

Hypertension – Diagnosis and Management

Effective Date: April 15, 2020

Scope

This guideline provides recommendations on how to diagnose and manage hypertension (HTN) in adults. Management of secondary causes of HTN, accelerated HTN, acute HTN in emergency settings, and HTN in pregnancy are out of scope.

For an algorithm of this guideline, refer to Appendix A: Diagnosis and Management of Hypertension Algorithm.

Key Recommendations[†]

Hypertension is a modifiable risk factor for cardiovascular disease (CVD) and an important public health issue.

Detection and Diagnosis

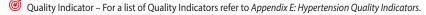
- 1. When measuring blood pressure in the office, the use of an automated office blood pressure (AOBP) electronic device is recommended in patients with regular heart rate.¹⁻³ [Strong Recommendation, Strong Evidence]
- 2. Hypertension is diagnosed in adults when automated office blood pressure reading is ≥ 135/85 in the higher BP arm. [Strong Recommendation, Strong Evidence]
 - When a manual office blood pressure device (MOBP) is used hypertension is diagnosed at \geq 140/90. ⁴⁻⁶ [Strong Recommendation, Strong Evidence]
- 3. Consider 24-hour ambulatory blood pressure monitoring, or standardized home blood pressure monitoring, to confirm a hypertension diagnosis in all patients⁷. [Strong Recommendation, Strong Evidence] ©

Management

- 1. A desired blood pressure level should be determined with each adult patient. Achieving an automated blood pressure reading of ≤ 135/85 is associated with the greatest reduction of risk for adults with no co-morbid conditions.⁸⁻¹⁰ [Strong Recommendation, Strong Evidence]

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- 2. Health behaviour change is recommended as a first step for those with average blood pressure 135-154/85-94 (AOBP), low-risk for cardiovascular disease and no co-morbidities.¹¹ [Strong Recommendation, Strong Evidence]
- 3. Initiate pharmaceutical management in context of the patient's overall cardiovascular risk and not solely on their blood pressure. [2,13] [Strong Recommendation, Strong Evidence]

[†] Strength of recommendation came from guidelines that used a GRADE approach, where available. If not present, the strength was based on consensus of the GPAC Guideline committee.







^{*} For examples of secondary causes of HTN, refer to Appendix C: Examples of Secondary Causes of Hypertension.

Definitions

An elevated automated office blood pressure (AOBP) is defined as an average systolic blood pressure (SBP) of > 135 mm Hg or an average diastolic blood pressure (DBP) of > 85 mm Hg or both with best available technique.

White-coat hypertension refers to the untreated condition in which BP is elevated in the office but is normal when measured by ambulatory blood pressure monitoring (ABPM), home blood pressure measurement (HBPM), or both.

Masked hypertension refers to untreated patients in whom the BP is normal in the office but is elevated when measured by HBPM or ABPM.

Classification

Based on the average BP recorded, hypertension is classified as High-Normal, Stage 1, Stage 2, or Stage 3 (Note: Figure 1 lists MOBP values only for Stage 2 and 3 since validated AOBP levels are currently unavailable). Management of hypertension based on the classification should be further informed and guided by the patient's CVD risk, organ damage, and presence of co-morbidities.

Figure 1: Hypertension Classification

AOB	P			135-154* 85-94		,	stolic (mm Hg) astolic (mm Hg)
	Low Normal	Normal	High Normal	Stage 1	Stage 2	Stage 3	
					- Hypertension -)
MOE	3P <120 <80	120-129 80-84	130-139 85-89	140-159 90-99	160-179 100-109	,	stolic (mm Hg) astolic (mm Hg)

^{*}Validated AOBP levels for the other classifications are currently unavailable and hence only previously published MOBP levels are listed.

Epidemiology

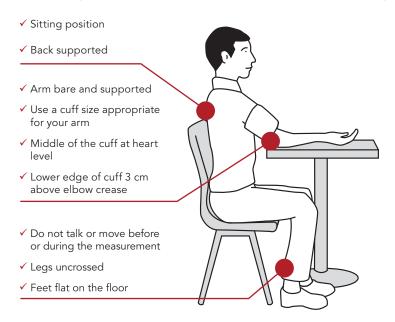
In BC, the age standardized prevalence rate for hypertension is 22.5 (per 100) and the age standardized annual incidence rate is 20.2 (per 1000 people over the age of 20) for 2017/18.¹⁴

Detection

Screening blood pressure should be recorded as accurately as possible in all adults at every appropriate visit. At appropriate visits, ask permission to check BP on all adults (trauma-informed practice). Inform patients that they may be sensitive to the tightening of the cuff on their arm.

Ensure standardized technique for measurement of BP (see Figure 2) and equipment are being used (see Table 1 in *Appendix B: Recommended Methods and Techniques for Measuring Blood Pressure*).^{3,15}

Figure 2: Standardized Technique for Hypertension Measurement (Image reproduced from Hypertension Canada Guideline⁶)



Diagnosis

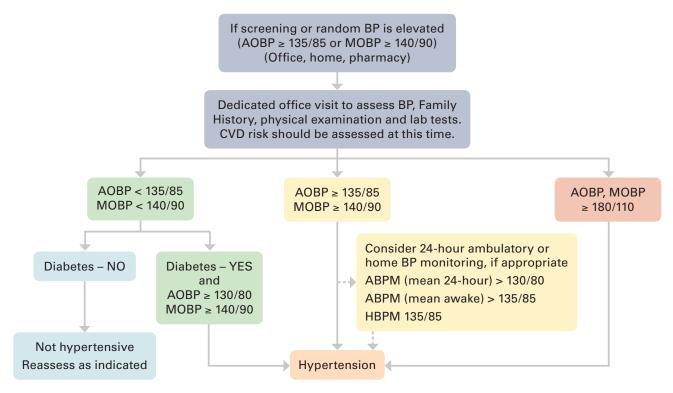
Assessment of Blood Pressure

- Automated office BP measuring electronic device is recommended, in preference to manual office BP technique. Using automated office BP reduces errors and avoids an overestimation of BP values (white-coat HTN), underestimation of BP values (masked HTN), reduces threshold avoidance (where the BP reading is adjusted to avoid thresholds that entails making a diagnosis) and digit preference (rounding their BP recording to a nearest zero end-digit).^{2,16,17} The advantages and limitations of the different methods are listed in *Appendix B: Recommended Methods and Techniques for Measuring Blood Pressure Table 1*.
- Assessment of postural hypotension should be included for appropriate patients (e.g., elderly).
- Ensure patient has not consumed caffeine or smoked in the last 30 minutes. Measure BP in both arms with the patient in a seated position resting quietly for at least 5 mins prior to measuring. Select the arm with the higher reading for further measurements. If average AOBP using the arm with the higher reading exceeds threshold for Hypertension diagnosis, proceed to investigations and work-up to assess target organ damage and cardiovascular disease (CVD) risk. If still using manual office technique, measure BP three more times using the arm with the higher reading, then discard the 1st reading and average the latter two.
- Consider 24 hour ambulatory or home BP monitoring for patients with borderline or variable measurements, significant anxiety or white coat syndrome.¹⁸

Table 1: Definition of Hypertension (in uncomplicated patients without co-morbidities)

Definition of Hypertension according to measurement method	SBP mm Hg	DBP mm Hg
measurement metriou	(and	d/or)
Automated Office BP (AOBP)	≥135	≥85
Manual Office BP (MOBP)	≥140	≥90
Ambulatory BP monitoring (ABPM)		
Daytime (awake) mean	≥135	≥85
Night-time (asleep) mean	≥120	≥70
24 hr mean	≥130	≥80
Home blood pressure measurement (HBPM) mean	≥135	≥85

Figure 3. Diagnosis of hypertension algorithm



Abbreviations: AOBP = automatic office blood pressure; ABPM = ambulatory blood pressure monitoring; BP = blood pressure; CVD = cardiovascular disease; DBP = diastolic blood pressure; HBPM = home blood pressure monitoring; MOBP = manual office blood pressure.

Evaluation and Investigations

Medical history

Collect personal and family medical history to identify risk factors and potential secondary causes of hypertension (See *Appendix C: Examples of Secondary Causes of Hypertension*).

Risk Factors

- *Modifiable*: smoking; high alcohol consumption; low physical activity levels/sedentary lifestyle; unhealthy eating (such as high sodium intake and low vegetable and fruit intake); body composition (e.g., high body weight, high body mass index, waist circumference); poor sleep; poor psychological factors (e.g., stress levels).
- Non-modifiable: age; family history; ethnicity (e.g., African, Caribbean, South Asian including East Indian, Pakistani, Bangladeshi, Sri Lankan origin)
- Prescription drugs (e.g., nonsteroidal anti-inflammatory drugs (NSAIDs), steroids, decongestants, oral contraceptive use); others (e.g., alcohol, stimulants, sodium).

Indications for a secondary cause of hypertension

- · Severe or refractory hypertension;
- An acute rise over previously stable values;
- Age < 30 years without family history; and/or
- No nocturnal fall in blood pressure (BP) during a 24-hour ambulatory BP monitoring period.

Refer to Appendix C: Examples of Secondary Causes of Hypertension for more details.

Physical examination

• Weight, height, waist circumference, dilated fundoscopy, central and peripheral cardiovascular examination, and abdominal examination.

Laboratory tests

- Urinalysis albumin to creatinine ratio (ACR), hematuria
- Blood chemistry potassium, sodium, creatinine/estimated glomerular filtration rate (eGFR)
- Fasting blood glucose or hemoglobin A1c level
- Blood lipids non-HDL cholesterol and triglycerides (non-fasting is acceptable)
- Electrocardiogram (ECG) standard 12-lead

Cardiovascular Risk Assessment

Administer a Cardiovascular Risk Assessment using one of the several assessment tools available, including the Framingham Risk Score (for patients age \leq 74), Qrisk risk calculator (for patients age \leq 84), Absolute CVD Risk/Benefit Calculator (for patients age \leq 80). It is recommended to be familiar with at least one of the tools to predict CVD risk.

- CVD risk assessment tools can provide only an approximate CVD risk value and clinical judgement is essential in the interpretation of the scores. Some tools (e.g., QRISK2) may not provide accurate risk scores when co-morbidities such as non-insulin dependent diabetes mellitus is present.¹⁹
- Use of risk assessment tools is not recommended for those with type 1 diabetes mellitus²⁰ or chronic kidney disease due to the known increased risk of CVD in this group²¹.

Refer to BCGuidelines.ca: Cardiovascular Disease – Primary Prevention for further information on cardiovascular risk.

Indications for Consultation

Indications for consultation with a specialist include:

- Hypertensive emergency DBP > 130 or BP > 180/110 with signs/symptoms[§];
- Sudden onset in the elderly;
- Abnormal nocturnal BP differences¹⁸ an extreme nocturnal BP dip (>20%), non/small nocturnal BP dip (<10%), or an increase in nocturnal BP are at risk for CVD;
- Signs or symptoms suggesting of secondary causes of the HTN (See *Appendix C: Examples of Secondary Causes of Hypertension*);
- Resistant HTN Not achieving desired BP despite considerable treatment effort; and
- More than 15 mm Hg difference between the arms.

Management

Once a diagnosis has been confirmed, conduct a patient-centred discussion to agree upon desirable BP readings and an individualized treatment plan. Engage the patient in committing towards changes in lifestyle to lower their BP and informed decisions on pharmacological interventions. This discussion should consider any benefits and potential harms.

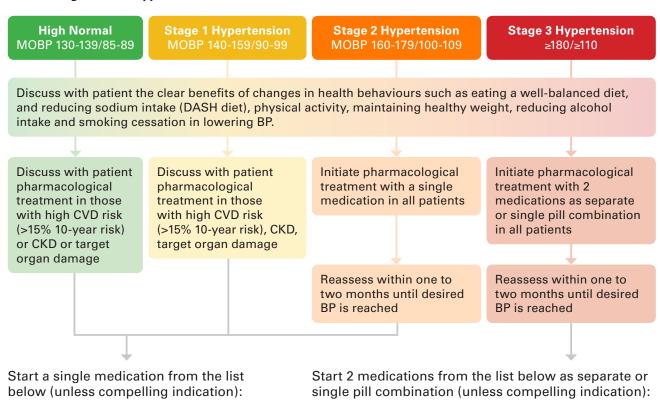
Desirable Blood Pressure Readings

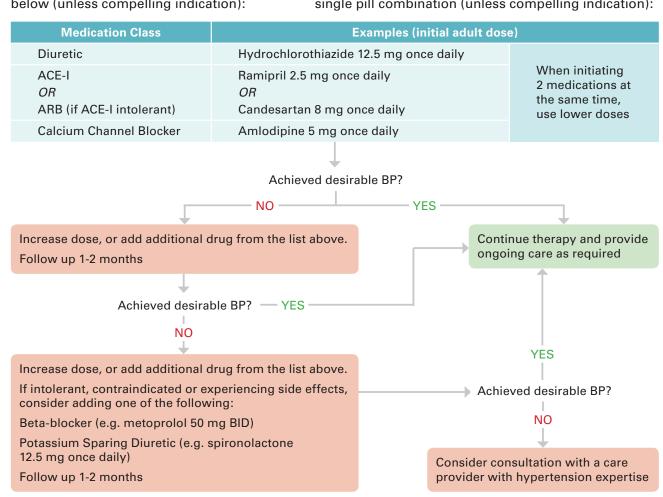
AOBP less than 135/85 is the desirable blood pressure reading for an adult with no comorbid conditions, diabetes, chronic kidney disease or other target organ damage. However, an individual patient's desirable BP is influenced by their age, presence of target organ damage, CVD risk level and/or the presence of other CVD risk factors (refer to BCGuidelines.ca: Cardiovascular Disease – Primary Prevention) and influenced by patient preferences, medication side effects and medication compliance.

This guideline uses the term 'desirable BP' instead of 'targets' to encourage individualized and patient-centred care. The suggested desirable BP readings of ≤135/85 is provided as guidance only, since recommending a uniform threshold for all patients or even patient groups is not optimal. Also, the term 'targets' is not used because the treat-to-target approach is not recommended.

[§] For more information on difference between hypertensive urgency and emergency, refer to www.rxfiles.ca/Hypertensive-Urgency-Management.pdf

Figure 4: Management of Hypertension





Healthy Behaviours

Recommend health behaviour changes for all patients with hypertension. The benefits of healthy behaviours such as smoking cessation, decreasing alcohol intake, increasing physical activity, obtaining or maintaining a healthy body composition, eating a well-balanced diet, and monitoring sodium intake has been shown to have clear benefits for high normal, stage I, and stage II hypertensive patients.^{22,23}

Patients in B.C. can access registered dietitian and exercise physiologist services by calling 8-1-1. Patient resources on lowering blood pressure are available through HealthLinkBC - Lifestyle Steps to Lower Your Blood Pressure (www.healthlinkbc.ca). Additional links for patient resources are available under Practitioner Resources and in 'A Guide for Patients: Diagnosis and Management of Hypertension'.

Health behaviour modification is recommended as a first line intervention for those in the high normal group (125/75-134/84 mm Hg) and those with stage I and II hypertension with <15% 10-year CVD risk. Recent meta-analyses and clinical trials showed pharmacologic treatment in the high-normal group and stage I and stage II group without established CVD and low to moderate CVD risk only minimally reduced the risk of cardiovascular morbidity and mortality and no reduction in all-cause mortality and coronary heart disease. 4,5,12,13,24,25

Table 2. Impact of health behaviours on blood pressure^{23,26}

Intervention	SBP (mm Hg)	DBP (mm Hg)	Goal
DASH diet ^b	-11.4	-5.5	
Weight control	-6.0	-4.8	• BMI < 25 kg/m²; WC ≤ 102/88 cm (Caucasian men/ women), ≤ 90/80 cm (Asian men/women)
Reduced salt/sodium intake	-5.4	-2.8	• < 2000 mg of sodium ^a
Reduced alcohol intake (heavy drinkers)	-3.4	-3.4	• ≤ 2 drinks/day
Physical activity	-3.1	-1.8	• 30-40 minutes 4-7 days/week
Smoking cessation	-	-	Smoke free environment
Relaxation therapies	-3.7	-3.5	-
Multiple interventions	-5.5	-4.5	-

Abbreviations: BMI = body mass index; DASH = dietary approaches to stop hypertension; DBP = diastolic blood pressure; $kg/m^2 = kilogram per square metre; mm Hg = millimetre of mercury; SBP = systolic blood pressure; WC = waist circumference.$

Footnotes: ^a Hypertension Canada now recommends a salt/sodium intake threshold 2000 mg (5 g of salt/sodium) per day. The previous threshold was ≤ 1500 mg (3.75 g of salt/sodium) and was changed based on clinical trial evidence from two systematic reviews published in 2013. The aim is to identify salt sensitive patients. ^b There are no mortality outcome studies of the DASH diet.

▶ Pharmacologic Management

Instigate pharmaceutical management in context of the patient's overall CVD risk (e.g., not solely based on a patient's BP) and in conjunction with health behaviour change.^{27,28}

Pharmacologic management should be considered in addition to lifestyle management if:

- 1) average BP is > 135/85 with target organ damage or CVD risk >15%;
- 2) average BP is > 135/85 with 1+ co-morbidities (refer to Table 4 for co-morbidities list);
- 3) average BP is ≥ 160/100; or
- 4) desirable BP is not reached with health behaviour change.

Treatment of Hypertension without Specific Indications

When prescribing, take into account cost of the drug, any potential side-effects and any contraindications. ^{25,29–31}

Without specific indications, consider monotherapy or single pill combination with one of the following first-line drugs³²:

- · low-dose thiazides and thiazide-like diuretic;
- long-acting calcium channel blocker (CCB);
- angiotensin converting enzyme inhibitor (ACE-I; in non-black patients); or
- angiotensin II receptor blocker (ARB).

Table 3. Contraindications for antihypertensive medications

Drug	Contraindications	Precautions
Angiotensin converting enzyme	Pregnancy	Electrolyte imbalances
inhibitors	History of angioedema	Severe renal impairment
Angiotensin II receptor blocker	Bilateral renal artery stenosis	
Beta-blockers	Second- or third-degree AV block	Athletes and physically active patients
	Sick sinus syndrome or SA block	Asthma (non-selective BBs)
	Bradycardia	
	Decompensated HF	
	Severe peripheral arterial	
	circulatory disorders	
Calcium Channel Blockers –		Heart Failure
Dihydropyridine (e.g., amlodipine)		Pre-existing severe leg edema
		Severe aortic stenosis
		Chronic constipation
Thiazides and Thiazide-like diuretics	Anuria	Gout
		Glucose intolerance
		Electrolyte imbalances
		Significant hepatic disease

Among these, thiazide diuretics are the least costly agents. Evidence suggests a non-significant difference in CV events and all-cause mortality between chlorthalidone and hydrochlorothiazide.^{33,34} In a recent meta analysis of routinely collected health data, chlorthalidone was associated with a significantly higher risk of hypokalemia, hyponatremia, acute renal failure, chronic kidney disease, and type 2 diabetes mellitus when compared to hydrochlorothiazide.³⁵

Note that alpha-blockers and beta-blockers are no longer considered to be a first-line option.³⁶

If desirable BP is not achieved with standard-dose monotherapy, use combination therapy by adding one or more of the first-line drugs. Combination of ACE-I and ARB is not recommended, and caution with combining a non-dihydropyridine CCB (i.e., verapamil or diltiazem) and a beta-blocker.

For a list of commonly prescribed antihypertensive medications in each class, refer to *Appendix D: Commonly Used Antihypertensive Drugs*.

Treatment of Hypertension with Specific Indications

Selecting an antihypertensive drug for a patient with 1+ co-morbidities may require a specific first-line drug. Refer to Table 4 for recommended first-line and second-line treatments.

Table 4. Pharmacologic treatment recommendations of hypertension complicated by co-morbidity⁷

Co-morbidity	Co-morbidity Pharmacologic Treatment Recommendations Notes					
Cardiovascular Diseas	se .					
Coronary heart disease First-line Second-line		ACE-I or ARB or Beta-blockers (for patients with stable angina) Long-acting CCB or DHP-CCB (for high-risk patients and in combination with a first-line ACE-I)	 Do not use short-acting nifedipine; Do not use ACE-I + ARB; Caution when lowering SBP to a desired level, if DBP is ≤ 60 mm Hg. 			
Myocardial infarction (recent)	First-line Second-line	Beta-blockers + ACE-I/ARB (if ACE-I intolerant) Long-acting CCB (if beta-blockers contraindicated or ineffective)	 Do not use non-DHP-CCB (diltiazem, verapamil) if heart failure is present. Caution when lowering SBP to a desired level, if DBP is ≤ 60 mm Hg. 			
Left ventricular hypertrophy	First-line Second-line	ACE-I/ARB (if ACE-I intolerant) or Thiazide/Thiazide-like diuretic or Long-acting CCB Combination of first-line drugs.	Do not use direct arterial vasodilators such as hydralazine and minoxidil.			
Heart failure reduced Ejection Fraction	First-line	Beta-blockers + ACE-I/ARB (if ACE-I intolerant) Aldosterone antagonist may be added in patients with recent CV hospitalization, acute MI, elevated BNP or NT-proBNP level, or NYHA Class II to IV symptoms.	I) If combining aldosterone antagonist to ACE-I/ARB, monitor for hyperkalemia. If combining ACE-I + ARB, monitor for potential adverse events including hypotension, hyperkalemia and worsening of renal function.			
	Second-line	Hydralazine + Isosorbide dinitrate (if ACE-I and ARBs are contraindicated or not tolerated) or Add ARB to ACE-I Thiazide/thiazide-like for BP control or loop diuretics for volume control as additive therapy. DHP-CCB may also be used.				
Cerebrovascular disease After acute stroke	First-line Second-line	ACE-I + Thiazide/Thiazide-like diuretic Long-acting DHP-CCB or combination of additional drugs	During acute stroke and not eligible for thrombolytic therapy do not treat HTN unless extreme BP increase. Combination of ACE-I + ARB is not recommended.			
Diabetes						
Diabetes with microalbuminuriab, CKD, CVD or CVD risk factors	First-line Second-line	ACE-I/ARB (if ACE-I intolerant) DHP-CCB				
Diabetes	First-line Second-line	ACE-I or ARB or Thiazide/Thiazide-like diuretic or DHP-CCB Combination of first-line drugs In combination with ACE-I or ARB, a DHP-CCB is preferable to a thiazide/thiazide-like	ke diuretic.			
Chronic Kidney Diseas	se					
Chronic kidney disease without diabetes	• Thiazide/thiazide-like diuretic as additive therapy. Loop diuretics for those with		If using ACE-I or ARB, monitor renal function and potassium. Combination of ACE-I + ARB is not recommended for patients without proteinuria.			
Renovascular disease	First-line Second-line	Thiazide diuretic or ACE-I or ARB (if ACE-I intolerant) or Long-acting CCB Combination of first-line drugs	Avoid ACE-I or ARB if bilateral renal artery stenosis or unilateral disease with solitary kidney.			

Peripheral arterial disease: Does not affect initial treatment recommendations. Avoid beta-blockers with severe disease.

Abbreviations: ACE-I = angiotensin-converting enzyme inhibitors; ACR = albumin to creatinine ratio; ARB = angiotensin II receptor blocker; BP = blood pressure; BNP = brain natriuretic peptide; CCB = calcium channel blocker; CKD = chronic kidney disease; CV = cardiovascular; CVD = cardiovascular disease; DBP = diastolic blood pressure; DHP = dihydropyridine; HF = heart failure; HTN = hypertension; MI = myocardial infarction; mm Hg = millimeter of mercury; NYHA = New York Heart Association functional classification system; NT-proBNP = N-terminal prohormone of brain natriuretic peptide; SBP = systolic blood pressure. **Footnotes**: a Proteinuria is defined as urinary protein > 500 mg/24hr or ACR > 30 mg/mmol in 2 of 3 specimens. b The term microalbuminuria is being phased out, which is now referred to as moderately increased albuminuria and as defined as ACR = 3 mg/mmol - 30 mg/mmol.

Follow-up to Treatment

Two weeks after initiating antihypertensive medications, follow-up with an eGFR to monitor kidney function and monitor for adherence to medications. Then, follow-up with the patient at monthly intervals until BP is in a desired range for two consecutive visits. Review every 3 - 6 months (as long as the patient remains stable). Establish the minimum dose of medication required to achieve the desired BP and reassess medication adherence with patients prior to adding/increasing medications. Periodically, consider discontinuing or reducing antihypertensive medications to assess the appropriate level of pharmacologic management. Monitor kidney function whenever medications are changed (e.g., dose adjustments).

Ongoing Care

Implement self-management strategies to assist the patient in managing their BP including measurement of their BP at home, committing to healthy behaviours and appropriate use of medications. At least annually, review the patient's medication, lifestyle change behaviours, risk factors, and examine for evidence of target organ damage.

Controversies in Care

Blood Pressure Readings in Population with Diabetes: For patients with diabetes, reaching a desirable MOBP reading of <130/80 is recommended by Hypertension Canada, American College of Cardiology, European Society of Hypertension and the Diabetes Canada Clinical Practice Guidelines. The desired level of MOBP <130/80 was determined by these groups following review of several recent clinical trials that support lower BP levels with reductions in risk of microvascular diabetic endpoints, stroke and major cardiovascular events.^{11,37}

Chronic Kidney Disease: For those diagnosed with chronic kidney disease a BP reading of AOBP < 135/85 is recommended as a desired level. Although there are differences in recommended BP targets for this population between the American College of Cardiology and of Hypertension Canada and the European Society of Hypertension, our recommendations align with the latter as the current evidence failed to show improved clinical outcomes for BP targets < 125/75 compared to < 135/85.^{9,38,39}

Older Adults: For adults aged 60 and above desirable BP reading of AOBP < 145/85 is recommended. Treating older adults to < 145/85 has been shown to significantly reduce mortality, stroke and cardiac events. BP targets lower than < 145/85 maybe beneficial for some (such as those with high cardiovascular risk) however clinical outcomes vary between trials. $^{40-42}$

A paradoxical relationship between lower BP and increased mortality in older adults has been suggested to be explained by frailty.43 Elevated BP is associated with greater mortality in *fit persons* whereas in *frail persons* higher BP was associated with lower mortality risk (e.g., National Health and Nutrition Examination Survey⁴⁴). The American College of Cardiology/American Heart Association Task Force provides no specific recommendation on treatment for this population due to the lack of evidence.⁴⁵

Finally, frailty is associated with limited life expectancy. Therefore, the time-until-benefit of a given treatment might exceed the life expectancy in frail individuals and may modify the risk-benefit ratio of preventive treatments for chronic diseases, including hypertension.⁴³

Hydrochlorothiazide and Skin Cancer Association:

At this time, substantial uncertainty exists around the evidence on the link between Hydrochlorothiazide (HCTZ) and skin cancer. Although photosensitivity is a known rare adverse reaction of HCTZ, and patients are advised of possible skin reactions such as sunburn, premature aging, and rash, malignancy is not one of them. Patients should be advised of the potential risk. Advise patients to regularly check for skin lesions, limit sun exposure and use adequate sun protection. Engage in shared-decision making with patients to find alternative medications especially in those with high risk for non-melanoma skin cancer.⁴⁶

HCTZ is a commonly prescribed medication for hypertension. In January of 2019, Health Canada issued a safety alert that concluded that prolonged use of HCTZ may be associated with a risk of non-melanoma skin cancer that is at least four times the risk of not using HCTZ.⁴⁶ The evidence for this safety alert came from 2 published studies from Denmark where nested case-control studies using the National database suggested a link between HCTZ use and the risk of cutaneous squamous cell carcinoma (cSCC) and cutaneous basal cell carcinoma (cBCC) (non-melanoma skin cancers). The studies suggested that high use of HCTZ (i.e., >3 years) could lead to 122 more (95% CI, from 112 more to 133 more) cases of cSCC per 1000 treated patients compared with its non-use (meta-analysis of 3 observational studies; very low certainty evidence) and 31 more (95% CI, from 24 more to 37 more) cases of cBCC per 1000 treated patients compared with its non-use (meta-analysis of 2 observational studies; very low certainty evidence).^{47,48}

References

- Final Recommendation Statement: High Blood Pressure in Adults: Screening US Preventive Services Task Force [Internet]. [cited 2019 Oct 3]. Available
 from: https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/high-blood-pressure-in-adults-screening
- Roerecke M, Kaczorowski J, Myers MG. Comparing Automated Office Blood Pressure Readings With Other Methods of Blood Pressure Measurement for Identifying Patients With Possible Hypertension: A Systematic Review and Meta-analysis. JAMA Intern Med. 2019 Mar 1;179(3):351.
- 3. Kollias A, Stambolliu E, Kyriakoulis KG, Gravvani A, Stergiou GS. Unattended versus attended automated office blood pressure: Systematic review and meta-analysis of studies using the same methodology for both methods. J Clin Hypertens Greenwich Conn. 2019 Feb;21(2):148–55.
- 4. Saiz LC, Gorricho J, Garjón J, Celaya MC, Erviti J, Leache L. Blood pressure targets for the treatment of people with hypertension and cardiovascular disease. Cochrane Hypertension Group, editor. Cochrane Database Syst Rev [Internet]. 2018 Jul 20 [cited 2019 May 14]; Available from: http://doi.wiley. com/10.1002/14651858.CD010315.pub3
- Brunström M, Carlberg B. Association of Blood Pressure Lowering With Mortality and Cardiovascular Disease Across Blood Pressure Levels. JAMA Intern Med. 2018 Jan;178(1):28–36.
- 6. Nerenberg KA, Zarnke KB, Leung AA, Dasgupta K, Butalia S, McBrien K, et al. Hypertension Canada's 2018 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of Hypertension in Adults and Children. Can J Cardiol. 2018 May;34(5):506–25.
- 7. Piper MA, Evans CV, Burda BU, Margolis KL, O'Connor E, Whitlock EP. Diagnostic and Predictive Accuracy of Blood Pressure Screening Methods With Consideration of Rescreening Intervals: A Systematic Review for the U.S. Preventive Services Task Force. Ann Intern Med. 2015 Feb 3;162(3):192.
- 8. Forouzanfar MH, Liu P, Roth GA, Ng M, Biryukov S, Marczak L, et al. Global Burden of Hypertension and Systolic Blood Pressure of at Least 110 to 115 mm Hg, 1990-2015. JAMA. 2017 10;317(2):165–82.
- 9. Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. Eur Heart J. 2018 Sep 1;39(33):3021–104.
- 10. Thomopoulos C, et al.,. Effects of blood pressure lowering on outcome incidence in hypertension. 1. Overview, meta-analyses, and meta-regression analyses of randomized tri... PubMed NCBI [Internet]. [cited 2020 Mar 13]. Available from: https://www-ncbi-nlm-nih-gov.ezproxy.hlth.gov.bc.ca/pubmed/25255397
- 11. Reboussin David M., Allen Norrina B., Griswold Michael E., Guallar Eliseo, Hong Yuling, Lackland Daniel T., et al. Systematic Review for the 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Hypertension. 2018 Jun 1;71(6):e116–35.
- 12. Lonn EM, Bosch J, López-Jaramillo P, Zhu J, Liu L, Pais P, et al. Blood-Pressure Lowering in Intermediate-Risk Persons without Cardiovascular Disease [Internet]. https://doi.org/10.1056/NEJMoa1600175. 2016 [cited 2019 May 15]. Available from: https://www.nejm.org/doi/10.1056/NEJMoa1600175?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dwww.ncbi.nlm.nih.gov
- 13. Musini VM, Gueyffier F, Puil L, Salzwedel DM, Wright JM. Pharmacotherapy for hypertension in adults aged 18 to 59 years. Cochrane Database Syst Rev [Internet]. 2017 [cited 2019 Apr 3];(8). Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD008276.pub2/full
- 14. British Columbia Ministry of Health [data provider]. BC Observatory for Population and Public Health [publisher]. Chronic Disease Dashboard. Available at: http://www.bccdc.ca/health-info/disease-system-statistics/chronic-disease-dashboard.
- 16. Pappaccogli M, Di Monaco S, Perlo E, Burrello J, D'Ascenzo F, Veglio F, et al. Comparison of Automated Office Blood Pressure With Office and Out-Off-Office Measurement Techniques. Hypertens Dallas Tex 1979. 2019 Feb;73(2):481–90.
- 17. Greiver M, Kalia S, Voruganti T, Aliarzadeh B, Moineddin R, Hinton W, et al. Trends in end digit preference for blood pressure and associations with cardiovascular outcomes in Canadian and UK primary care: a retrospective observational study. BMJ Open. 2019 Jan;9(1):e024970.
- 18. Yang W-Y, Melgarejo JD, Thijs L, Zhang Z-Y, Boggia J, Wei F-F, et al. Association of Office and Ambulatory Blood Pressure With Mortality and Cardiovascular Outcomes. JAMA. 2019 Aug 6;322(5):409–20.
- 19. Read SH, Diepen M van, Colhoun HM, Halbesma N, Lindsay RS, McKnight JA, et al. Performance of Cardiovascular Disease Risk Scores in People Diagnosed With Type 2 Diabetes: External Validation Using Data From the National Scottish Diabetes Register. Diabetes Care. 2018 Sep 1;41(9):2010–8.
- 20. Schofield J, Ho J, Soran H. Cardiovascular Risk in Type 1 Diabetes Mellitus. Diabetes Ther. 2019 Jun;10(3):773–89.
- 21. Major RW, Cheng MRI, Grant RA, Shantikumar S, Xu G, Oozeerally I, et al. Cardiovascular disease risk factors in chronic kidney disease: A systematic review and meta-analysis. PLOS ONE. 2018 Mar 21;13(3):e0192895.
- 22. Aronow WS. Lifestyle measures for treating hypertension. Arch Med Sci AMS. 2017 Aug;13(5):1241-3.
- 23. Hypertension Canada. Hypertension Canada. Health Behaviour Management [Internet]. Available from: https://guidelines.hypertension.ca/prevention-treatment/health-behaviour-management/
- 24. Diao D, Wright JM, Cundiff DK, Gueyffier F. Pharmacotherapy for mild hypertension. Cochrane Database Syst Rev [Internet]. 2012 [cited 2019 Apr 3];(8). Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD006742.pub2/full
- 25. Thomopoulos C, Parati G, Zanchetti A. Effects of blood-pressure-lowering treatment on outcome incidence. 12. Effects in individuals with high-normal and normal blood pressure: overview and meta-analyses of randomized trials. J Hypertens. 2017;35(11):2150–60.
- 26. National Clinical Guideline Centre (UK). Hypertension: The Clinical Management of Primary Hypertension in Adults: Update of Clinical Guidelines 18 and 34 [Internet]. London: Royal College of Physicians (UK); 2011 [cited 2019 May 16]. (National Institute for Health and Clinical Excellence: Guidance). Available from: http://www.ncbi.nlm.nih.gov/books/NBK83274/
- 27. Karmali KN, Lloyd-Jones DM, van der Leeuw J, Goff DC, Yusuf S, Zanchetti A, et al. Blood pressure-lowering treatment strategies based on cardiovascular risk versus blood pressure: A meta-analysis of individual participant data. PLoS Med. 2018;15(3):e1002538.
- 28. Blood pressure-lowering treatment based on cardiovascular risk: a meta-analysis of individual patient data. The Lancet. 2014 Aug 16;384(9943):591–8.
- 29. Thomopoulos C, Parati G, Zanchetti A. Effects of blood pressure-lowering treatment on cardiovascular outcomes and mortality: 14 effects of different classes of antihypertensive drugs in older and younger patients: overview and meta-analysis. J Hypertens. 2018;36(8):1637–47.
- 30. Thomopoulos C, Parati G, Zanchetti A. Effects of blood pressure-lowering on outcome incidence in hypertension: 5. Head-to-head comparisons of various classes of antihypertensive drugs overview and meta-analyses. J Hypertens. 2015 Jul 1;33(7):1321–41.
- 31. Thomopoulos C, Parati G, Zanchetti A. Effects of blood-pressure-lowering treatment in hypertension: 9. Discontinuations for adverse events attributed to different classes of antihypertensive drugs meta-analyses of randomized trials. J Hypertens. 2016 Oct 1;34(10):1921–32.
- 32. Wright JM, Musini VM, Gill R. First-line drugs for hypertension. Cochrane Database Syst Rev [Internet]. 2018 [cited 2019 Apr 3];(4). Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001841.pub3/full
- 33. Olde Engberink Rik H.G., Frenkel Wijnanda J., van den Bogaard Bas, Brewster Lizzy M., Vogt Liffert, van den Born Bert-Jan H. Effects of Thiazide-Type and Thiazide-Like Diuretics on Cardiovascular Events and Mortality. Hypertension. 2015 May 1;65(5):1033–40.

- 34. Liang W, Ma H, Cao L, Yan W, Yang J. Comparison of thiazide-like diuretics versus thiazide-type diuretics: a meta-analysis. J Cell Mol Med. 2017 Nov;21(11):2634–42.
- 35. Hripcsak G, Suchard MA, Shea S, Chen R, You SC, Pratt N, et al. Comparison of Cardiovascular and Safety Outcomes of Chlorthalidone vs Hydrochlorothiazide to Treat Hypertension. JAMA Intern Med. 2020 Feb 17;
- 36. Wiysonge CS, Bradley HA, Volmink J, Mayosi BM, Opie LH. Beta-blockers for hypertension. Cochrane Hypertension Group, editor. Cochrane Database Syst Rev [Internet]. 2017 Jan 20 [cited 2019 May 15]; Available from: http://doi.wiley.com/10.1002/14651858.CD002003.pub5
- 37. Tobe SW, Gilbert RE, Jones C, Leiter LA, Prebtani APH, Woo V. Treatment of Hypertension. Can J Diabetes. 2018 Apr;42:S186-9.
- 38. Malhotra R, Nguyen HA, Benavente O, Mete M, Howard BV, Mant J, et al. Association Between More Intensive vs Less Intensive Blood Pressure Lowering and Risk of Mortality in Chronic Kidney Disease Stages 3 to 5: A Systematic Review and Meta-analysis. JAMA Intern Med. 2017 Oct 1;177(10):1498–505.
- 39. Upadhyay A, Earley A, Haynes SM, Uhlig K. Systematic review: blood pressure target in chronic kidney disease and proteinuria as an effect modifier. Ann Intern Med. 2011 Apr 19;154(8):541–8.
- 40. Garrison SR, Kolber MR, Korownyk CS, McCracken RK, Heran BS, Allan GM. Blood pressure targets for hypertension in older adults. Cochrane Database Syst Rev [Internet]. 2017 [cited 2019 Apr 5];(8). Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD011575.pub2/full
- 41. Weiss J, Freeman M, Low A, Fu R, Kerfoot A, Paynter R, et al. Benefits and Harms of Intensive Blood Pressure Treatment in Adults Aged 60 Years or Older: A Systematic Review and Meta-analysis. Ann Intern Med. 2017 Mar 21;166(6):419.
- 42. The SPRINT Research Group. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. N Engl J Med. 2015 Nov 26;373(22):2103–16.
- 43. Vetrano DL, Palmer KM, Galluzzo L, Giampaoli S, Marengoni A, Bernabei R, et al. Hypertension and frailty: a systematic review and meta-analysis. BMJ Open. 2018 Dec;8(12):e024406.
- 44. Odden MC, Peralta CA, Haan MN, Covinsky KE. Rethinking the Association of High Blood Pressure with Mortality in Elderly Adults: The Impact of Frailty. Arch Intern Med. 2012 Aug 13;172(15):1162–8.
- 45. Whelton Paul K., Carey Robert M., Aronow Wilbert S., Casey Donald E., Collins Karen J., Dennison Himmelfarb Cheryl, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Hypertension. 2018 Jun 1;71(6):1269–324.
- 46. Health Canada. Important new safety information regarding the use of hydrochlorothiazide and the risk of non-melanoma skin cancer [Internet]. [cited 2019 Jul 25]. Available from: https://healthycanadians.gc.ca/recall-alert-rappel-avis/hc-sc/2019/68976a-eng.php
- 47. Pedersen SA, Gaist D, Schmidt SAJ, Hölmich LR, Friis S, Pottegård A. Hydrochlorothiazide use and risk of nonmelanoma skin cancer: A nationwide case-control study from Denmark. J Am Acad Dermatol. 2018;78(4):673-681.e9.
- 48. Pottegård A, Pedersen SA, Schmidt SAJ, Hölmich LR, Friis S, Gaist D. Association of Hydrochlorothiazide Use and Risk of Malignant Melanoma. JAMA Intern Med. 2018 Aug 1;178(8):1120–2.

Practitioner Resources

• RACE: Rapid Access to Consultative Expertise Program – www.raceconnect.ca

A telephone consultation line for select specialty services for physicians, nurse practitioners and medical residents. **If the relevant specialty area is available through your local RACE line, please contact them first.** Contact your local RACE line for the list of available specialty areas. If your local RACE line does not cover the relevant specialty service or there is no local RACE line in your area, or to access Provincial Services, please contact the Vancouver/Providence RACE line.

- o **Vancouver Coastal Health Region/Providence Health Care:** www.raceconnect.ca 604-696-2131 (Vancouver) or 1-877-696-2131 (toll free)
 - Available Monday to Friday, 8 am to 5 pm
- o Northern RACE: 1-877-605-7223 (toll free)
- o Kootenay Boundary RACE: www.divisionsbc.ca/kb/race 1-844-365-7223 (toll free)
- o For Fraser Valley RACE: www.raceapp.ca (download at Apple and Android stores)
- o **South Island RACE:** www.raceapp.ca (download at Apple and Android stores) or see www.divisionsbc.ca/south-island/RACE
- Health Data Coalition: https://hdcbc.ca/

An online, physician-led data sharing platform that can assist you in assessing your own practice in areas such as chronic disease management or medication prescribing. HDC data can graphically represent patients in your practice with chronic diseases in a clear and simple fashion, allowing for reflection on practice and tracking improvements over time.

- Hypertension Canada, www.hypertension.ca
- BHS British Hypertension Society, www.bhsoc.org/
- Heart and Stroke Foundation, www.heartandstroke.ca
 - o The DASH Diet: Heart and Stroke Foundation: www.heartandstroke.ca/dash-diet
- BC Guidelines www.BCGuidelines.ca Cardiovascular Disease Primary Prevention (2014)

- **HealthLink BC**, www.healthlinkbc.ca. You may call HealthLinkBC at 8-1-1 toll-free in B.C., or for the deaf and the hard of hearing, call 7-1-1. You will be connected with an English speaking health-service navigator, who can provide health and health-service information and connect you with a registered dietitian, exercise physiologist, nurse, or pharmacist.
 - o HealthLinkBC, Lifestyle Steps to Lower Your Blood Pressure
 - o HealthLink BC: DASH Diet Sample Menu www.healthlinkbc.ca/DASH Diet
- **Quit Smoking:** QuitNow.ca provides one-on-one support and valuable resources in multiple languages to help you plan your strategy and connect with a Quit Coach.
 - Phone: 1-877-455-2233 (toll-free) Email: quitnow@bc.lung.ca
- The BC Smoking Cessation Program helps cover the cost of nicotine replacement therapy products (nicotine gum, lozenges, patches, inhaler) and specific smoking cessation prescription drugs (Zyban® or Champix®). For prescription medications to help you guit smoking, speak to your doctor.
- For more information about reducing alcohol intake
 - Refer to Canada's Low Risk Drinking Guidelines also available at HealthLink BC: Alcohol: Drinking and Your Health
 - Refer to **BC Guidelines** www.BCGuidelines.ca *Problem Drinking (2013)* under revision in collaboration with BC Centre on Substance Use (www.bccsu.ca)
 - BC Centre on Substance Use has recently published guidance on supporting those living with alcohol addiction.
 - o A Provincial Guideline for the Clinical Management of High-Risk Drinking and Alcohol Use Disorder (December 2019; www.bccsu.ca/aud-guideline)
 - o A Guideline for the Clinical Management of High-Risk Drinking and Alcohol Use Disorder (December 2019; www.bccsu.ca/aud-recommendations)

Appendices

- Appendix A: Diagnosis and Management of Hypertension Algorithm
- Appendix B: Recommended Methods and Techniques for Measuring Blood Pressure
- Appendix C: Examples of Secondary Causes of Hypertension
- Appendix D: Commonly Used Antihypertensive Drugs
- Appendix E: Hypertension Quality Indicators

Associated Documents

The following documents accompany this guideline:

- Summary of Guideline: Hypertension Diagnosis and Management
- A Guide for Patients: Diagnosis and Management of Hypertension

This guideline is based on scientific evidence current as of the effective date.

The guideline was developed by the Guidelines and Protocols Advisory Committee and adopted by the Medical Services Commission.

For more information about how BC Guidelines are developed, refer to the GPAC Handbook available at BCGuidelines.ca: GPAC Handbook.

THE GUIDELINES AND PROTOCOLS ADVISORY COMMITTEE

The principles of the Guidelines and Protocols Advisory Committee are to:

- encourage appropriate responses to common medical situations
- recommend actions that are sufficient and efficient, neither excessive nor deficient
- permit exceptions when justified by clinical circumstances

Contact Information:

Guidelines and Protocols Advisory Committee PO Box 9642 STN PROV GOVT Victoria BC V8W 9P1

Email: hlth.guidelines@gov.bc.ca Website: www.BCGuidelines.ca

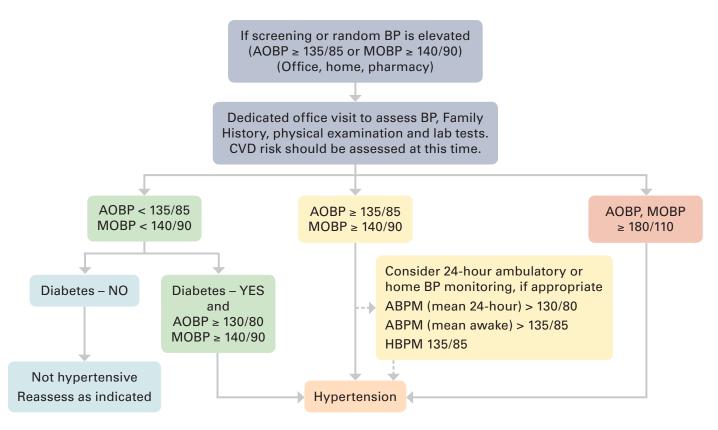
Disclaimer

The Clinical Practice Guidelines (the "Guidelines") have been developed by the Guidelines and Protocols Advisory Committee on behalf of the Medical Services Commission. The Guidelines are intended to give an understanding of a clinical problem, and outline one or more preferred approaches to the investigation and management of the problem. The Guidelines are not intended as a substitute for the advice or professional judgment of a health care professional, nor are they intended to be the only approach to the management of clinical problem. We cannot respond to patients or patient advocates requesting advice on issues related to medical conditions. If you need medical advice, please contact a health care professional.

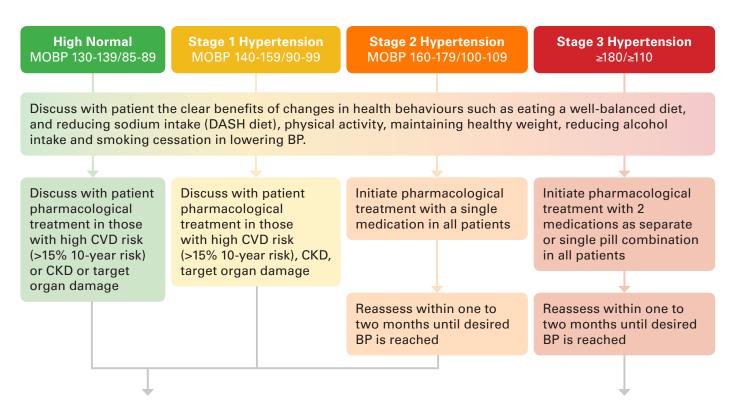
Appendix A: Diagnosis and Management of Hypertension Algorithm

AOE	BP			135-154* 85-94			Systolic (mm Hg) Diastolic (mm Hg)
	Low Normal	Normal	High Normal	Stage 1	Stage 2	Stage 3	
					- Hypertension		\supset
MOI	3P <120 <80	120-129 80-84	130-139 85-89	140-159 90-99	160-179 100-109		Systolic (mm Hg) Diastolic (mm Hg)

^{*}Validated AOBP levels for the other classifications are currently unavailable and hence only previously published MOBP levels are listed.

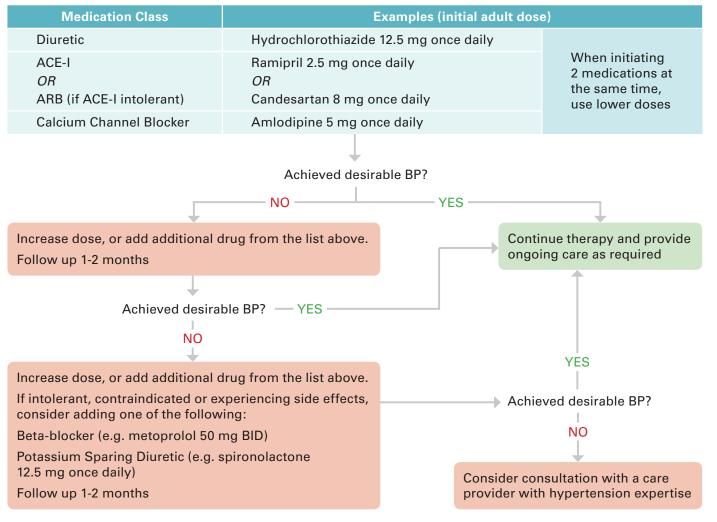


Abbreviations: AOBP = automatic office blood pressure; ABPM = ambulatory blood pressure monitoring; BP = blood pressure; CVD = cardiovascular disease; DBP = diastolic blood pressure; HBPM = home blood pressure monitoring; MOBP = manual office blood pressure.



Start a single medication from the list below (unless compelling indication):

Start 2 medications from the list below as separate or single pill combination (unless compelling indication):





Appendix B: Recommended Methods and Techniques for Measuring Blood Pressure

Recommended Methods for Measuring Blood Pressure

At appropriate visits, ask permission to check BP on all adults (trauma-informed practice). Inform patients that they may be sensitive to the tightening of the cuff on their arm.

In the office setting, the use of automated office blood pressure (BP) electronic device, which averages multiple readings, is recommended as an alternative to taking a manual office BP. The advantages of automated office BP measurements include:

1) BP measurements are comparable to ambulatory BP monitoring; 2) readings are consistent from visit-to-visit; 3) reduces white-coat and masked hypertension (HTN); and 3) correlates well with cardiovascular (CV) outcomes (e.g., acute myocardial infarction, cerebrovascular events). However, manual office BP may be appropriate in cases such as for patients with arrhythmias.

Table 1. Comparison of measurement equivalence numbers

Method	Automated Office BP	Ambulatory BP Monitoring (mean 24-hour)	Ambulatory BP Monitoring (mean awake)	Home BP Monitoring	Manual Office BP
Measurements (mm Hg)	135/85	130/80	135/85	135/85	140/90

Abbreviations: BP = blood pressure; mm Hg = millimetre of mercury.

When confirming a HTN diagnosis, consider a 24-hour ambulatory or home BP monitoring for appropriate patients (e.g., suspected white-coat HTN, unusual fluctuating office-based BP readings).^{7,11} Even though ambulatory BP monitoring is considered the most accurate for BP measurements, there are some known limitations including: 1) cost (patient-pay ~ \$50); 2) accessibility issues (both in actual devices and trained professionals to interpret results); and 3) patient may not be able to tolerate ambulatory BP monitoring device. Home BP measurements are comparable to ambulatory BP measurement and may be used if ambulatory BP monitoring is not tolerated or available. Ambulatory and home BP monitoring may also have a role in the management of HTN, including determining the efficacy of antihypertensive drugs or assessing resistant HTN.

Both the method used and the presence of any errors (refer to Table 2 below) may lead to a misdiagnosis and/or inappropriate treatment decision. When comparing common manual office BP practices versus proper standardized technique measurements, the mean manual office BP was at least 10/5 mm Hg higher. As well, manual office BP was consistently higher than the recognized 5 mm Hg difference when compared to mean ambulatory BP monitoring (awake).

Table 2. Common errors in when measuring blood pressure

Type of Error	% Affect	Notes
Natural variation	≥ 14%	After 2 office visits, a patient with a true systolic BP of 130 mm Hg will have a 14% chance of an average above 140 mm Hg. After 10 visits, the risk of this average (and potential misdiagnosis) increases to 64%. In healthy adults < 35 years, the probability of misclassification exceeds that of accurate diagnosis.
Incorrect measure- ment technique	> 60%	 63% of physicians and nurses were found to be out of range in BP measurement (false increases or reductions); none followed the American Heart Association's technique recommendations. When comparing common MOBP practices to proper technique, the mean MOBP was at least 10/5 mm Hg higher than the proper technique.
White-coat HTN	20%	 More common in elderly patients and is generally associated with a relatively benign prognosis. Physicians consistently obtain higher readings than nurses.
Office-based measurement	~ 100%	An AOBP measurement, which averages multiple readings, is superior to MOBP in the office setting.
CVD risk not assessed	~ 100%	Patients with CVD or are high-risk for CVD are approached the same as low-risk patients.

Abbreviations: ABPM = ambulatory blood pressure monitoring; AOBP = automated office blood pressure; BP = blood pressure; CVD = cardiovascular disease; HTN = hypertension; MOBP = manual office blood pressure; mm = millimetre of mercury.

Techniques for Measuring Blood Pressure

Office Blood Pressure Measurement

Equipment Requirements

• Ensure appropriate equipment is being used (e.g., accurate sphygmomanometer, calibrated and validated electronic devices, cuff with an appropriate bladder size).

Patient Requirements

- Patient has rested comfortably for 5 minutes in a seated position, legs uncrossed and a supported bare arm.
- For elderly and diabetic patients, BP may be measured in a supine position.

Arm Selection

• Select which arm to be used by measuring both arms with the BP cuff at heart level. Use the arm with the higher BP for future measurement and interpretation.

Taking Measurements

- For AOBP: Set the device to take measurements at 1- or 2-minute intervals. Discard the 1st reading and average the latter readings.
- For auscultation:
 - o Take 3 measurements, with at least one-minute elapse between readings. Discard the 1st reading and average the latter 2 readings.
 - o Increase the pressure rapidly to 30 mm Hg above the level at which the radial pulse is extinguished.
 - o Place the bell or diaphragm of the stethoscope gently and steadily over the brachial artery.
 - o Open the control valve so that the rate of deflation of the cuff is approximately 2 mm Hg per heartbeat. A cuff deflation rate of 2 mm Hg per beat is necessary for accurate systolic and diastolic estimation.
 - o Read the systolic level the first appearance of a clear tapping sound (phase I Korotkoff) and the diastolic level (the point at which the sounds disappear (phase V Korotkoff)). If Korotkoff sounds persist as the level approaches 0 mm Hg, then the point of muffling of the sound is used (phase IV) to indicate the diastolic pressure. Leaving the cuff partially inflated for too long will fill the venous system and make the sounds difficult to hear.
- For those with an arrhythmia: additional readings with auscultation may be required to estimate the average systolic and diastolic pressure.

Results

- Record BP to the closest 2 mm Hg (for manual office BP) or 1 mm Hg (for automated office BP); which arm was used; position of patient (i.e., supine, sitting or standing); and heart rate.
- A mean 24-hour ambulatory BP monitoring 130/80 equates to an automated office BP 135/85 and a manual office BP of 140/90 mm Hg.

Ambulatory Blood Pressure Monitoring Measurement

Equipment Requirements

• Ensure ambulatory BP monitoring device has been validated independently using established protocols. A list of validated devices is provided at Hypertension Canada's website on Blood Pressure Measurement Devices under the 'Hypertension & You' heading (www.hypertension.ca)

Patient Requirements

• Ensure the patient is able to tolerate ambulatory BP monitoring (e.g., keeping cuff in correct position and dry) and is willing to keep a diary of events (e.g., when medication(s) were taken, bedtime).

Taking Measurements

• Have the device take 2 measurements per hour during the patient's daytime (i.e., awake) hours. Record the average BP from at least 14 measurements.

Results

- A mean 24-hour ambulatory BP monitoring 130/80 equates to a mean awake ambulatory BP monitoring of 135/85 and a manual office BP of 140/90 mm Hg.
- Any changes in nocturnal BP should be taken into account with any decisions to prescribe or withhold drug therapy. This is because a decrease in nocturnal BP of less than 10% is associated with increased risk of CV events.

Resources

 Ambulatory BP monitoring Educational Resource Video for healthcare professionals from the British and Irish Hypertension Society (BIHS) YouTube channel, under 'Blood Pressure Measurement'.

► Home Blood Pressure Monitoring Measurement

Equipment Requirements

• Ensure home BP monitoring device has been validated independently and is calibrated. Follow the instruction manual that comes with the device and reach out to a health care professional to confirm accuracy of BP measurements. A list of validated devices is listed on Hypertension Canada's website (www.hypertension.ca) and have the endorsement logo on their package.





Patient Requirements

• Ensure patient is well suited (e.g., does not have arrhythmia or experiences undue anxiety) and is capable of implementing proper technique (e.g., using proper cuff size being relaxed, seated position, reasonable amount of time after heavy physical activity, drinking coffee or smoking).

Taking Measurements

• Have the patient take 2 consecutive (at 1 minute intervals) measurements once in the morning and once in the evening for 4–7 days. Discard 1st day of measurements, and average the remaining measurements.

Results

 A home BP monitoring 135/85 equates to a mean awake ambulatory BP monitoring 135/85 and a manual office BP 140/90 mm Hg.

Table 1. Ranking of preferred methods for measuring blood pressure by accuracy and accesibility^{2,7,15–17}

1. Automated Off	ice BP							
35/85 (automate	d office BP) = 135/85 (ambulatory BP monitoring: mean awake)							
Advantages	Advantages 1) Measurements are comparable to ambulatory BP monitoring (the gold standard); 2) readings are consistent from visit-to-visit and between care providers; 3) reduces white-coat and masked HTN; and 4) correlates well with CV outcomes (e.g., acute MI and cerebrovascular events); 5) Can be performed by trained non-medical staff such as medical office assistants, saving healthcare provider and patient visit time.							
Limitations	1) May be challenging to find quiet/alone place and appropriate positioning of the patient; 2) Staff may have time and space constraints to perform AOBP.							
2. Ambulatory BF	P Monitoring							
130/80 (ambulato	ry BP monitoring: mean 24-hour) = 135/85 (ambulatory BP monitoring: mean awake) = 140/90 (manual office BP)							
Advantages	Ambulatory BP monitoring is considered the preferred method for accurate BP measurements.							
Limitations	1) May cost (patient-pay ~ \$50); 2) accessibility issues (both in actual devices and trained professionals to interpret results); and 3) patient may not be able to tolerate ambulatory BP monitoring.							
Technical Notes	Offer ambulatory BP monitoring to patients with elevated BP and who can tolerate keeping the cuff position correctly and dry for 24 hours. Use 24 hr standard (average) and not awake when there is uncertainty regarding patient sleep times.							
3. Home BP Moni	toring							
135/85 (home BP ı	monitoring) = 135/85 (ambulatory BP monitoring: mean awake) = 140/90 (manual office BP)							
Advantages	1) Measurements are comparable to ambulatory BP monitoring (the gold standard); 2) correlates well with target organ damage and CV mortality.							
Limitations	Offer home BP monitoring if ambulatory BP monitoring is not tolerated. Ensure device is appropriate (e.g., cuff size) and validated (i.e., includes the endorsement logo and/or listed on www.hypertension.ca). A Standard protocol should be used.							
4. Manual Office	BP							
Advantages	1) Considered a more accurate reading for patients with arrhythmias; and 2) accessibility.							
Limitations	1) Known issues with the accuracy of manual office BP (e.g., white-coat effect, improper technique, faulty equipment digit preference, & threshold avoidance) that may result in approximately 10/5 mm Hg higher readings; and 2) relatively poor predictor of CV risk related to BP status.							

 $\textbf{Abbreviations}: BP = blood\ pressure; CV = cardiovascular; HTN = hypertension; mm\ Hg = millimetre\ of\ mercury; MI = myocardial\ infarction.$

Appendix C: Examples of Secondary Causes of Hypertension

Indications for a secondary cause of hypertension are: 1) severe or refractory hypertension; 2) an acute rise over previously stable values; 3) age < 30 years without family history; and/or 4) no nocturnal fall in blood pressure (BP) during a 24-hour ambulatory BP monitoring period.

Table 1. Examples of identifiable secondary causes of hypertension and initial investigations

Aldosteronism (Primary)	
 Signs/symptoms: Spontaneous hypokalemia (though more than one-half of patients are normokalemic) Profound diuretic-induced hypokalemia (< 3.0 mmol/L) Hypertension refractory to treatment with 3 or more drugs Hypertension and adrenal incidentaloma 	 Initial Investigations: Plasma renin activity and plasma aldosterone concentration Note: ideally measured before 10 am after 1 hour of ambulation, if possible. Patient should be on an unrestricted sodium diet. Certain medications affect aldosterone and renin. If safe, suggested drug-free periods prior to testing are: Beta-blockers = 1 week ACE-I, ARB, diuretics, NSAIDs = 2 weeks Spironolactone, eplerenone, amiloride, triamterene, potassium-wasting diuretics = 4 weeks.
Sleep Apnea	
Signs/symptoms: Loud snoring Daytime somnolence and fatigue	Initial Investigations: Sleep diary Overnight oximetry
Renovascular Disease	
 Signs/symptoms: ↑ > 30% creatinine after introducing angiotensin converting enzyme inhibitor (ACE-I) or angiotensin II receptor blocker (ARB) Hypertension with diffuse atherosclerosis or a unilateral small kidney Episodes of flash pulmonary edema Abdominal bruit (not very sensitive) 	 Initial Investigations may include: Magnetic resonance angiography (MRA) Computed tomography angiography (CTA)
Kidney Disease (Primary)	
Signs/symptoms: • ✓ estimated glomerular filtration rate (eGFR) and/or abnormal urinalysis Refer to BCGuidelines.ca – Chronic Kidney Disease – Identification, Evaluation and Management of Adult Patients.	 Initial Investigations: eGFR Urinalysis - albumin to creatinine ratio (ACR), hematuria Physical exam & medical history Renal ultrasound
Cushing's Syndrome	
Signs/symptoms:Cushingoid faciesCentral obesityProximal muscle weaknessEcchymoses	 Initial Investigations may include any of: late-night salivary cortisol levels 24-hour urine free cortisol (UFC) low-dose (1-mg overnight or 48-hour [2-mg/24-hour]) dexamethasone suppression test (LDDST)

Pheochromocytoma	
Signs/symptoms: Paroxysmal elevations in BP Headache Palpitations Sweating	 Initial Investigations: 24-hour urine for catecholamines and metanephrinesn Note: False positives can be caused by tricyclic antidepressants, antipsychotics, levodopa, decongestants, labetalol, sotalol, buspirone, ethanol, acetaminophen, phenoxybenzamine, withdrawal from clonidine (and other drug withdrawal) and major physical stress (e.g., surgery, stroke, sleep apnea).
Oral Contraceptives	
Signs/symptoms: • ↑ BP temporally related to oral contraceptive use	Initial Investigations: -
Coarctation of the Aorta	
Signs/symptoms: • ↑ BP in right arm with diminished or delayed femoral pulses, and low BP in the legs	Initial Investigations: Echocardiogram Note: most occur just distal to the left subclavian origin.
Hypo/Hyperthyroidism	
Signs/symptoms: Refer to BCGuidelines.ca – Thyroid Function Tests in the Diagnosis and Monitoring of Adults	Initial Investigations: Thyroid-stimulating hormone (TSH)
Hyperparathyroidism	
Signs/symptoms:Bone painNon-specific symptomsPatients often asymptomatic	 Initial Investigations: Parathyroid hormone (PTH) Total Calcium (follow-up with ionized calcium, if necessary) Phosphate



Appendix D: Commonly Used Antihypertensive Drugs 1-4, a

				-	
Generic Name (trade name) (strengths and dosage form)	Usual Adult Dosages for Hypertension ^b	Annual Cost ^c	PharmaCare Coverage	Common Adverse Effects	Therapeutic Considerations
			Diuretics		
chlorthalidone G Tabs: 50 mg	Usual: 12.5 mg once daily Usual: 12.5 mg to 25 mg once daily Maximum: 50 mg per day (some sources: max 25 mg per day)	\$12-25	Regular Benefit	Hypotension, muscle cramps, weakness, erectile dysfunction	Monitor SCr and potassium. Generally ineffective in CrCl < 30 mL/min. Use cautiously in patients with history of or predisposition to gout (may precipitate gout)
hydrochlorothiazide G Tabs: 12.5, 25, 50, 100 mg triamterene/ hydrochlorothiazide Triazide, G	Initial: 12.5 mg daily Usual: 12.5 mg to 25 mg once daily Maximum: 50 mg per day (some sources: max. 25 mg per day) Initial: 25/12.5 mg once daily Usual: 50/25 mg once daily	\$12-13	Regular Benefit	Hypokalemia, hyponatremia, hyperglycemia, hyperlipidemia, hyperuricemia Less Common Allergic reactions (cross sensitivity to sulfonamides not proven), photosensitivity,	or renal impairment (cumulative effects may develop). May change glycemic control in patient with diabetes or prediabetes. Consider an alternative antihypertensive for patients with or predisposed to arrhythmias. May be available in combination with other entity. See other agents for available combination
Tabs: 50/25 mg indapamide Lozide, G Tabs: 1.25, 2.5 mg	Initial: 1.25 mg once daily Usual: 1.25 mg to 2.5 mg once daily Maximum: 2.5 mg per day	\$30-45	Limited Coverage	fatigue, blood dyscrasias, azotemia	products.
spironolactone Aldactone, G Tabs: 25, 100 mg spironolactone/ hydrochlorothiazide Aldactazide, G Tabs: 25/25, 50/50 mg	Initial: 12.5 mg once daily Usual: 25-50 mg once daily Maximum: 200 mg per day	\$50-115	Regular Benefit	Common Gynecomastia, breast tenderness, headache, erectile dysfunction Hyperkalemia, hyponatremia, hypochloremia Less Common	Monitor SCr and potassium. May change glycemic control in patient with diabetes or prediabetes. Particularly effective in ISH, the elderly and black patients. Use cautiously in patients with history of or predisposition to gout (may precipitate gout)
				Allergic reactions, irregular menses	Combination: Lower incidence of hypokalemia than with hydrochlorothiazide alone
	Angi	otensin-Co	nverting Enzy	me Inhibitor (ACE-I)	
ramipril Altace, G Caps: 1.25, 2.5, 5, 10, 15 mg ramipril/ hydrochlorothiazide Altace-HCT, G Tabs: 2.5/12.5, 5/12.5, 5/25, 10/12.5, 10/25 mg	Initial: 2.5 mg once daily Usual: 2.5 to 10 mg once daily Maximum: 20 mg per day	\$30-80	Regular Benefit, RDP Reference Drug	Common	Nonitor SCr and potassium at initiation of therapy and periodically. Reduce initial dose by 50% if on concomitant diuretics (risk of hypotension with hypovolemia). Cough associated with ACE-I is dry, hacking and non-productive and typically occurs within months of initiation of therapy.
benazepril Lotensin, G Tabs: 5, 10, 20 mg	Initial: 10 mg once daily Usual: 20 mg once daily Maximum: 40 mg per day	\$365- 742	Partial Benefit, RDP	concomitant NSAID use	dysfunction, diabetes and concomitant use of potassium supplements, potassium-sparing diuretics or potassium-containing salts.
captopril <i>Capoten, G</i> Tabs: 6.25, 12.5, 25, 50, 100 mg	Initial: 12.5 - 25 mg BID to TID Usual: 50 mg BID to TID Maximum: 450 mg per day Administer one hour prior to meals	\$230- 1570	Partial Benefit, RDP	For combination products , see other entity for additional adverse effects	Consider a thiazide diuretic or CCB instead of an ACE-I or ARB as initial antihypertensive therapy in black patients. For patients who experience reduced antihypertensive effect near the end of the
cilazapril Inhibace, G Tabs: 1, 2.5, 5 mg cilazapril/ hydrochlorothiazide	Initial: 2.5 mg once daily Usual: 2.5 to 5 mg once daily Maximum: 10 mg per day	\$70-160	Partial Benefit, RDP		24-hour dosing interval, divide total daily dose into two equal doses given every 12 hours or increase once daily dose. For combination products , see other entity for
Inhibace Plus, G Tabs: 5/12.5 mg					additional therapeutic considerations

(strengths and dosage form) enalapril Vasotec, G Tabs: 2.5, 5, 10, 20 mg enalapril/ hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg Hyper Hyper Hyper Hyper Hyper Hyper Hottla Hyper Hottla Hyper Hype	al Adult Dosages for ertension ^b al: 5 mg once daily al: 10 mg to 40 mg daily as a e dose or two divided doses	Annual Cost ^c \$85-240	PharmaCare Coverage	Common Adverse Effects	Therapeutic Considerations
enalapril Usual Single Parameter (Strengths and dosage form) enalapril Usual Usual Single enalapril/hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg	al: 5 mg once daily al: 10 mg to 40 mg daily as a		Coverage		
Vasotec, G Tabs: 2.5, 5, 10, 20 mg enalapril/ hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg	al: 10 mg to 40 mg daily as a	\$85-240			
Tabs: 2.5, 5, 10, 20 mg single enalapril/ hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg		703 2 10	Partial		
enalapril/ hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg	a daca ar two dividad dacac		Benefit, RDP		
hydrochlorothiazide Vaseretic, G Tabs: 5/12.5, 10/25 mg	imum: 40 mg per day				
<i>Vaseretic, G</i> Tabs: 5/12.5, 10/25 mg	imum: 40 mg per day	\$290-			
Tabs: 5/12.5, 10/25 mg		400			
fosinopril Initial	al: 10 mg once daily	\$85-200	Partial		
	al: 20 mg once daily		Benefit, RDP		
Tabs: 10, 20 mg Maxir	imum: 40 mg per day				
	al : 10 mg once daily	\$65-150	Partial		
	al: 10 to 40 mg once daily		Benefit, RDP		
	imum: 80 mg per day	+00.100			
lisinopril/ hydrochlorothiazide		\$80-100			
Zestoretic, G					
Tabs: 10/12.5, 20/12.5,					
20/25 mg					
perindopril erbumine Initial	al: 4 mg once daily	\$75-100	Partial		
	al: 4 to 8 mg once daily		Benefit, RDP		
	imum : 8 mg per day				
perindopril erbumine/		\$280-	Non-benefit		
indapamide Coversyl Plus, G		370			
Tabs: 2/0.625, 4/1.25, 8/2.5					
mg					
	al: 3.5/2.5 mg once daily		Non-benefit		
	al: 3.5/2.5 to 7/5mg once daily				
	imum : 14/10 mg per day				
Tabs: 3.5/2.5, 7/5, 14/10 mg					
	al: 10 mg once daily	\$90	Partial		
	al: 10 to 20 mg once daily imum: 40 mg per day		Benefit, RDP		
	illium. 40 mg per day	¢270			
quinapril/ hydrochlorothiazide		\$270			
Accuretic, G					
Tabs: 10/12.5, 20/12.5,					
20/25 mg					
	al: 1 mg once daily	\$65-95	Partial		
	al: 1 to 2 mg once daily		Benefit, RDP		
Caps: 0.5, 1, 2, 4 mg Maxir	imum : 4 mg per day	6670			
		\$670- 750			
			in II Passata	Plackors (APP)	
				Blockers (ARB)	
	al: 8 mg once daily	\$90	Limited Coverage,	Common	Monitor SCr and potassium at initiation of therapy and regularly.
	al: 8 to 32 mg once daily imum: 32 mg per day		RDP	Hyperkalemia	and regularly. Reduce initial dose if using concomitant diuretics
candesartan/	gpci day	\$85	Reference	Less Common	(risk of hypotension with hypovolemia).
hydrochlorothiazide		303	Drug	Angioedema	Risk factors for hyperkalemia include renal
Atacand Plus, G				Precipitation of renal failure	dysfunction, diabetes and concomitant use of
Tabs: 16/12.5, 32/12.5,				in patients with renovascular	potassium supplements, potassium-sparing.
32/25 mg				disease, volume depletion or concomitant NSAID use	diuretics or potassium-containing salts
	al: 25-50 mg once daily	\$95	Limited Coverage, RDP	Consider a thiazide diuretic or CCB inste ACE-I or ARB as initial antihypertensive to black patients.	Consider a thiazide diuretic or CCB instead of an ACE-Lor ARB as initial antihypertensive therapy in
	Usual: 50 to 100 mg once daily				7.
	Maximum: 100 mg per day		Reference	see other entity for additional	
losartan/ hydrochlorothiazide		\$100- 120	Drug	adverse effects	For combination products , see other entity for
Hyzaar, G		120			additional therapeutic considerations
Tabs: 50/12.5, 100/12.5,					
100/25 mg					

Generic Name (trade name) (strengths and dosage form)	Usual Adult Dosages for Hypertension ^b	Annual Cost ^c	PharmaCare Coverage	Com
telmisartan <i>Micardis, G</i> Tabs: 40, 80 mg	Initial: 40 mg once daily Usual: 40 to 80 mg once daily Maximum: 80 mg per day	\$85	Limited Coverage, RDP Reference Drug	
telmisartan/ amlodipine Twynsta Tabs: 40/5, 40/10, 80/5, 80/10 mg		\$270		
telmisartan/ hydrochlorothiazide Micardis Plus, G		\$80		
Tabs: 80/12.5, 80/25 mg valsartan <i>Diovan, G</i> Tabs: 40, 80, 160, 320 mg	Initial: 80 mg once daily Usual: 80 to 320 mg once daily Maximum: 320 mg per day	\$85	Limited Coverage, RDP	
valsartan/ hydrochlorothiazide Diovan HCT, G Tabs: 80/12.5, 160/12.5, 160/25, 320/12.5, 320/25 mg		\$90	Reference Drug	
azilsartan <i>Edarbi</i> Tabs: 40, 80 mg	Initial: 20 mg once daily Usual: 40 to 80 mg once daily Maximum: 80 mg per day	\$450	Non-benefit	
azilsartan/ chlorthalidone Edarbyclor Tabs: 40/12.5, 40/25 mg		\$450		
eprosartan Teveten Tabs: 400, 600 mg	Initial: 600 mg once daily Maximum: 800 mg per day	\$420	Limited Coverage, Partial benefit	
eprosartan/ hydrochlorothiazide Teveten Plus Tabs: 600/12.5 mg		\$420	RDP	
irbesartan Avapro, G Tabs: 75, 150, 300 mg	Initial: 75-150 mg once daily Usual: 150 to 300 mg once daily Maximum: 300 mg per day	\$90	Limited Coverage, Partial benefit	
irbesartan/ hydrochlorothiazide Avalide, G Tabs: 150/12.5, 300/12.5, 300/25 mg	j., ,	\$90	RDP	
olmesartan Olmetec, G Tabs: 20, 40 mg	Initial: 20 mg once daily Usual: 20 to 40 mg once daily Maximum: 40 mg per day	\$100	Limited Coverage, Partial benefit	
olmesartan/ hydrochlorothiazide Olmetec plus Tabs: 20/12.5, 40/12.5, 40/25 mg		\$210	RDP	

Generic Name (trade name) (strengths and dosage form)	Usual Adult Dosages for Hypertension ^b	Annual Cost ^c	PharmaCare Coverage	Common Adverse Effects	Therapeutic Considerations			
Beta ₁ -Adrenergic Antagonists (Beta-Blockers)								
Beta ₁ -selective								
atenolol Tenormin, G Tabs: 25, 50, 100 mg bisoprolol Monocor, G Tabs: 5, 10 mg	Initial: 50 mg once daily Usual: 50 to 100 mg once daily Maximum: 100 mg per day Initial: 5 mg once daily Usual: 10 mg once daily Maximum: 20 mg per day	\$45-70 \$30-80	Regular Benefit Regular Benefit	Common Bradycardia, fatigue, decreased exercise tolerance, headache, erectile dysfunction, vivid dreams Less Common	Low doses of beta1-selective beta-blockers may be used in patients with mild to moderate reversible airway disease (ensure access to a bronchodilating beta2-agonist is readily available). Initiate cautiously and titrate slowly in patients with heart failure.			
metoprolol Lopressor, Betaloc, G Tabs: 50, 100 mg SR tabs: 100, 200 mg	Initial: 50 mg BID Usual: IR: 50 to 100 mg BID SR: 100 to 200 mg once daily Maximum: 400 mg per day Regular release: dose BID; Sustained release: dose once daily.	\$50-245	Regular Benefit	Less Common • Hyperglycemia, heart failure, heart block, depression Cardiac selectivity of beta1-selective beta-blockers may result in fewer non-cardiac adverse effects.	 When discontinuing in chronic users, gradually taper doses over 1 to 2 weeks (abrupt discontinuation may precipitate cardiac events, sinus tachycardia and rebound hypertension). Consider alternatives in patients at high risk of heart block (contraindicated in 2nd or 3rd degree heart block without pacemaker). Avoid in severe PAD. Avoid beta-blockers as initial therapy in patients > 60 years without other compelling indications. 			
	Non-selective with intrinsic sympathomimetic activity (ISA)							
labetalol Trandate, Tabs: 100, 200 mg Duration of action: 8-12 h	Initial: 100 mg BID Usual: 200 to 400 mg BID Maximum: 1200 mg per day	\$285- 1500	Regular Benefit	Common Bradycardia, fatigue, decreased exercise tolerance, headache, erectile dysfunction, vivid dreams Less Common Hyperglycemia, heart failure, heart block, depression Adverse effects specific to labetalol Edema, postural hypotension, dizziness, nasal congestion	Beta-blockers with ISA have a lesser effect on resting heart rate compared to agents without ISA. Avoid non-selective beta-blockers in reactive airways disease. Initiate cautiously and titrate slowly in patients with heart failure. When discontinuing in chronic users, gradually taper doses over 1 to 2 weeks (abrupt discontinuation may precipitate cardiac events, sinus tachycardia and rebound hypertension). Consider alternatives in patients at high risk of heart block (contraindicated in 2nd or 3rd degree heart block without pacemaker). Avoid in severe PAD. Avoid beta-blockers as initial therapy in patients > 60 years without other compelling indications.			
	Non-selective							
propranolol Inderal, G [regular release], Inderal-LA (24h) Tabs: 10, 20, 40, 80, 120 mg LA tabs: 60, 80, 120, 160 mg	Initial: 40 mg BID using regular release tablets Usual: 60 to 320 mg once daily (LA tabs) for patients stabilized on maintenance dosage of regular release formulation Maximum: 320 mg per day Some patients may require upward titration of the total daily dose of extended release propranolol when switching from regular release tablets.	\$100-	Regular Benefit	Common Bradycardia, fatigue, decreased exercise tolerance, headache, erectile dysfunction, vivid dreams Less Common Hyperglycemia, heart failure, heart block, depression Propranolol has higher lipophilicity than other beta- blockers and is more likely to cause CNS adverse effects (e.g., insomnia, depression, vivid dreams).	Avoid non-selective beta-blockers in reactive airways disease (risk of bronchospasm or bronchoconstriction). Initiate cautiously and titrate slowly in patients with heart failure. When discontinuing in chronic users, gradually taper doses over 1 to 2 weeks (abrupt discontinuation may precipitate cardiac events, sinus tachycardia and rebound HTN). Consider alternatives in patients at high risk of heart block (contraindicated in 2nd or 3rd degree heart block without pacemaker). Avoid in severe PAD. Avoid beta-blockers as initial therapy in patients > 60 years without other compelling indications.			

Generic Name (trade name) (strengths and dosage form)	Usual Adult Dosages for Hypertension ^b	Annual Cost ^c	PharmaCare Coverage	Common Adverse Effects	Therapeutic Considerations	
Calcium Channel Blockers (CCB)						
Dihydropyridine (DHP)						
amlodipine Norvasc, G Tabs: 2.5, 5, 10 mg	Initial: 5 mg once daily Usual: 5 to 10 mg once daily Maximum: 10 mg per day	\$50-75	Regular Benefit, RDP Reference Drug	 Adverse effects related to vasodilation (e.g., pedal edema, flushing, headache, palpitations) Do not use immed essential HTN. DHP-CCBs may wo Grapefruit juice ma potentiate adverse felodipine). When discontinuin (ahrunt withdrawa) 	Do not use immediate release DHP-CCBs for acute reduction of BP (strokes have been reported). Do not use immediate release nifedipine to treat essential HTN. DHP-CCBs may worsen heart failure symptoms.	
telmisartan/amlodipine <i>Twynsta</i> Tabs: 40/5, 40/10, 80/5, 80/10 mg		\$270	Limited Coverage, RDP Reference Drug		Grapefruit juice may increase drug levels and potentiate adverse effects (particularly with	
felodipine Plendil, G XR tabs: 2.5, 5, 10 mg	Initial: 2.5 to 5 mg once daily Usual: 2.5 to 10 mg once daily Maximum: 20 mg per day	\$145- 385	Partial Benefit RDP			
nifedipine Adalat XL, G XL tabs: 20 (brand only), 30, 60 mg	Initial: 20 to 30 mg once daily Usual: 30 to 60 mg once daily Maximum: 90 mg per day	\$235- 590	Partial Benefit RDP			
		Non-di	hydropyridine	(non-DHP)		
diltiazem Cardizem CD, Tiazac XC, Tiazac (ER), G CD, ER, T, TZ, or XR capsule or tablet: 120, 180, 240, 300, 360 mg	Initial: 120 to 240 mg once daily Usual: 240 to 360 mg once daily Maximum: 360 mg per day Note: a SR formulation is available for BID dosing	\$85-300	Regular Benefit	Common • Headache, peripheral edema, dizziness, bradycardia, flushing, nausea, constipation	Contraindicated post-MI in patients with moderate or severe left ventricular dysfunction. Use cautiously in patients with heart failure, or 2nd or 3rd degree heart block without pacemaker. Grapefruit juice may increase drug levels and	
verapamil Isoptin, Isoptin SR, G Tabs: 80, 120 mg SR tabs: 120, 180, 240 mg	Immediate-release (IR): Initial: 80 mg TID Usual: 160 mg TID Maximum: 480 mg per day Sustained-release (SR): Initial: 180 to 240 mg once daily Usual: 180-240 mg BID Maximum: 480 mg per day	\$200- 640	Regular Benefit	Serious • Heart block, worsening of heart failure, hypotension, ECG abnormality, asthenia, arrhythmia	potentiate adverse effects. • When discontinuing, taper doses gradually (abrupt withdrawal may provoke chest pain).	

Abbreviations: ACE-I = angiotensin-converting enzyme inhibitor; ARB = angiotensin II receptor blockers; BID = twice daily; BP = blood pressure; Caps = capsules; CCB = calcium channel blocker; CD = controlled delivery; CR = controlled release; CNS = central nervous system, CrCI = creatinine clearance in millimeters per minute, CV = cardiovascular, DHP = dihydropyridine; ECG = electrocardiogram; ER = extended release; G = generics available; HCTZ = hydrochlorothiazide; HTN = hypertension; IR = immediate release; ISA = intrinsic sympathomimetic activity; MI = myocardial infarction, mg = milligram; NSAID = nonsteroidal anti-inflammatory drugs; PAD = peripheral arterial disease; RDP = reference drug program; SCr = Serum creatinine; SR = sustained release; Tabs = tablets; TID = three times daily; XL = extended release.

Footnotes: ^a Not an exhaustive list; ^b For normal renal and hepatic function. Consult product monograph for detailed dosing instructions and dose adjustments for unique patient populations; ^c Pricing is approximate of usual dose as per October 2019 and does not include dispensing fees or additional markups.

Note: Please review product monographs at www.canada.ca/en/health-canada/drug-product-database and regularly review current Health Canada advisories, warnings and recalls at https://healthycanadians.gc.ca/recall-alert.

PharmaCare Coverage Definitions: Regular Benefit: Eligible for full reimbursement*; does not require Special Authority. Limited Coverage: Requires Special Authority to be eligible for reimbursement*. RDP: Reference Drug Program. Drugs included in the RDP are comparable agents of the same therapeutic class. RDP Reference Drug: Eligible for full reimbursement* within the therapeutic class, subject to Benefit status of the therapeutic class. Partial Benefit RDP: Eligible for limited reimbursement* under the RDP program up to the price of the Reference Drug. Non-benefit: Not eligible for coverage under any circumstances.

Note: Information on which products PharmaCare covers can be obtained using the B.C. PharmaCare Formulary Search (www2.gov.bc.ca/gov/pharmacare-for-bc-residents).
*Reimbursement is subject to the rules of a patient's PharmaCare plan, including any deductibles. In all cases, coverage is subject to drug price limits set by PharmaCare. See: www2.gov.bc.ca/drug coverage for further information.

References:

- 1. Gray Jean, editor. e-Therapeutics+ [Internet]. Ottawa (ON): Canadian Pharmacists Association; c2019 [Accessed Oct 3, 2019].
- 2. e-CPS [Internet]. Ottawa, ON: Canadian Pharmacists Association; c2019 [Accessed Oct 3, 2019].
- 3. Jobson MD. UpToDate [Internet]. Waltham, MA: UpToDate Inc.; c2019 [Accessed Oct 3, 2019]
- 4. Health Canada Drug Product Database Product Monographs. Ottawa, ON: Health Canada; 2019 [Accessed Oct 3, 2019].



Appendix E: Hypertension Quality Indicators

Hypertension is a public health issue and an important CVD risk factor requiring continuous evaluation and quality improvement. Included here are quality indicators for key recommendations that can facilitate optimal team-based intervention for hypertension.

Quality indicators are evidence based and can provide comparable and actionable information across different geographic or organizational boundaries and/or can track progress over time. This list of quality indicators can be an initial discussion document for primary care teams, patient medical homes and/or patient medical networks to engage EMR vendors and stakeholders to initiate quality improvement initiatives.

No	Key Recommendation	Quality Indicator 🎯
1.	Blood pressure should be measured accurately in adults, at all appropriate visits, by trained healthcare practitioners.	Percentage and/or number of people who had their BP recorded during their office visit
2.	When measuring blood pressure in the office, the use of an automated office blood pressure (AOBP) electronic device is recommended in patients with regular heart rate.	Physician office has access to automated office BP devices for BP measurements
3.	Hypertension is diagnosed in adults when automated office blood pressure reading is \geq 135/85 in the higher BP arm.	Percentage and/or number of patients with hypertension
4.	Consider 24-hour ambulatory blood pressure monitoring, or standardized home blood pressure monitoring, to confirm a hypertension diagnosis in all patients.	People with suspected hypertension are offered ambulatory blood pressure monitoring (ABPM) to confirm a diagnosis of hypertension
5.	Achieving an automated blood pressure reading of ≤ 135/85 is associated with the greatest reduction of risk for adults, with no co-morbid conditions.	Proportion of patients with hypertension who have met their desired BP level
6.	Health behaviour change is recommended as a first step for those with average blood pressure 135-154/85-94 (AOBP), low-risk for cardiovascular disease and no co-morbidities.	Patients engaged in a discussion about the role of health behaviour change as a first step towards their desired BP level
7.	Initiate pharmaceutical management in context of the patient's overall cardiovascular risk and not solely on their blood pressure.	Patients with hypertension have CVD risk assessment performed and engaged in a discussion about risk scores