber, Fruits, Vegetables, Nuts, Fish, Reduce Calories (sugar, fried, refined, sweeteners, meats), Milk, Guacamole, Lentils, Beans, Tea, Moderate Alcohol, Party, Avoid negative relationships, Social Media for Family only, Sex, Smart Phone, Wash Hands, Flu Vaccine, Reduce Stress, Don’t drink and climb, Sit in back of plane, Life Jacket, Volunteer, Shinrin-yoku, Hang around kids, Read books, Pray
Atherosclerosis (CAD/MI)

- Genetics
- Age
- Genetics

Risk Factors:
- Homocysteine
- Coagulopathy
- Systemic inflammation
- Lack of activity
- Pollution expo
- Tobacco use

Other Risk Factors:
- Diabetes
- Dyslipidemia
- Hypertension
- Obesity

Heritability:
- Diabetes: 70%
- Dyslipidemia: 75%
- Hypertension: 50%
- Obesity: 80% (Reported heritability of each risk factor)
## INTERHEART: Association of risk factors with acute MI in women and men

### Table: Risk Factors and Gender

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smoking</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Diabetes</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Hypertension</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Abdominal obesity</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Psychosocial index</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Fruits/Vegetables</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Exercise</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>Alcohol</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>ApoB-ApoA1 ratio</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
</tbody>
</table>

### Odds Ratio (99% CI)

Adjusted for age, sex, geographic region

Note: odds ratio plotted on a doubling scale

INTERHEART: Clinical implications

- 9 simple and modifiable risk factors are strongly associated with acute MI worldwide.
- These 9 risk factors account for >90% of the PAR globally and in most regions.
- Abnormal ApoB-ApoA1 ratio and smoking are the 2 most important risk factors and account for over two thirds of the PAR.
- Implementing preventive strategies based on our current knowledge would prevent the majority of premature CHD worldwide.

PAR = population attributable risk
Apo = apolipoprotein

The major risk factors for stroke include:

- **High blood pressure.** High blood pressure is the main risk factor for stroke. Blood pressure is considered high if it stays at or above 140/90 millimeters of mercury (mmHg) over time. If you have diabetes or chronic kidney disease, high blood pressure is defined as 130/80 mmHg or higher.
- **Diabetes.** Diabetes is a disease in which the blood sugar level is high because the body doesn't make enough insulin or doesn't use its insulin properly. Insulin is a hormone that helps move blood sugar into cells where it's used for energy.
- **Heart diseases.** Ischemic heart disease, cardiomyopathy, heart failure, and atrial fibrillation can cause blood clots that can lead to a stroke.
- **Smoking.** Smoking can damage blood vessels and raise blood pressure. Smoking also may reduce the amount of oxygen that reaches your body’s tissues. Exposure to secondhand smoke also can damage the blood vessels.
- **Age and gender.** Your risk of stroke increases as you get older. At younger ages, men are more likely than women to have strokes. However, women are more likely to die from strokes. Women who take birth control pills also are at slightly higher risk of stroke.
- **Race and ethnicity.** Strokes occur more often in African American, Alaska Native, and American Indian adults than in white, Hispanic, or Asian American adults.
- **Personal or family history of stroke or TIA.** If you've had a stroke, you're at higher risk for another one. Your risk of having a repeat stroke is the highest right after a stroke. A TIA also increases your risk of having a stroke, as does having a family history of stroke.
- **Brain aneurysms or arteriovenous malformations (AVMs).** Aneurysms are balloon-like bulges in an artery that can stretch and burst. AVMs are tangles of faulty arteries and veins that can rupture (break open) within the brain. AVMs may be present at birth, but often aren't diagnosed until they rupture.

Other risk factors for stroke, many of which of you can control, include:

- Alcohol and illegal drug use, including cocaine, amphetamines, and other drugs
- Certain medical conditions, such as sickle cell disease, vasculitis (inflammation of the blood vessels), and bleeding disorders
- Lack of physical activity
- **Overweight and Obesity**
- Stress and depression

**Screening and Prevention**

- **OR: BP 2.98, Psychosocial 2.20, Apo b/A1 1.84, smoke 1.67, <EtOH 1.67, waist/hip 1.44, DM 1.16, diet 0.60, exercise 0.60**

- Don't smoke, or if you smoke or use tobacco, quit. Smoking can damage and tighten blood vessels and raise your risk of stroke. Talk with your doctor about programs and products that can help you quit. Also, secondhand smoke can damage the blood vessels.
- **Aim for a healthy weight.** If you're overweight or obese, work with your doctor to create a reasonable weight loss plan. Controlling your weight helps you control risk factors for stroke.
- Make heart-healthy eating choices. Heart-healthy eating can help lower your risk or prevent a stroke.
- Manage stress. Use techniques to lower your stress levels.
Reduce Your Risk Recap

At the doctor
Assess the 4 Hs:
- Heredity
- High blood pressure
- Heart disease
- High cholesterol

Take steps to treat:
- Sleep Apnea
- Diabetes
- Circulation problems

At home
- Stop smoking
- Maintain a healthy weight
- Be Active
- Watch what you eat
- Drink less alcohol
Cholesterol Lowering and Stroke

LnRR = -0.061 - 0.005(% cholesterol reduction)

Stroke Risk Reduction

Cholesterol Reduction

Am Journal Medicine 133:1 January 2020
Controlling High Blood Pressure at <140/90 mmHg (PY 2015-2018)

Controlling Blood Pressure (<140/90 mmHg) for People with Diabetes (PY 2012-2018)

Controlling Blood Sugar (HbA1c < 8) for People with Diabetes (PY 2012-2018)

Controlling Cholesterol for People with Heart Disease (PY 2012-2013); Prescribing Statins to People with Heart Disease (PY 2017-2018)

Source: Performance data for managed care patients, CA Office of the Patient Advocate Report

a) PY = Performance Year
b) Red Line marks 90th Percentile Performance

**Blood Pressure (BP) Thresholds and Recommendations for Treatment and Follow-Up**

(For non-institutionalized, ambulatory, community-living adults)

- **Normal BP** (BP <120/80 mm Hg)
- **Elevated BP** (BP 120-129/80 mm Hg)
- **Stage 1 Hypertension** (BP 130-139/89-89 mm Hg)
- **Stage 2 Hypertension** (BP ≥ 140/90 mm Hg)

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**Oral Antihypertensive Drugs**

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Usual Dose, Range (mg per day)*</th>
<th>Daily Frequency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Agents</td>
<td></td>
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</tr>
<tr>
<td>Thiazide or thiazide-type diuretics</td>
<td>Chlorothalidone 12.5-25 1</td>
<td>• Chlorothalidone preferred based on prolonged half-life and proven trial reduction of CVD</td>
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<tr>
<td></td>
<td>Hydrochlorothiazide 25-50 1</td>
<td>• Monitor for hyponatremia and hypokalemia, uric acid and calcium levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indapamide 1.25-2.5 1</td>
<td>• Use with caution in patients with history of acute gout unless patient is on uric acid-lowering therapy</td>
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<tr>
<td></td>
<td>Metolazone 2.5-10 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACE Inhibitors</td>
<td>Benazepril 10-40 1 or 2</td>
<td>• Do not use in combination with ARBs or direct renin inhibitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Captopril 12.5-150 2 or 3</td>
<td>• Increased risk of hyperkalemia, especially in patients with CKD or in those on K+ supplements or K+ sparing drugs</td>
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<tr>
<td></td>
<td>Enalapril 5-40 1 or 2</td>
<td>• May cause acute renal failure in patients with severe bilateral renal artery stenosis</td>
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</tr>
<tr>
<td></td>
<td>Fosinopril 10-40 1</td>
<td>• Do not use if history of angioedema with ACE inhibitors</td>
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<tr>
<td></td>
<td>Lisinopril 10-40 1</td>
<td>• Avoid in pregnancy</td>
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<tr>
<td></td>
<td>Moexipril 7-50 1 or 2</td>
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<td>Perindopril 4-16 1</td>
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<td></td>
<td>Quinapril 10-80 1 or 2</td>
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<tr>
<td></td>
<td>Ramipril 2.5-10 1 or 2</td>
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<td></td>
<td>Trandolapril 1.4-1</td>
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<tr>
<td>ARBs</td>
<td>Azilsartan 40-80 1</td>
<td>• Do not use in combination with ACE inhibitors or direct renin inhibitor</td>
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<tr>
<td></td>
<td>Candesartan 8-32 1</td>
<td>• Increased risk of hyperkalemia in CKD or in those on K+ supplements or K+ sparing drugs</td>
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<tr>
<td></td>
<td>Eprosartan 600-800 1 or 2</td>
<td>• May cause acute renal failure in patients with severe bilateral renal artery stenosis</td>
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<tr>
<td></td>
<td>Irbesartan 150-300 1</td>
<td>• Do not use if history of angioedema with ARBs. Patients with a history of angioedema with an ACEI can receive an ARB beginning 6 weeks after ACEI discontinued</td>
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<tr>
<td></td>
<td>Losartan 50-100 1 or 2</td>
<td>• Avoid in pregnancy</td>
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<tr>
<td></td>
<td>Olmesartan 20-40 1</td>
<td></td>
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<tr>
<td></td>
<td>Telmisartan 20-80 1</td>
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<tr>
<td></td>
<td>Valsartan 80-320 1</td>
<td></td>
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</tr>
<tr>
<td>CCB- dihydropyridines</td>
<td>Amlodipine 2.5-10 1</td>
<td>• Avoid use in patients with HF-REF; amiodipine or felodipine may be used if required</td>
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<tr>
<td></td>
<td>Felodipine 5-10 1</td>
<td>• Associated with dose-related pedal edema, which is more common in women than men</td>
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<td></td>
<td>Isradipine 5-10 2</td>
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<td></td>
<td>Nicardipine SR 5-20 1</td>
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<td></td>
<td>Nifedipine LA 60-120 1</td>
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<td></td>
<td>Nisoldipine 30-90 1</td>
<td></td>
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</tr>
<tr>
<td>CCB- nondihydropyridines</td>
<td>Diltiazem SR 180-360 2</td>
<td>• Avoid routine use with beta blockers due to increased risk of bradycardia and heart block</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diltiazem ER 120-460 1</td>
<td>• Do not use in patients with HF-REF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verapamil SR 40-80 3</td>
<td>• Drug interactions with diltiazem and verapamil (CYP3A4 major substrate and moderate inhibitor)</td>
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</tr>
<tr>
<td></td>
<td>Verapamil delayed onset ER (various forms) 100-480 1 (in the evening)</td>
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</tbody>
</table>

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**Nonpharmacologic interventions to reduce BP include:** weight loss for overweight or obese patients with a Heart healthy diet, sodium restriction, and potassium supplementation within the diet; and increased physical activity with a structured exercise program. Men should be limited to no more than 2 and women no more than 1 standard alcohol drinks per day. The usual impact of each lifestyle change is a 4-5 mmHg decrease in SBP and 2-4 mmHg in DBP, but diet low in sodium, saturated fat, and total fat and increase in fruits, vegetables, and grains may decrease SBP by approximately 11 mmHg.

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Improving the Health of Americans Through Prevention and Management of Diabetes and Heart Disease and Stroke – Financed in Part by 2018 Prevention and Public Health Funds (PPHF) – CDC NU58DP006540

Prevention and Management of Heart Disease, Stroke, Diabetes, and High Blood Cholesterol, and their associated risk factors, make a huge impact on the health of Californians.

CDPH will contract with 12 local agencies to focus on evidence-based prevention and self-management measures within high burden populations to improve overall health while reducing health inequities.

Updated: 6/06/2019
Right Care Initiative Statewide Goal: Drive Toward Zero Preventable Heart Attack, Stroke, Diabetes, and Heart Failure Deaths & Disabilities Through Best Available Science Combined with Proactive Screening & Outreach

Achieve 80% in good control, or “A Grade” (90th Percentile) HEDIS levels for Cardiovascular Disease and Diabetes, whichever is greater.

Priorities:

- 80% of hypertensive patients with blood pressure (BP) controlled: <140/90 mm Hg (Optimally 130/80 mm Hg per 2017 American College of Cardiology Guidelines, endorsed by ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA)
- 80% of diabetic patients with blood sugar controlled: Hemoglobin A1c<8
- 80% of patients with diabetes and/or cardiovascular conditions on appropriate cholesterol therapy (proxy, LDL controlled: LDL-C<100mg/dL)

Proactive Community Outreach to Screen & Identify Vulnerable Patients to Connect to Treatment & Support
Figure 12: Sacramento County Hot Spots for Diabetes, Heart Disease, Hypertension and Stroke Mortality Rates (2007-2011)
Source: California Department of Public Health, Map 3,4,5,6. Community Health Status Report 2014
Medicines

If you have a stroke caused by a blood clot, you may be given a clot-dissolving, or clot-busting, medication called tissue plasminogen activator (tPA). A doctor will inject tPA into a vein in your arm. This type of medication must be given within 4 hours of symptom onset. Ideally, it should be given as soon as possible. The sooner treatment begins, the better your chances of recovery. Thus, it's important to know the signs and symptoms of a stroke and to call 9-1-1 right away for emergency care.

If you can’t have tPA for medical reasons, your doctor may give you antplatelet medicine that helps stop platelets from clumping together. To control blood clots or anticoagulant medicine (blood thinner) that keeps existing blood clots from getting larger. Two common medicines are aspirin and clopidogrel.

Medical Procedures

If you have carotid artery disease, your doctor may recommend a carotid endarterectomy or carotid artery stent surgery. Both procedures open blocked carotid arteries.

Researchers are testing other treatments for ischemic stroke, such as intra-arterial thrombolysis and mechanical clot removal in cerebral ischemia (MERCi).

In intra-arterial thrombolysis, a long flexible tube called a catheter is put into the groin (upper thigh) and threaded to the tiny arteries of the brain. Your doctor can deliver medicine through this catheter to break up a blood clot in the brain.

MERCi is a device that can remove blood clots from an artery. During the procedure, a catheter is threaded through a carotid artery to the affected artery in the brain. The device is then used to pull the blood clot out through the catheter.

Treating a Hemorrhagic Stroke

A hemorrhagic stroke occurs if an artery in the brain leaks blood or ruptures. The first steps in treating a hemorrhagic stroke are to find the cause of bleeding in the brain and then control it. Unlike ischemic strokes, hemorrhagic stroke aren’t treated with antplatelet medicines and blood thinners because these medicines can make bleeding worse.

If you’re taking antplatelet medicines or blood thinners and have a hemorrhagic stroke, you’ll be taken off the medicine. If high blood pressure is the cause of bleeding in the brain, your doctor may prescribe medicines to lower your blood pressure. These will help prevent further bleeding.

Surgery also may be needed to treat a hemorrhagic stroke. The types of surgery used include aneurysm clipping, coil embolization, and arteriovenous malformation (AVM) repair.

Aneurysm Clipping and Coil Embolization

If an aneurysm (a balloon-like bulge in an artery) is the cause of a stroke, your doctor may recommend aneurysm clipping or coil embolization.

Aneurysm clipping is done to block off the aneurysm from the blood vessels in the brain. This surgery helps prevent further leak of blood from the aneurysm. It also can help prevent the aneurysm from bursting again. During the procedure, a surgeon will make an incision (cut) in the brain and place a tiny clamp at the base of the aneurysm. You’ll be given medicine to make you sleep during the surgery. After the surgery, you’ll need to stay in the hospital’s intensive care unit for a few days.

Coil embolization is a less complex procedure for treating an aneurysm. The surgeon will insert a tube called a catheter into an artery in the groin. He or she will thread the tube to the site of the aneurysm. Then, a tiny coil will be pushed through the tube and into the aneurysm. The coil will cause a blood clot to form, which will block blood flow through the aneurysm and prevent it from bursting again. Coil embolization is done in a hospital. You’ll be given medicine to make you sleep during the surgery.

Arteriovenous Malformation Repair

If an AVM is the cause of a stroke, your doctor may recommend an AVM repair. (An AVM is a tangle of faulty arteries and veins that can rupture within the brain.) AVM repair helps prevent further bleeding in the brain.

Doctors use several methods to repair AVMs. These methods include:

- Injecting a substance into the blood vessels of the AVM to block blood flow
- Surgery to remove the AVM
- Using radiation to shrink the blood vessels of the AVM