

Secondary stroke prevention: An update

Get the latest facts on evidence-based strategies to prevent stroke or TIA recurrence.

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EVERY 40 SECONDS, a stroke occurs in the United States. This translates to approximately 795,000 strokes annually; of these, about 25% are recurrent strokes. Although stroke has declined from the fourth to the fifth leading cause of death in this country, it remains a major cause of adult disability and significantly changes the lives of stroke survivors and their families. The need for better stroke-prevention strategies is crucial. Without them, stroke prevalence and costs are expected to rise substantially over the next two decades.

Defining stroke

While the broader definition of stroke includes both ischemic and hemorrhagic stroke, this article focuses on ischemic stroke and transient ischemic attack (TIA).

- *Ischemic* stroke is a central nervous system (CNS) infarction accompanied by signs and symptoms of stroke persisting more than 24 hours.
- *TIA* conventionally is defined as signs or symptoms of a brief neurologic dysfunction that lasts less than 24 hours. However, more widespread use of brain imaging (especially magnetic resonance imaging) has shown that up to one-third of patients with symptoms lasting less than 24 hours have had a CNS infarction. This has led to a new definition of TIA as a transient neurologic dysfunction resulting from focal brain, spinal cord, or retinal is-



chemia without infarction, regardless of duration.

Primary vs. secondary stroke prevention

Primary stroke prevention refers to prevention strategies in persons with no previous history of stroke or TIA. *Secondary* prevention refers

to treatment strategies in persons who've already had a stroke or TIA, with the goal of preventing a recurrence.

Stroke risk factors can be modifiable or nonmodifiable. *Nonmodifiable* risk factors include age, race, sex, ethnicity, and a family history of stroke or TIA. *Modifiable* factors include hypertension, hyperlipidemia, diabetes, and lifestyle factors. This article focuses on modifiable risk factors.

Risk factors for both initial and recurrent stroke are similar. However, people who've had a stroke or TIA are at increased risk for a recurrence. Annual risk for future ischemic stroke after an initial event is approximately 3% to 4%—a significant decrease over the past two decades. The decline stems from widespread use of evidence-based secondary prevention practices, including antiplatelet therapy, effective blood pressure and hyperlipidemia management, and atrial fibrillation (AF) treatment.

Secondary stroke prevention

The most recent prevention guidelines for stroke and TIA place greater emphasis on lifestyle, based on the growing evidence that supports the role of lifestyle modification in vascular risk reduction. As a nurse, you can play a key role in helping stroke and TIA patients achieve evidence-based lifestyle changes. For treatment of each risk factor, see *Stroke risk factors and treatment recommendations*.



LEARNING OBJECTIVES

1. Discuss the management of risk factors for stroke.
2. Describe the nurse's role in secondary stroke prevention.
3. State examples of tools that can be used for secondary stroke prevention.

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Stroke risk factors and treatment recommendations

This table lists risk factors for stroke, along with corresponding evidence-based recommendations.

Risk factor	Treatment recommendations
Hypertension	<ul style="list-style-type: none">• Antihypertensive drug therapy for patients with SBP \geq 140 mm Hg or DBP \geq 90 mm Hg• Diet rich in fruits, vegetables, and low-fat dairy products and low in sodium ($<$ 1,500 mg/day)• Limited alcohol consumption• Regular aerobic physical activity• Weight loss, if needed
Hyperlipidemia	<ul style="list-style-type: none">• High-dose statin therapy for patients \leq age 75 and LDL-C \geq 190 mg/dL
Diabetes	<ul style="list-style-type: none">• Pharmacotherapy• Lifestyle interventions• Adherence to ADA guidelines
Overweight and obesity	<ul style="list-style-type: none">• Screening for obesity with BMI and waist circumference measurements
Physical inactivity	<ul style="list-style-type: none">• If patient is able, three to four 40-minute sessions/week of aerobic physical activity• Depending on physical disability, may require initial supervision from rehabilitation specialist
Diet and nutrition	<ul style="list-style-type: none">• Sodium intake \leq 1,500 mg/day• Mediterranean diet: primarily fruits and vegetables, whole grains, legumes and nuts; replacing butter with healthy fats, such as olive oil; herbs and spices instead of salt to flavor foods; red meat no more than a few times a month; fish and poultry at least twice weekly
Cigarette smoking	<ul style="list-style-type: none">• Smoking cessation• Avoidance of passive tobacco smoke
Alcohol consumption	<ul style="list-style-type: none">• Alcohol elimination or reduction in heavy drinkers

ADA = American Diabetes Association. BMI = body mass index. DBP = diastolic blood pressure. LDL-C = low-density lipoprotein cholesterol. SBP = systolic blood pressure.

Hypertension

Hypertension is the most significant risk factor. Approximately 70% of people with a recent stroke have a history of hypertension. Evidence shows that lowering blood pressure (BP) is effective in secondary stroke prevention. A recent meta-analysis of 10 randomized trials confirmed the benefits of lowering BP in preventing recurrent stroke. Overall, antihypertensive drug therapy was associated with a 22% reduction in stroke recurrence.

Experts recommend initiating

therapy in adults with a history of stroke or TIA who have a systolic BP of 140 mm Hg or higher or a diastolic BP (DBP) of 90 mm Hg or higher. No evidence suggests a specific antihypertensive medication or class of medications is best for secondary stroke prevention. Instead, the goal is to reduce BP.

Besides pharmacologic treatment, several lifestyle modifications are linked to BP reduction and should be considered as part of a comprehensive BP management plan. They include sodium restric-

tion; weight loss, if needed; a Mediterranean-type diet rich in fruits, vegetables, and low-fat dairy products; limited alcohol consumption; and regular aerobic physical activity.

Hyperlipidemia

Epidemiologic data suggest a modest link between high low-density lipoprotein cholesterol (LDL-C) levels and increased risk of ischemic stroke among stroke and TIA survivors. A clinical trial that examined LDL-C lowering for secondary stroke prevention found a 2.2% absolute stroke reduction over the 5 years of follow-up in the group receiving atorvastatin (a cholesterol-lowering drug) compared to placebo. (Statin treatment carries an increased risk of hemorrhagic stroke, so statin drugs may need to be avoided in certain stroke survivors with a history of intracerebral hemorrhage.)

Recommendations for hyperlipidemia treatment among patients with a history of stroke or TIA are consistent with the 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults. High-dose statin therapy (to reduce LDL-C by 50% or more) is recommended for patients who have had atherosclerotic-related strokes, are age 75 or younger, and have an LDL-C level of 190 mg/dL or higher.

Diabetes mellitus

Both prediabetes and diabetes mellitus (DM) are common in persons who've had a stroke, with an estimated prevalence of 25% to 45% among stroke and TIA survivors. DM carries a higher risk for recurrent stroke. The Cardiovascular Health Study (CSH), funded by the National Institutes of Health, is a large epidemiologic observational study of cardiovascular risk factors in adults ages 65 and older living in four U.S. communities. In a sub-

study of participants who'd had a stroke and were followed for recurrence, those with DM were almost 1.6 times more likely to have a recurrence than those without DM.

Given the high DM prevalence among stroke survivors, everyone who has had a stroke or TIA should be screened for DM. Because no studies of secondary stroke prevention have examined interventions for prediabetes or DM in preventing stroke recurrence, general recommendations are based on achieving good DM management, with lifestyle interventions and pharmacotherapy as the mainstays.

Studies on the optimal level of glucose control among stroke patients haven't reported a benefit from intensive glucose lowering. Clinicians should follow recommendations from the American Diabetes Association (ADA) for glycemic control and cardiovascular risk-factor management. Also, no evidence suggests one antidiabetic agent is better than another for secondary stroke prevention; this remains an area of intensive research. ADA recommends a patient-centered approach that considers the desired glycated hemoglobin reduction, side-effect profiles, and cost.

Overweight and obesity

Defined as a body mass index (BMI) of 30 kg/m² or higher, obesity is linked to an increased risk of first stroke. Central obesity (large waist circumference) is more strongly associated with first stroke than general obesity.

Diagnosed in approximately one-third of persons with a recent history of stroke or TIA, obesity is linked to increasing prevalence of vascular risk factors. Its association with recurrent stroke is more controversial; in fact, recent studies indicate obese patients with stroke had a somewhat lower risk for a recurrent vascular event than lean patients. This unexpected relationship is puzzling because weight loss is

linked to improvements in major vascular risk factors, including dyslipidemia, DM, hypertension, and inflammation. Underestimation of the adverse effect of obesity may stem from bias in epidemiologic studies. Although weight loss benefits cardiovascular risk factors, its usefulness in secondary stroke prevention is unclear.

Despite the uncertain relationship between obesity and recurrent stroke, the most recent guidelines recommend BMI and obesity screening for all patients who've had TIA or strokes.

Physical inactivity

Physical activity improves stroke risk factors and may reduce stroke risk. No clinical trials have examined the effectiveness of exercise in secondary stroke prevention, but the presumed benefit is based on indirect evidence related to improved risk factors, such as BP, lipid metabolism, insulin resistance, and weight management. Two trials currently underway may provide information about the effectiveness of exercise in secondary prevention.

Although the American Heart Association (AHA) recommends adults participate in three to four 40-minute sessions per week of aerobic physical activity, fewer than half of noninstitutionalized American adults achieve this goal. For stroke survivors, these recommendations may be even harder to achieve because of motor weakness, altered perception and balance, and impaired cognition. For stroke and TIA survivors who are capable of exercising, the above AHA recommendations apply. Patients with post-stroke disability should be supervised by a rehabilitation specialist at least during initiation of an exercise program.

Diet and nutrition

Several components of diet and nutrition can lead to increased BP and consequently an increased stroke

risk. They include increased sodium intake, excess weight, and excess alcohol consumption. DASH-type diets (Dietary Approaches to Stop Hypertension), high in consumption of fruits and vegetables and low-fat dairy products, and reduced intake of sodium and saturated fats can help reduce BP and thus may lower stroke risk.

More recently, several studies have examined the Mediterranean diet and its link to reduced stroke risk. This diet emphasizes fruits, vegetables, whole grains, low-fat dairy products, poultry, fish, olive oil, and nuts while limiting sweets and red meat. A recent study found it had a significant effect on primary stroke prevention compared to a low-fat diet. Recommendations include the Mediterranean diet and counseling for stroke and TIA patients to reduce sodium intake to less than approximately 2.4 g/day, with an additional reduction to less than 1.5 g/day associated with an even greater BP reduction.

Cigarette smoking

Extensive data confirm a link between cigarette smoking and first ischemic stroke, although evidence in secondary stroke prevention is less well-established. In the CHS, elderly smokers were twice as likely as nonsmokers to have a recurrent stroke. No clinical trials have investigated smoking cessation for secondary stroke or TIA prevention. Given the overwhelming evidence on the harmful effects of smoking, such trials are unlikely to be done. All patients with stroke or TIA who are current smokers should be strongly advised to quit smoking and avoid passive tobacco smoke. Counseling, nicotine products, and oral smoking-cessation medications are recommended to support smoking cessation.

Alcohol consumption

Few studies have directly evaluated the link between alcohol consump-

tion and recurrent stroke. With ischemic stroke, the association with alcohol appears to be J-shaped, meaning that light to moderate consumption is protective whereas heavier alcohol use carries an elevated risk. The protective effect may relate to the effects of alcohol on high-density lipoprotein cholesterol (HDL-C), whereas the elevated risk with heavier alcohol use may come from its effect on BP and glucose, as well as atrial fibrillation.

Because alcohol consumption can lead to dependence and alcoholism is a significant public health problem, an important goal for secondary stroke prevention is to eliminate or reduce alcohol consumption in heavy drinkers. Light to moderate consumption (up to two drinks daily for men and up to one drink daily for women) may be reasonable, although nondrinkers shouldn't be counseled to start drinking.

Antiplatelet and anticoagulant agents for secondary stroke prevention

The mainstay of secondary stroke prevention is either antiplatelet or anticoagulant therapy, depending on the stroke mechanism. For people who've had strokes or TIAs of a noncardioembolic origin, the Food and Drug Administration has approved four antiplatelet drugs for prevention of vascular events— aspirin, combination aspirin/dipyridamole, clopidogrel, and ticlopidine. Each agent carries an approximately 22% relative risk reduction for recurrent stroke, myocardial infarction, or death.

The drugs have important differences with direct implications for selecting a specific agent. Aspirin alone or in combination with dipyridamole is recommended as initial therapy for preventing a recurrence. Clopidogrel is recommended as a reasonable replacement for aspirin or aspirin/dipyridamole, as well as for patients

with aspirin allergies. The aspirin/clopidogrel combination isn't recommended for routine long-term secondary prevention because of an increased hemorrhage risk. Ticlopidine rarely is used in clinical practice because of its side effect-profile and availability of newer agents.

Atrial fibrillation

AF is an important risk factor for stroke and may cause 10% to 12% of all strokes each year. Several validated risk assessment tools classify stroke risk among patients with AF, taking into account such factors as comorbid heart failure, hypertension, DM, and age. Research shows an increasing stroke risk with higher scores on the classification system (more comorbidities along with AF). The evidence is strong and consistent for using warfarin in preventing stroke among AF patients, for both primary and secondary prevention. The optimal warfarin dose for stroke prevention among these patients is one that produces an international normalized ratio (INR) of 2.0 to 3.0. Maintaining a therapeutic level is a challenge, though. A high percentage of AF patients have subtherapeutic levels and therefore inadequate stroke protection.

Newer agents, such as apixaban, dabigatran, and rivaroxaban, also can be used for secondary stroke prevention in patients with nonvalvular AF. For patients unable to take oral anticoagulants, aspirin alone is recommended. Clinicians should base selection of an agent on the patient's risk factors and preference, drug interactions, and other clinical characteristics.

Life's Simple 7®

Despite our knowledge of stroke risk factors and strong evidence on treatment strategies to control risk, we've been largely unsuccessful in supporting good risk-factor control after stroke. Research continues to show suboptimal control of vascu-

lar risk factors in patients who've had strokes. The American Heart and Stroke Association's 2020 goal is to improve Americans' cardiovascular health by 20%. Toward this goal, these organizations have defined seven modifiable health metrics (BP, cholesterol, glucose, exercise, smoking, diet, and BMI) that increase the chance of living free of cardiovascular disease and stroke; these are called Life's Simple 7. Although designed for primary prevention, Life's Simple 7 metrics also apply to secondary stroke prevention.

In a recent study examining Life's Simple 7 among stroke survivors, investigators reported that fewer than one in every 100 stroke survivors met all AHA criteria for ideal cardiovascular health. (See *Defining poor, intermediate, and ideal cardiovascular health.*)

Implications for nurses

Clinicians need to develop effective interventions that engage stroke survivors and their families in achieving excellent risk factor control and subsequently reducing stroke burden. For nurses, a key challenge in secondary stroke prevention is providing education and supporting adherence to secondary-prevention medications and lifestyle changes. Nursing has played a significant role in quality improvement programs, such as the American Heart and Stroke Association's "Get With the Guidelines—Stroke" program to improve initiation of secondary prevention measures in acute-care settings.

As nurses, we have a responsibility to ensure secondary stroke-prevention practices across the continuum of care. Research shows that medication adherence diminishes over time, with more than one-third of patients stopping medications in the 2 years after stroke. Not only must we provide information about secondary-prevention drugs patients will take after dis-

Defining poor, intermediate, and ideal cardiovascular health

This table defines poor, intermediate, and ideal behaviors and health categories according to the American Heart Association's Life's Simple 7[®] metric for defining and improving cardiovascular health.

Metric	Poor health	Intermediate health	Ideal health
Current smoking	Yes	Former smoker; quit 12 months ago or less	Never smoked or quit more than 12 months ago
Body mass index	≥ 30 kg/m ²	25 - 29.9 kg/m ²	< 25 kg/m ²
Physical activity	None	At least 149 minutes/week at moderate intensity <i>or</i> at least 74 minutes/week at vigorous intensity <i>or</i> a combination	≥ 150 minutes/week at moderate intensity <i>or</i> ≥ 75 minutes/week at vigorous intensity <i>or</i> a combination
Diet score	0 to 1 components*	2 to 3 components*	4 to 5 components*
Total cholesterol	≥ 240 mg/dL	200-239 mg/dL <i>or</i> treated to goal	< 200 mg/dL
Blood pressure	SBP ≥ 140 mm Hg <i>or</i> DBP ≥ 90 mm Hg	SBP 120-139 mm Hg <i>or</i> DBP 80-89 mm Hg <i>or</i> treated to goal	<120/<80 mm Hg (not on medication)
Fasting plasma glucose	≥126 mg/dL	100-125 mg/dL <i>or</i> treated to goal	< 100 mg/dL

*The five components of diet that define a healthy dietary score are:

- fruits and vegetables: 4.5 cups or more per day
- fish: two 3.5-oz servings or more per week (preferably oily fish)
- fiber-rich whole grains: three 1-oz-equivalent servings or more per day
- sodium: less than 1,500 mg per day
- sugar-sweetened beverages: 450 kcal (36 oz) or less per week.

charge (including antiplatelets or anticoagulants, antihypertensives, and statins); but we also must assess for potential barriers to adherence. Poststroke disabilities, such as swallowing difficulties, motor weakness, and cognitive impairment, may interfere with medication management. Involving family members (especially the primary family caregiver) in discussions about medications is crucial. Also, be sure to assess the patient's financial and insurance-related issues. If inadequate finances are a potential barrier

to medication adherence, consult with a social worker to assist the patient.

Begin education early in the patient's hospital stay and reinforce your teaching on a regular basis. Be sure to provide written materials, as stroke survivors and their families report difficulty recalling information given during the hospital stay. Post-discharge follow-up programs (by telephone or in person) to identify concerns about medications and to ensure all prescriptions have been filled can

boost adherence.

Health promotion

Although health promotion is an important domain of nursing care, some nurses devote little patient-encounter time to it. The significance of lifestyle in secondary prevention and the low rate of control among stroke survivors highlights the need for action in this area.

We need to use approaches that support patients in risk-factor self-management in their own environment. Lifestyle changes, such as in-

creasing physical activity, need to be tailored to each individual, with consideration of stroke-related deficits. Interventions with stroke survivors to increase awareness of risk and manage risk factors over the long term, such as education, written materials, behavior modification, and stroke nurse specialist follow-up, have shown modest effects. Empowering patients to succeed in goal-setting around healthy lifestyle choices has proven to be an effective strategy.

Post-Stroke Checklist

The Post-Stroke Checklist was developed in 2013 by an international team of stroke experts to help ensure stroke survivors' long-term needs are identified and managed appropriately. The tool addresses 11 areas, including secondary stroke prevention, mood, communication, relationships, and incontinence. These often-overlooked needs have a tremendous impact on quality of life and long-term outcomes after stroke. The easy-to-use checklist can be incorporated into regular follow-up care after stroke; visit <http://goo.gl/ORZKT4> to see the checklist.

Health information technologies

Health information technologies may hold promise for supporting self-management practices around risk-factor control—both in real time and over the long term. A Netherlands study reported modest support for improved risk-factor control through a website personalized to individual risk, identified during a baseline visit with a nurse practitioner. Patients were instructed to use the website frequently and to log in at least every other week to submit new risk-factor measurements, BP, or smoking status, as well as to read and send messages. The sample included both patients at risk for a first stroke and those at risk for a recurrent stroke. After 12 months of par-

ticipation, patients in the Internet-based, nurse-led vascular prevention group showed a 14% reduction in Framingham heart risk score compared to patients in the usual care group.

Evidence is building for the effectiveness of mobile health (mHealth) tools in supporting lifestyle changes. Numerous health apps can be recommended to stroke survivors to identify their risk factors and provide a risk score, including the American Heart Association's My Life Check, which provides a score related to Life's Simple 7. A recent study examined use of an mHealth app at the bedside; nursing students used a secondary prevention app to provide patients with information about risk factors at the bedside. Evidence-based practice has been cited as a core competency for nurses; now it's possible to have this evidence at the bedside so nurses can more easily translate it into practice, thereby improving secondary stroke prevention and promoting better patient outcomes.

The global trend of increasing stroke incidence underscores the importance of working with patients who've had strokes or TIA to reduce their recurrence risk. Nurses play an essential role in screening for risk factors, increasing awareness of risk, and supporting stroke or TIA survivors in reducing risk, particularly when it comes to adhering to medications and lifestyle changes. The complexity of behavior change required suggests multifaceted and tailored strategies most likely are needed to support and sustain change. ★

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Please mark the correct answer online.

1. Your patient, 72-year-old Sam Mortimer, recently experienced an ischemic stroke. He has no serious neurologic deficits, and you want to help him prevent another stroke. Which consistent blood pressure (BP) reading would prompt you to ask his primary care provider if Mr. Mortimer should begin antihypertensive therapy?

- a. Systolic BP of 132 mm Hg
- b. Systolic BP of 136 mm Hg
- c. Diastolic BP of 86 mm Hg
- d. Diastolic BP of 94 mm Hg

2. Which low-density lipoprotein cholesterol (LDL-C) finding would cause you to expect Mr. Mortimer to begin high-dose statin therapy?

- a. 140 mg/dL
- b. 160 mg/dL
- c. 180 mg/dL
- d. 200 mg/dL

3. Mr. Mortimer does not have diabetes, but he is obese. Which of the following statements about stroke and obesity is correct?

- a. Central obesity is more strongly associated with recurrent stroke than general obesity.
- b. General obesity is more strongly associated with first stroke than central obesity.
- c. The relationship between obesity and recurrent stroke is somewhat controversial.
- d. Obesity is strongly associated with an increased risk of recurrent stroke.

4. Mr. Mortimer works part time as a data entry clerk for an insurance firm. He spends most of his other time reading, watching TV, and getting together with friends to dine out. Which advice related to physical activity is appropriate for Mr. Mortimer?

- a. Set a goal of one to two 30-minute

sessions/week of aerobic physical activity, as able.

- b. Set a goal of three to four 40-minute sessions/week of aerobic physical activity, as able.
- c. Continue his current activity level.
- d. Begin training for a marathon race.

5. You discuss Mr. Mortimer's typical diet with him. Which of the following comments would concern you?

- a. "I eat red meat every day. I just love it."
- b. "I switched to nonfat milk 5 years ago."
- c. "I eat vegetables at least three times a day."
- d. "I don't have much of a sweet tooth."

6. You advise Mr. Mortimer to limit his sodium intake to less than:

- a. 2.4 g/day.
- b. 3 g/day.
- c. 3.6 g/day.
- d. 4 g/day.

7. Mr. Mortimer says he stopped smoking 10 years ago, but he enjoys drinking alcohol several times a week with his friends. Which of the following is an appropriate action?

- a. Advise him to eliminate or reduce his alcohol intake, knowing that up to four drinks daily may be reasonable.
- b. Recommend that he eliminate or reduce his alcohol intake, knowing that up to two drinks daily may be reasonable.
- c. Tell him that his current practice is acceptable because drinking isn't associated with a risk of stroke.
- d. Inform him that alcohol consumption won't affect his blood pressure or blood sugar.

8. Which statement regarding antiplatelet/anticoagulation therapy for Mr. Mortimer is correct?

- a. Aspirin alone or in combination with dipyridamole is recommended as initial therapy.
- b. Clopidogrel should not be used in

- patients who are allergic to aspirin.
- c. Ticlopidine is recommended as initial therapy.
- d. Aspirin and dipyridamole are recommended for long-term use.

9. Mr. Mortimer has a normal sinus rhythm. If he develops atrial fibrillation (AF), what should you keep in mind?

- a. AF is not a risk factor for recurrent stroke.
- b. AF may cause 5% of all strokes each year.
- c. Optimal warfarin dose for stroke prevention among AF patients is one that produces an international normalized ratio (INR) of 2.0 to 3.0.
- d. The optimal warfarin dose for stroke prevention among patients with AF is one that produces an INR of 1.0 to 2.0.

10. Mr. Mortimer has a fasting blood plasma glucose level of 110 mg/dL. What is his category of cardiovascular health according to the American Heart Association's (AHA's) Life's Simple 7[®] metric?

- a. Poor
- b. Fair
- c. Intermediate
- d. Ideal

11. Another patient has a body mass index of 33 kg/m². What is his category of cardiovascular health according to the AHA's Life's Simple 7[®] metric?

- a. Poor
- b. Fair
- c. Intermediate
- d. Ideal

12. When planning Mr. Mortimer's discharge, you should consider all of the following except:

- a. financial barriers.
- b. the need to involve his family in education.
- c. avoiding written education materials.
- d. setting up a postdischarge call.