MedStar Family Choice

Management of Hypertension in Pediatric Patients up to 18 Years of Age in the Ambulatory Setting

Clinical Practice Guideline
MedStar Health

These guidelines are provided to assist physicians and other clinicians in making decisions regarding the care of their patients. They are not a substitute for individual judgment brought to each clinical situation by the patient's primary care provider in collaboration with the patient. As with all clinical reference resources, they reflect the best understanding of the science of medicine at the time of the publication but should be used with the clear understanding that continued research may result in new knowledge and recommendations.

Please refer to the following article for an extensive review of this topic:

Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*. 2017; 140(3): e20171904

The above referenced article is written for primary care practitioners who care for children and adolescents. It is endorsed by the American Heart Association.

Introduction:

Hypertension is not a common problem in pediatric patients. The prevalence of hypertension is estimated at 3-4%. Hypertension in children may be secondary to underlying pathology or primary essential hypertension; so recognizing and elucidating the cause of hypertension in the pediatric patient is important. However, primary hypertension is by far the most common cause of hypertension in children. Risk factors for hypertension in children include obesity, diabetes mellitus, Sleep Disordered Breathing, premature birth, coarctation of the aorta and renal disease. Certain medications cause elevations in blood pressure as a side effect. Identifying hypertension is not straight forward in the pediatric patient because normative values vary with age and size. Appropriate equipment is necessary for accurate assessment of blood pressure in the pediatric patient due to size variation.

Correctly Measuring Blood Pressure

- Providers and support staff should be aware of the importance of understanding the equipment used to measure blood pressure in pediatric patients. Normal values for blood pressure are based on the traditional Auscultation method with a stethoscope using a pressurized sphygmomanometer. Many offices now have Oscillometric BP measuring devices. This type of equipment has been noted to overestimate blood pressure. Offices using Oscillometric BP devices should be sure it has been validated for use in pediatric patients as the readings are based on Mean Arterial Pressure measurements which are then used in an algorithm to

calculate systolic and diastolic blood pressures. If the oscillometric BP is normal that is acceptable, however if elevated a manual BP should be performed.

- Cuff size matters. The air bladder in the blood pressure cuff should cover 80-100% of the arm circumference. The cuff width should cover at least 40% of the length of the upper arm. Using a cuff that is too small will overestimate blood pressure in the patient. It is better to have a cuff that is too big.
- Optimal blood pressure measurements occur when the patient has been seated in a chair with back support, feet resting on the floor, using the right arm with the arm supported at the level of the heart. The arm should be unencumbered by clothing.

When to Measure Blood Pressure[1]

- The American Academy of Pediatrics recommends measurement of blood pressure annually starting at age 3 for all children
- Blood pressures should be measured more frequently in children at high risk:
  - Over age 3: at every visit for those with risk factors for hypertension such as obesity, renal disease, diabetes mellitus, aortic arch disease and use of medications known to have hypertension as a side effect.
  - Under age 3: annually for those with risk factors such as with conditions known to increase BPs, such as prematurity, chronic kidney disease, and malignancy,

Identifying Abnormal Blood Pressure

- Blood Pressures over the 90th % are considered abnormal. For children over 13 years of age, the cut-off is the same as adults: 120/80.
- For children under 13 years of age, normal blood pressure varies based on age, sex and height. Updated normative tables for Blood Pressure stratified by sex, age and height percentile are published in the AAP Clinical Practice Guidelines referenced above on pp 9-13.
- **A table of Screening BP Values Requiring Further Evaluation** is also included in the 2017 AAP guidelines and is reproduced below.[1] For patients with a confirmed blood pressure measurement falling at or above the ranges noted below, the provider should go to the more specific table for BP *stratified by height as well.*
- Elevated blood pressure readings should be validated. Review that the patient was properly seated, appropriate cuff size was used and repeat BP measurement twice at the visit taking the average. If oscillometric BP measurement (automatic BP cuff) was used with elevated blood pressure reading, then repeat using auscultatory method (manual BP cuff).
- Ambulatory blood pressure should be used when available to help confirm the diagnosis of high blood pressure.

Screening BP Values Requiring Further Evaluation

Age	Boys Systolic BP	Boys Diastolic BP	Girls Systolic BP	Girls Diastolic BP
1	98	52	98	52
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

Definitions of Blood Pressure Categories and Stages[1]

Normal BP :< 90th % for age and height (<120/80 for children ≥13 yo)

Elevated BP: ≥90th but ≤95th % for age and height (120/80 to 129/80 for children ≥13 yo)

Stage 1 HTN: ≥95% for age and height to [<95th % for age and height + 12 mm Hg or 130/80 to 139/89, (whichever is lower)] (130/80-139/89 for children ≥13 yo)

Stage 2 HTN: ≥95% for age and height + 12 mm Hg or 140/90, (whichever is lower)] (140/90 for children ≥13 yo)

Diagnostic Evaluation:

Goal of evaluation is to identify possible underlying etiologies, detect end organ damage and identify other cardiovascular risk factors.

Patient Population	Screening Tests
All patients	Urinalysis Chemistry Panel (BMP) Lipid panel (fasting or nonfasting)
In children < 6 or in those with abnormal U/A or renal function	Renal ultrasound
In obese children	HemoglobinA1c (screen for DM) ALT, AST (screen for fatty liver) Fasting lipid panel (screen for dyslipidemia)
If loud snoring, daytime sleepiness or history of apnea	Sleep study
If growth delay or abnormal renal function	CBC
Other optional studies based on history	TSH Drug Screen

- Patient who are older than 6 years and are overweight or obese, have a family history of high blood pressure and/or do not have a history or exam findings suggestive of secondary case of hypertension, do not need an extensive evaluation for secondary causes of hypertension
- Clinicians should not perform ECG in hypertensive patients being evaluated for LVH.

Managing Abnormal Blood Pressure:[1]

Elevated BP: >90th but <95th % for age and height (120/80 to 129/80 for children >13 yo)

- Review dietary and medication history to exclude the role of pharmacologic agents, such as caffeine, decongestants, NSAIDs, herbal supplements, oral contraceptive agents or stimulants in elevating BP.
- Educate patients on lifestyle changes including healthy diet suggestions, increased physical activity and improved sleep hygiene. Consider referral to a nutritionist or weight management specialist if obesity is a risk factor. Follow-up BP measurement in 6 months by auscultation.
- If BP remains elevated at 6 month follow-up, evaluate BP in both upper extremities and 1 lower extremity BP for Coarctation of the Aorta, repeat healthy lifestyle education, consider referrals for support with nutritionist or weight management. Follow-up BP measurement in 6 months.

- If BP remains in elevated range over a year of evaluation, initiate evaluation including urinalysis, chemistry panel and complete blood count to assess renal function follow-up with renal ultrasound if abnormal. If patient is obese, consider Hgb A1c, AST, ALT and fasting lipid panel. Additional tests to consider based on history include sleep study, drug screening and/or Thyroid function test (TSH). Subspecialty referral as needed to cardiology or nephrology. Consider Ambulatory Blood Pressure Monitoring.

Stage 1 Hypertension: >95% for age and height to [<95th % for age and height + 12 mm Hg or 130/80 to 139/89, (whichever is lower)] (130/80-139/89 for children ≥13 yo)

- Review dietary and medication history to exclude the role of pharmacologic agents, such as caffeine, decongestants, NSAIDs, herbal supplements, oral contraceptive agents or stimulants in elevating BP.
- If the patient is asymptomatic, educate on healthy lifestyle including physical activity, dietary changes (See DASH diet Appendix A) and improved sleep hygiene. Repeat BP in 1-2 weeks by auscultation.
- If BP remains elevated at 1-2 week follow-up, evaluate BP in both upper extremities and 1 lower extremity to evaluate for Coarctation of the Aorta, reinforce healthy lifestyle education, consider referrals to nutritionist or weight management specialist if obesity is a risk factor. Follow-up BP measurement in 3 months.
- If BP remains in range of Stage 1 Hypertension after 3 months of evaluation, initiate evaluation including urinalysis, chemistry panel and complete blood count to assess renal function. Follow-up with renal ultrasound if abnormal. If patient is obese, consider Hgb A1c, AST, ALT and fasting lipid panel. Additional tests to consider based on history include sleep study, drug screening and/or Thyroid function test (TSH). Subspecialty referral should be considered to cardiology or nephrology. Consider Ambulatory Blood Pressure Monitoring.

Stage 2 Hypertension: ≥95% for age and height + 12 mm Hg or 140/90, (whichever is lower)] (140/90 for children ≥13 yo)

- Evaluate both upper extremities and 1 lower extremity BP to evaluate for Coarctation of the Aorta, offer healthy lifestyle education including increased physical activity, dietary changes such as DASH (Dietary Approaches to Stop Hypertension) diet and recommend moderate to vigorous physical activity at least 3 to 5 days per week (30–60 min per session) to help reduce BP. Improve sleep hygiene. Patients should be re-evaluated in 1 week in the office or by a subspecialist in cardiology or nephrology. Consider referrals to subspecialty care support with nutritionist or weight management.
- If BP remains in range of Stage 2 Hypertension at the 1 week follow-up, initiate evaluation including urinalysis, chemistry panel and complete blood count to assess renal function. Follow-up with renal ultrasound if abnormal. If patient is obese, consider Hgb A1c, AST, ALT and fasting lipid panel. Additional tests to consider based on history include sleep study, drug screening and/or Thyroid

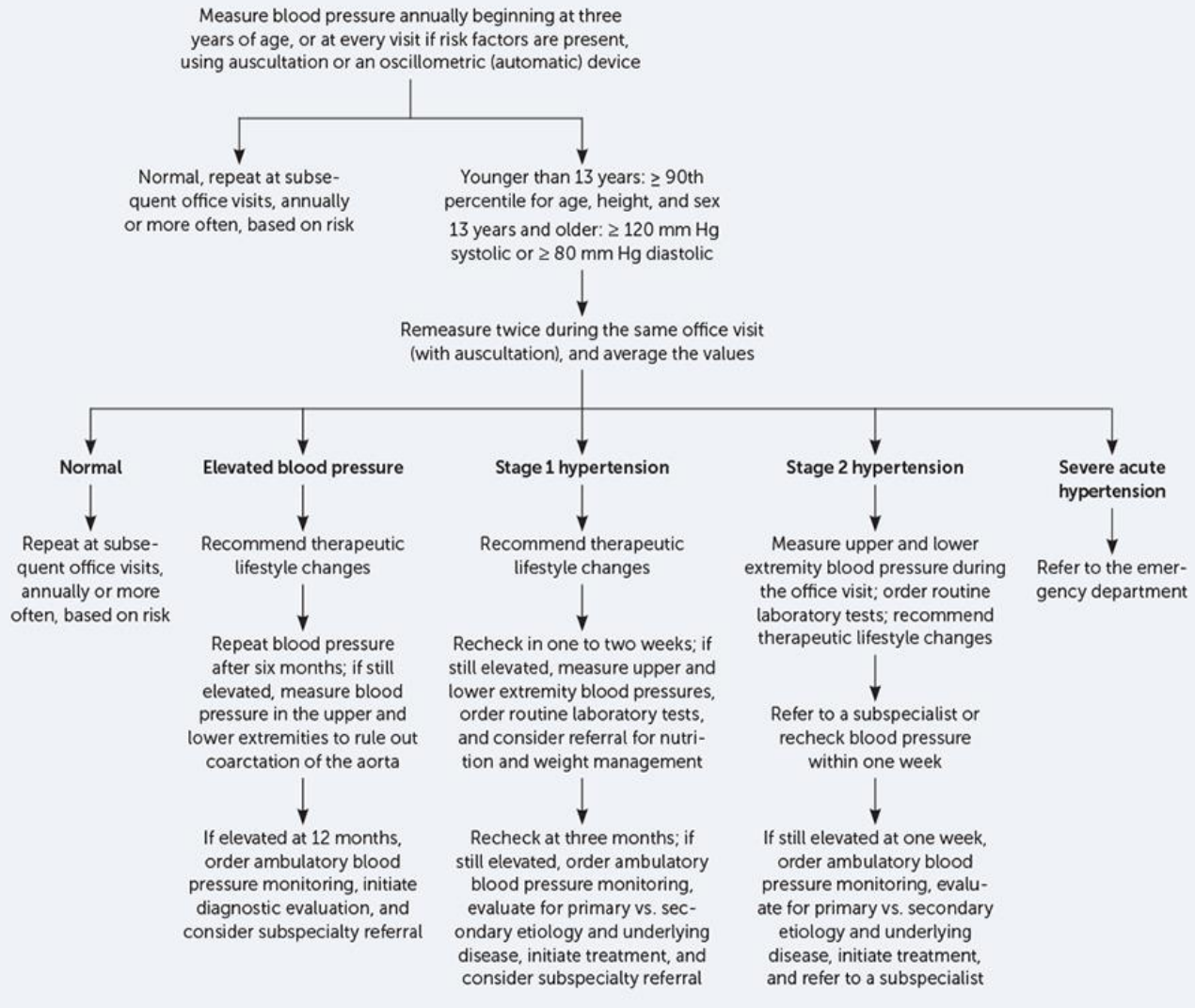
function test (TSH). Subspecialty referral should be considered to cardiology or nephrology. Consider Ambulatory Blood Pressure Monitoring.

Urgent Evaluation of Stage 2 Hypertension

- Severe acute hypertension: Refer to ER for symptomatic Stage 2 Hypertension or if the BP is > 180/120 in a patient over 13 yo or if the BP is > 30 mmHg above the 95th% in a child under 13 yo.

Algorithm for managing elevated blood pressure in children and adolescents

Figure 1



Flynn JT. Summary slide set of Pediatric Hypertension Guidelines 2017

Treatment of Hypertension:

The overall treatment goal in children and adolescents diagnosed with HTN with nonpharmacologic and pharmacologic therapy should be a reduction in SBP and DBP to <90th percentile and <130/80 mm Hg in adolescents ≥13 years of age.

Lifestyle Interventions:

At the time of diagnosis of elevated BP or HTN in a child or adolescent, clinicians should provide advice on the DASH diet (Dietary Approaches to Stop Hypertension, Refer to Appendix A) and recommend moderate to vigorous physical activity at least 3 to 5 days per week (30–60 min per session) to help reduce BP.

Pharmacologic Treatment:

Prescribe antihypertensive medications or refer to the pediatric hypertension specialist, if the patient has failed at least 6 months of lifestyle changes, has symptomatic hypertension, has Left Ventricular Hypertrophy on echocardiogram, or has Stage 2 hypertension without clearly modifiable risk factors (e.g. obesity). Prescribing clinicians should initiate pharmacologic treatment with an angiotensin converting enzyme (ACE) inhibitor, angiotensin receptor blocker (ARB), long-acting calcium channel blocker, or thiazide diuretic. In chronic kidney disease or diabetes, it is recommended to use an ACE or ARB.

See the guidelines and tables for additional details.

AAP Hypertension Guidelines: Table 17 Page 34-35

Treatment Follow-Up and Monitoring:

Patients treated with antihypertensive medications should be seen every 4–6 weeks for dose adjustments until goal BP is reached, then every 3–4 months.

Patients treated with lifestyle change only should be seen every 3–6 months to assess success of BP reduction and to reassess the need for pharmacologic treatment.

Hypertension and the Athlete:

Children and adolescents with Elevated BP or Stage 1 hypertension may participate in competitive sports once hypertensive target organ effects and CV risk have been assessed.

Children and adolescents with Stage 2 hypertension should be restricted from competitive sports until BP is below Stage 2 thresholds.

References

1. Flynn JT, Kaelber DC, Baker-Smith CM, et al. Clinical Practice Guideline for Screening and Management of High Blood Pressure in Children and Adolescents. *Pediatrics*. 2017; 140(3):e20171904

2. Margaret Riley, MD; Anita K. Hernandez, MD; and Angela L. Kuznia, MD, MPH. High Blood Pressure in Children and Adolescents. https://www.afp-digital.org/afp/october_15__2018/MobilePagedArticle.action?articleId=1434196#articleId1434196

Appendix A

The DASH Diet

(Dietary Approaches to Stop Hypertension)

Food Group	Daily Serving	Serving Size	Examples and Notes	Significance in the DASH Diet Pattern
Grains and grains products	6 - 8	1 slice bread 1 oz. dry cereal ½ cup cooked rice, pasta, or cereal	Whole wheat bread and rolls, whole wheat pasta, English muffin, pita bread, bagel, cereals, grits, oatmeal, brown rice, unsalted pretzels and popcorn	Major sources of energy and fiber
Vegetables	4 - 5	1c raw leafy vegetables 1/2c raw cut up or cooked vegetables 4 oz vegetable juice	Broccoli, carrots, collards, green beans, green peas, kale, lima beans, potatoes, spinach, squash, sweet potatoes, tomatoes	Rich sources of potassium, magnesium, and fiber
Fruits	4 - 5	4 oz fruit juice 1 medium fruit ¼ c dried fruit ½ c fresh, frozen, or canned fruit	Apples, apricots, bananas, dates, grapes, oranges, grapefruit, grapefruit juice, mangoes, melons, peaches, pineapples, raisins, strawberries, tangerines	Important sources of potassium, magnesium, and fiber

Fat free or low fat milk, milk products	2 - 3	1 cup milk 1c yogurt 1 ½ oz. cheese	Fat-free (skim) or low-fat (1%) milk or buttermilk, fat-free, low-fat, or reduced-fat cheese, fat-free or low-fat regular or frozen yogurt	Major sources of calcium and protein
Lean meats, poultry, and fish	6 or less	1 oz cooked meats, poultry, or fish 1 egg	Select only lean; trim away visible fats; broil, roast, or poach; remove skin from poultry	Rich sources of protein and magnesium
Nuts, seeds, and legumes	4 - 5/wk.	1/3 cup or 1 ½ oz. nuts 2 Tbsp peanut butter 2 Tbsp or ½ oz seeds ½ cup cooked legumes (dry beans and peas)	Almonds, hazelnuts, mixed nuts, peanuts, walnuts, sunflower seeds, peanut butter, kidney beans, lentils, split peas	Rich sources of energy, magnesium, potassium, protein and fiber
Fats and oils	2 – 3	1 tsp soft margarine 1 tsp vegetable oil	1 Tbsp mayonnaise 2 Tbsp salad dressing	The DASH study had 27 percent of calories as fat, including fat in or added to foods

Sweets and added sugars	5 or less per week	1 Tbsp sugar 1 Tbsp jelly or jam ½ cup sorbet, gelatin 1 cup lemonade	Fruit-flavored gelatin, fruit punch, hard candy, jelly, maple syrup, sorbet and ices, sugar	Sweets should be low in fat

Þ Since eggs are high in cholesterol, limit egg yolk intake to no more than four per week; two egg whites have the same protein content as 1 oz of meat.

Þ Fat content changes serving amount for fats and oils. For example, 1 Tbsp of regular salad dressing equals one serving; 1 Tbsp of a low-fat dressing equals one-half serving 1 Tbsp of a fat-free dressing equals zero servings.

Þ From the Dietary Approaches to Stop Hypertension (DASH) clinical study. U.S. Department of Health and Human Services: Dash Diet, Revised 2006. Retrieved from http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdfRetrieved from http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf the results show that the DASH "combination diet" lowered blood pressure and, may help prevent and control high blood pressure. The "combination diet" is rich in fruits, vegetables, and low-fat dairy foods, and low in saturated and total fat. It is also low in cholesterol, high in dietary fiber, potassium, calcium, and magnesium and moderately high in protein. The DASH eating plan shown above is based on 2000 calories a day. Depending on the energy needs, the number of daily servings in a food group may vary from those listed.

The DASH Diet Sodium Table

Sodium Table - Food Group	Examples	Sodium (mg)
Whole and other grains and grain products*	Cooked cereal, rice, pasta, unsalted, 1/2 cup Ready-to-eat cereal, 1 cup Bread, 1 slice	0–5 mg 0–360 m g 110–175 mg

Vegetables	Fresh or frozen, cooked without salt, 1/2 cup Canned or frozen with sauce, 1/2 cup Tomato juice, canned, 1/2 cup	1–70 mg 140–460 mg 330 mg
Fruit	Fresh, frozen, canned, 1/2 cup	0–5
Low-fat or fat-free milk and milk products	Milk, 1 cup Yogurt, 1 cup Natural cheeses, 11/2 oz Process cheeses, 2 oz	107 mg 175 mg 110–450 mg 600 mg
Nuts, seeds, and legumes	Peanuts, salted, 1/3 cup Peanuts, unsalted, 1/3 cup Beans, cooked from dried or frozen, without salt, 1/2 cup Beans, canned, 1/2 cup	120 mg 0–5 mg 0–5 mg 400 mg
Lean meats, fish, and poultry	Fresh meat, fish, poultry, 3 oz Tuna canned, water pack, no salt added, 3 oz Tuna canned, water pack, 3 oz Ham, lean, roasted, 3 oz	30–90 mg 35–45 mg 230–350 mg 1,020 mg

* Whole grains are recommended for most grain servings. Only a small amount of sodium occurs naturally in foods. Most sodium is added during processing. This table gives examples of sodium in some foods.

Tips to Reduce Salt

· Choose low- or reduced-sodium, or no-salt-added versions of foods and condiments when available.

· Choose fresh, frozen, or canned (low-sodium or no-salt-added) vegetables.

· Use fresh poultry, fish, and lean meat, rather than canned, smoked, or processed types.

· Choose ready-to-eat breakfast cereals that are lower in sodium.

· Limit cured foods (such as bacon and ham); foods packed in brine (such as pickles, pickled vegetables, olives, and sauerkraut); and condiments (such as mustard, horseradish, ketchup, and barbecue sauce). Limit even lower sodium versions of soy sauce and teriyaki sauce. Treat these condiments sparingly as you do table salt.

· Cook rice, pasta, and hot cereals without salt. Cut back on instant or flavored rice, pasta, and cereal mixes, which usually have added salt.

· Choose “convenience” foods that are lower in sodium. Cut back on frozen dinners, mixed dishes such as pizza, packaged mixes, canned soups or broths, and salad dressings—these often have a lot of sodium.

· Rinse canned foods, such as tuna and canned beans, to remove some of the sodium.

· Use spices instead of salt in cooking and at the table, flavor foods with herbs, spices, lemon, lime, vinegar, or salt-free seasoning blends. Start by cutting salt in half.

The DASH Diet Potassium Tab

Potassium Table - Food Group	Examples	Potassium (mg)
Vegetables	Potato, 1 medium	926 mg
	Sweet Potato, 1 medium	540 mg
	Spinach, cooked, 1/2 cup	290 mg
	Zucchini, cooked, 1/2 cup	280 mg
	Tomato, fresh, 1/2 cup	210 mg
	Kale, cooked, 1/2 cup	150 mg
	Romaine lettuce, 1 cup	140 mg
	Mushrooms, 1/2 cup	110 mg
	Cucumber, 1/2 cup	80 mg
Fruit	Banana, 1 medium	420 mg
	Apricots, 1/4 cup	380 mg
	Orange, 1 medium	237 mg
	Cantaloupe chunks, 1/2 cup	214 mg
	Apple, 1 medium	150 mg
Low-fat or fat-free milk and milk products	Milk, 1 cup	380 mg
	Yogurt, 1 cup	370 mg

Nuts, seeds, and legumes	Cooked soybeans, 1/2 cup Cooked lentils, 1/2 cup Cooked kidney beans, 1/2 cup Cooked split peas, 1/2 cup Almonds, roasted, 1/3 cup Walnuts, roasted, 1/3 cup Sunflower seeds, roasted, 2 Tbsp Peanuts, roasted, 1/3 cup	440 mg 370 mg 360 mg 360 mg 310 mg 190 mg 124 mg 120 mg
Lean meats, fish, and poultry	Fish (cod, halibut, rockfish, trout, tuna), 3 oz Pork tenderloin, 3 oz Beef tenderloin, chicken, turkey, 3 oz	200–400 mg 370 mg 210 mg

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