



# HYPERTENSION GUIDELINES FOR BERMUDA

# 2011



GOVERNMENT OF BERMUDA

Ministry of Health

**Department of Health**

# **HYPERTENSION GUIDELINES FOR BERMUDA 2011**

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P.O. Box HM 1195, Hamilton HM EX Bermuda

Tel: 278-6500

E-mail: [healthpromotion@gov.bm](mailto:healthpromotion@gov.bm)

**Author:**

Hypertension Task Group

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## **ABBREVIATIONS**

ACEI – angiotensin converting enzyme inhibitors (the ‘ACE inhibitors’)

AKI – Acute kidney injury

ARBs – angiotensin II receptor blockers

BB – Beta-blocker

BP – Blood pressure

CCB – Calcium channel blocker

CHF – Congestive heart failure

CKD – Chronic kidney disease

Cr – Creatinine

DBP – Diastolic blood pressure

DM – Diabetes mellitus

DM CKD – Diabetes mellitus chronic kidney disease

ED – Erectile dysfunction

ESRD – End-stage renal disease

eGFR/GFR – Glomerular filtration rate

HTN – Hypertension

K – Potassium

LVH – Left ventricular hypertrophy

NDM CKD – Non diabetes mellitus chronic kidney disease

RAS – Renin-angiotensin system

SBP – Systolic blood pressure

SR – Slow-release

TIA – Transient ischemic attack

T1DM – Type 1 Diabetes mellitus

T2DM – Type 2 Diabetes mellitus

tPA – Tissue plasminogen activator

## **INTRODUCTION**

The Government of Bermuda is committed to standardize and improve health care for all people in Bermuda.

In 2004, a Department of Health Study determined Bermuda's health priorities<sup>1</sup> and identified heart disease and stroke as the number two health problem for the country.

The 2006 Health Survey of Adults and Children in Bermuda revealed that 25% of adults reported they had high blood pressure<sup>2</sup>. Diseases of the circulatory system, of which high blood pressure is a major contributing factor, are the leading cause of death in Bermuda (43.4% of all deaths in 2007<sup>3</sup>).

The 2008 National Health Promotion Strategy, Well Bermuda<sup>4</sup>, listed *Improve Heart Health* among the primary health promotion goals for the country. The *Improve Heart Health* objectives are to:

1. Reduce the proportion of adults with high blood pressure.
2. Reduce the proportion of adults with high total blood cholesterol levels.
3. Increase the proportion of adults with high blood pressure whose blood pressure is under control.
4. Increase the proportion of adults who have had their blood pressure measured within the preceding year.
5. Increase the proportion of adults who are aware of the early warning symptoms and signs of a stroke.

To facilitate Government's goal for hypertension (high blood pressure), the then Minister of Health appointed a Task Group of representative stakeholders from Bermuda's health professionals in October 2010. The purpose of the Task Group was to provide a consultative forum to review clinical guidelines from recognized hypertension organizations overseas and to develop guidelines best suited to Bermuda's needs.

The following five guidelines were reviewed:

1. Caribbean Health Research Council: Managing Hypertension in primary care in the Caribbean. St. Augustine, Trinidad and Tobago: Caribbean Health Research Council 2007.<sup>5</sup>
2. Royal College of Physicians (NICE): NICE clinical guidelines 18 (and 34): Hypertension: *The management of hypertension in adults in primary care (Quick Reference)*. London: Royal College of Physicians, 2008.<sup>6</sup>

3. U.S. Department of Health and Human Services (NIH, NHLBI, NH-BPEP). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, 2004.<sup>7</sup>
4. Central Review Committee of the Evidence-Based Recommendations Task Force of the Canadian Hypertension Education Programme: Canadian Hypertension Education Programme Recommendations for Management of Hypertension (CHEP). Hypertension Canada. 2010.<sup>8</sup>
5. National Heart Foundation of Australia (National Blood Pressure and Vascular Disease Advisory Committee). Guide to management of hypertension 2008. Updated August 2009. Web version. 2009.<sup>9</sup>

*The Hypertension Guidelines for Bermuda* represent the consensus of the Hypertension Task Group based on collective analysis, evaluation and opinion on the current information available to them. The information included throughout the guidelines is taken largely from the above five guidelines and additional referenced documents. These guidelines are designed to be easy to follow and serve as key tools in improving patient care.

## **TASK GROUP MEMBERS**

1. Dr. Femi Bada – Chairman Bermuda Diabetes Association
2. Myrian Balitian-Dill, RN – Nurse Specialist, Cardiac Care Programme – KEMH
3. Simone Barton – Executive Director, Bermuda Heart Foundation
4. Dr. Arlene Basden – Director of the Hospitalist Service – KEMH
5. Gloria Burgess, RN – Public Health Nurse, Maternal Health – Department of Health
6. Dr. Annabel Fountain – Director of Endocrinology – KEMH
7. Mellonie Furbert, RD – Public Health Nutritionist, Department of Health
8. Dr. Carl Levick – Director of Cardiology – KEMH
9. Tracy Marra, Pharm D – Pharmacist
10. Sara McKittrick, RD – Dietitian and Diabetes Educator, Bermuda Diabetes Association
11. Dr. Katherine Michelmore – BHB Employee Health Physician – KEMH
12. Dr. Fiona Ross – Family Physician representative
13. Dr. Cathy Siddle – Internal Medicine
14. Norma Smith, RN – Vice President – Nursing (Acting), KEMH
15. Dr. Jayalakshmi Thamidela – Medical Officer – Department of Health
16. Dr. Lynette Thomas – Director of Nephrology – KEMH
17. Denise Walls, RN – Clinical Manager Nursing, KEMH
18. Dr. Louise White – Family Physician representative Task Group Coordinator
19. Betsy Baillie, MPH, RD – Public Health Consultant, Department of Health

## **DIAGNOSIS AND CLASSIFICATION**

### **MEASUREMENT OF BLOOD PRESSURE (BP)**

#### **Setting and Circumstance**

- BP can be measured in the office, clinic, hospital, at home or with an ambulatory BP machine.
- No caffeine/tobacco or exercise 30 minutes prior to measurement.
- Rested for five minutes, seated in comfortable chair.
- Arm at heart level; back supported and feet on ground.
- Arm is bare.
- Room is warm and quiet.

#### **Equipment**

- Recommend auscultatory method of BP measurement.
- Use mercury sphygmomanometer, or calibrated aneroid, or validated electronic device.
- Ensure appropriate cuff size – with the bladder encircling at least 80% of the circumference and covering 2/3 length of the arm.
- Note, a bladder that is too small may cause falsely high readings.
- Use bell of the stethoscope.

#### **Recommended Dimensions for BP Cuff Bladders**

Age Range	Width, cm	Length, cm	Maximum Arm Circumference, cm*
Newborn	4	8	10
Infant	6	12	15
Child	9	18	22
Small adult	10	24	26
Adult	13	30	34
Large adult	16	38	44
Thigh	20	42	52

\*Calculated so that the largest arm would still allow the bladder to encircle arm by at least 80%. Source: The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005. The National Heart, Lung and Blood Institute Information Center<sup>10</sup>.

## **Technique**

- Wrap cuff smoothly, snugly and evenly around the arm with the middle of the balloon over the brachial artery.
- Palpate radial artery and inflate cuff to 20 mmHg systolic pressure above the point when radial pulse is obliterated.
- Deflate bladder 3 mmHg per second, listening with the bell of the stethoscope over the brachial artery for Korotkoff phase I (appearance) and phase V (disappearance)—corresponding to systolic and diastolic values respectively.
- In children, Korotkoff phase IV (distinct, abrupt muffling of sounds, becoming soft and blowing in quality) is preferred.

## **Quality Control**

- The nurses and office assistants measuring blood pressure must be trained and regularly re-trained in auscultatory method of BP measurement.
- Non-mercury BP equipment should be validated every six months.

## **Readings**

- Initial readings are taken from both arms, with the higher values used for subsequent measurements.
- Because blood pressure normally varies up to 10 mmHg, it is necessary to take three readings to obtain the most accurate present blood pressure.
- If the first measurement exceeds 140/90 mmHg\*, if practical, take a second confirmatory reading at the end of the consultation.
- Standing BP should be recorded at the initial estimation in the elderly and diabetic patients.
- A decrease in standing SBP >10 mmHg with associated dizziness and/or fainting is considered positive for postural hypotension and should be monitored in subsequent visits using upright position.
- In patients with symptoms or documented postural hypotension (fall in systolic BP when standing of 20 mmHg or more) consider referral to a specialist.
- Record the BP reading, patient position, and arm and cuff size in notes.
- All readings are recorded to the nearest 2 mmHg, not rounded to the nearest 0 or 5.

## CLASSIFICATION AND DIAGNOSIS OF HYPERTENSION

### Classification of Hypertension

Category	Systolic	Diastolic
Optimal BP	<120	<80
Normal BP	120 – 129	80 – 84
Pre-Hypertensive*	130 – 139	85 – 89
Stage 1 hypertension (mild)	140 – 159	90 – 99
Stage 2 hypertension (moderate)	160 – 179	100 – 109
Stage 3 hypertension (severe)	≥180	≥110
**Isolated systolic hypertension 1	≥140	<90
**Isolated systolic hypertension 2	≥160	<90

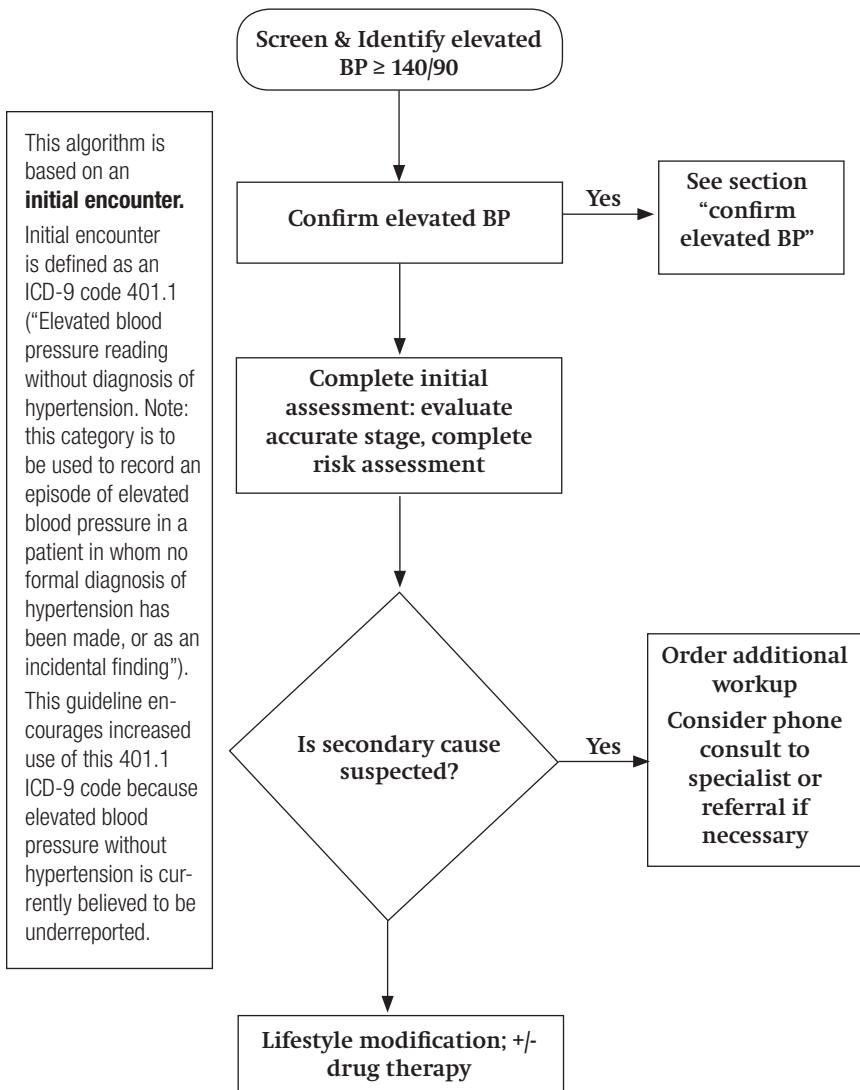
#### \*Pre-hypertension

- Pre-hypertension is not a disease category. It is a designation chosen to identify individuals at **high risk** of developing hypertension, so that both patients and physicians are alerted to this risk, and are encouraged to intervene and prevent or delay the disease from developing.

#### \*\* Isolated systolic hypertension

- There is impressive evidence which has accumulated to warrant greater attention to the importance of **isolated systolic hypertension** as a major risk for cardiovascular diseases.
- BP changes occur with increasing age; the rise in systolic BP continues throughout life in contrast to diastolic BP, which rises until approximately the age of 50, and then tends to level off over the next decade, and may remain the same or even fall thereafter.
- Diastolic hypertension predominates before age 50 either alone or in combination with systolic hypertension. The prevalence of systolic hypertension increases with age, and above age 50, it represents the most common form of hypertension.
- Before the age of 50, DBP is a more potent cardiovascular system (CVS) risk factor than SBP; thereafter, SBP is more important. Clinical trials have shown that control of **isolated systolic hypertension** reduces total mortality, CVS mortality, stroke, and HF events.
- Poor SBP control is largely responsible for the unacceptable low rates of overall BP control.

**ALGORITHM 1:**  
**FOR SCREENING AND IDENTIFYING HYPERTENSION**



Adapted from: Health Care Guidelines: Hypertension Diagnosis and Treatment, Institute for Clinical Systems Improvement, 13th edition, November 2010<sup>11</sup>

## **Confirm High Blood Pressure**

- Confirmation is based on the initial visit, plus one or more follow-up visits with at least three blood pressure readings at each visit.
- Follow up recommendations based on JNC VII schedule (see next table).
- Use ambulatory BP monitoring to assist with equivocal findings.
- Document stage of hypertension based on classification: Normal, Pre-hypertensive, Stage 1, Stage 2 or Stage 3.

## **Recommendations for Follow-up Based on Initial Blood Pressure Measurements for Adults without Acute End Organ Damage**

Initial Blood Pressure, mmHg	Follow-up recommended
Normal BP	Re-check in 2 years
Pre-Hypertensive	Re-check in 1 year*
Stage 1 hypertension (mild)	Confirm within 2 months.** If still stage 1 and no other risk factors prescribe lifestyle modification and sodium restriction for 6 months. If other risk factors present, treat.
Stage 2 hypertension (moderate)	Evaluate, treat, or refer to source of care within 1 month.
Stage 3 hypertension (severe)	For those with high pressures greater than 180/110 mmHg, evaluate and treat immediately or within one week depending on clinical situation and complications.

\* Provide lifestyle modification. If systolic and diastolic categories are different, follow recommendations for the shorter time follow-up (e.g., 160/86 mmHg should be evaluated or referred to source of care within one month).

\*\* Modify the scheduling or follow-up according to reliable information about past BP measurements, other cardiovascular risk factors, or target organ disease.

*Source:* Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. 2004.

## **White-Coat Hypertension**

- Is defined as consistently high BP in a medical setting ( $>140/90$ ) and normal BP at home ( $<129/84$  mmHg).
- It is more common in the elderly, accounting for more than 20% of all patients diagnosed with high blood pressure and is normally benign.

- It requires continued monitoring at home and if measurements are elevated, ambulatory blood pressure monitoring can assist with diagnosis.

#### **Ambulatory BP Monitoring (ABPM)**

- This provides detailed BP information over a 24-hour period.
- It is useful if the diagnosis of hypertension is in doubt.
- It provides more information than the office or home measurement especially showing mean daytime and night time values.
- There is an increasing body of evidence suggesting that ABPM values are better predictors of cardiovascular disease (CVD) risk, target organ damage, and a better method of assessing treatment effects on blood pressure.

## **EVALUATION AND ASSESSMENT**

### **Risk Assessment**

The risk for cardiovascular disease in patients with hypertension is determined not only by the level of blood pressure, but also by the presence or absence of target organ damage and other risk factors such as smoking, dyslipidemia and diabetes, as shown in the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. These factors independently modify the risk for subsequent cardiovascular disease, and their presence or absence is determined during the routine evaluation of patients with hypertension (i.e., history, physical examination, laboratory tests).

### **Evaluation**

- Determine stage of hypertension, specifically looking for secondary causes.
- Assess impact of hypertension (end organ damage).
- Estimate overall risk of developing premature cardiovascular disease.

### **History should document:**

- A family history of hypertension, cardiovascular disease, cerebrovascular disease, diabetes mellitus and dyslipidemia.
- All medications being used including herbal supplements, over-the-counter, prescription and illicit drugs – as many agents may temporarily elevate blood pressure and/or adversely affect antihypertensive medications.
- Symptoms and signs of target organ disease and secondary hypertension.

### **Physical Exam**

- General appearance: distribution of body fat, skin lesions, muscle strength, alertness
- Fundoscopy
- Neck: palpation and auscultation of carotids, thyroid
- Heart: size, rhythm, sounds
- Lungs: rhonchi, rales
- Abdomen: renal masses, bruits over aorta or renal arteries, femoral pulses
- Extremities: peripheral pulses, edema
- Neurologic assessment

## Routine Investigations

Initial Pertinent Labs:	Routine Labs:
Order tests as necessary, especially if not done within past year.	<ul style="list-style-type: none"><li>• 12-lead ECG</li><li>• Microalbuminuria</li><li>• Urinalysis</li><li>• Fasting blood glucose or HbA1c</li><li>• Hematocrit</li><li>• Serum sodium</li><li>• Potassium</li><li>• Creatinine</li><li>• Estimated glomerular filtration rate eGFR</li><li>• Calcium</li><li>• Lipid profile (total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglycerides)</li></ul>

Source: Hypertension Diagnosis and Treatment Clinical Evaluation of Confirmed Hypertension Thirteenth Edition / November 2010<sup>10</sup>

## Secondary Causes of Hypertension

- Chronic kidney disease
- Obstructive uropathy
- Thyroid and parathyroid disease
- Drug induced or related causes (prescription, over-the-counter, herbal supplements, illicit drugs)
- Excessive alcohol use
- Obstructive sleep apnoea
- Primary aldosteronism and other mineralocorticoid excess states
- Other glucocorticoid excess states including chronic steroid therapy
- Renal artery stenosis
- Pheochromocytoma
- Cushing's syndrome
- Aortic coarctation
- Obesity

# CARDIOVASCULAR RISK ASSESSMENT

## Cardiovascular Risk Factors<sup>7</sup>

- Gender
- Age (older than 55 years for men, 65 years for women)
- Hypertension
- Diabetes
- Elevated cholesterol (total or LDL) or low HDL cholesterol
- Estimated glomerular filtration rate <60 mL/min.
- Family history of premature cardiovascular disease
- Microalbuminuria
- Obesity (BMI ≥30 and waist circumference <40" men and <35" women (see appendix IV))
- Physical inactivity
- Cigarette and tobacco use
- Evidence of atrial fibrillation (history, examination, electrocardiogram)

## Stratification of Risk and Prognosis

Risk Factors (RF) and disease history	Stage 1 140 – 159/90 – 99	Stage 2 160 – 179/100 – 109	Stage 3 ≥ 180/110
None	Low Risk	Medium risk	High risk
1 or 2 risk factors	Medium risk	Medium risk	Very high risk
3 or more risk factors OR target organ damage	High risk	High risk	Very high risk
Associated clinical conditions	Very high risk	Very high risk	Very high risk

Source: WHO, ISH Writing Group. 2003 World Health Organization/International Society of Hypertension Statement on Management of Hypertension. Journal of Hypertension 2003. Vol. 21:11 1983 – 1992<sup>12</sup>

## Cardiovascular Risk Charts and Calculators

Various cardiovascular risk charts and web-based decision support programmes are available for assessing cardiovascular risk. CVD risk is estimated using epidemiological data such as those generated from the Framingham Study. Any of the following websites can be used to assess cardiovascular risk in patients.

## **U.S.A.**

1. Interactive Risk Assessment Tool for Estimating 10-year Risk of Developing Hard CHD (Myocardial Infarction and Coronary Death).  
<http://hp2010.nhlbihin.net/atpiii/calculatorasp?usertype=prof#moreinfo>
2. American Heart Association has an interactive “Heart Attack Risk Calculator” for patients to use. At the following website click on “Learn Your Risk”. After patients enter their health information they can get a Risk Report and Action Plan to assist them in achieving health goals.  
[http://www.heart.org/HEARTORG/Conditions/HeartAttack/HeartAttackToolsResources/Heart-Attack-Risk-Assessment\\_UCM\\_303944\\_Article.jsp](http://www.heart.org/HEARTORG/Conditions/HeartAttack/HeartAttackToolsResources/Heart-Attack-Risk-Assessment_UCM_303944_Article.jsp)

## **Britain**

1. The Joint British Societies Cardiovascular Disease New Risk Assessment Charts 2009.  
[http://www.bhsoc.org/Cardiovascular\\_Risk\\_Prediction\\_Chart.stm](http://www.bhsoc.org/Cardiovascular_Risk_Prediction_Chart.stm)
2. The Joint British Societies Cardiovascular Risk Assessor (V01.06) is available to download onto your PC from the HEART U.K. website with the permission of Professor Durrington.  
[http://www.heartuk.org.uk/HealthProfessionals/index.php/jbs\\_cv\\_risk\\_assessor/](http://www.heartuk.org.uk/HealthProfessionals/index.php/jbs_cv_risk_assessor/)

## **Australia**

1. National Heart Foundation of Australia – Australia Cardiovascular Risk Charts.  
[http://www.heartfoundation.org.au/SiteCollectionDocuments/A\\_AR\\_RiskCharts\\_FINAL%20FOR%20WEB.pdf](http://www.heartfoundation.org.au/SiteCollectionDocuments/A_AR_RiskCharts_FINAL%20FOR%20WEB.pdf)

## **COMPLICATED AND RESISTANT HYPERTENSION**

**Complicated hypertension is defined as hypertension with end organ damage.**

### **End Organ Damage<sup>7</sup>**

#### **Heart**

- Left ventricular hypertrophy (LVH)
- Angina/prior MI
- Prior coronary revascularization
- Heart failure

#### **Brain**

- Stroke or transient ischemic attack

- Dementia
- Chronic kidney disease (CKD)
- Peripheral arterial disease
- Retinopathy

The Task Group recommends:

- Referral of patients with significant cardiac dysfunction to a cardiologist.
- Referral to a nephrologist for patients with:
  - Proteinuria greater than 300 mgs/24 hr., or a
  - Rising Creatinine, or a
  - GFR less than 60
- Referral of patients with retinal haemorrhages or papilloedema, to hospital as an emergency.

**Resistant hypertension** is defined as failure to achieve goal blood pressure in patients who are adhering to full doses of an appropriate three drug regimen that includes a diuretic.

For resistant hypertension, the Task Group recommends first determining adherence, and then if the patient is judged to be adherent, referral to a specialist for evaluation for secondary causes of hypertension (see list on page 11).

In **resistant cases of hypertension**, also consider other medications (including complementary medicines) that patient may be taking that may increase blood pressure (see table below).

#### Medications that can increase blood pressure

Medications:	Complementary medicines:
Corticosteroids	Caffeine containing products (guanara, cola, green tea)
Haemopoietic agents (Epo)	Ephedra
Immunomodulators (cyclosporine, tacrolimus)	Ginger
MAOIs	Ginseng
Oral contraceptives	Licorice
Oral decongestants (pseudoephedrine)	Sage
Stimulants (amphetamines)	St. John's Wort
Cocaine use	

Adapted from: Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. NIH, NHLBI, NHBPEP

## HYPERTENSIVE URGENCIES

- These are defined as situations associated with severe elevations in BP without progressive target organ dysfunction.
- Conditions would include: Upper levels of Stage 2 hypertension associated with severe headache, shortness of breath, or severe anxiety. These patients present as non-adherent or inadequately treated.
- Some patients with hypertensive urgencies may benefit from treatment with an oral, short-acting agent such as captopril, labetolol, or clonidine followed by several hours of observation. There is no evidence to suggest that failure to aggressively lower BP in the ER is associated with any increased short-term risk to the patient who presents with severe hypertension. Such a patient may benefit from adjustment in their antihypertensive therapy, particularly the use of combination drugs.

Note that early triage to establish appropriate therapeutic strategies is critical to limit morbidity and mortality; and also most importantly, arrange confirmed follow up visit with G.P.

## MALIGNANT HYPERTENSION

Malignant hypertension is a medical emergency.

### **Diagnosis Criteria:**

- BP  $\geq$  180/110 mmHg PLUS ONE OR MORE of the following:
  - intracerebral haemorrhage
  - retinal haemorrhage
  - papilloedema
  - haematuria
  - thrombocytopenia
  - pulmonary edema
- Malignant hypertension requires immediate blood pressure reduction (not necessarily to normal) to prevent or limit organ damage.
- Admit to ICU for continuous monitoring of BP and parenteral administration of vasodilators (sodium nitroprusside, nicardipine hydrochloride, nitroglycerin, hydralazine, enalaprilat) or adrenergic inhibitors (labetolol, esmolol, phentolamine). The goal is to reduce mean arterial BP by no more than 25% (within minutes to one hour), then if stable, to 160/100 –110 mmHg within the next 2 – 6 hours.
- Excessive falls in pressure that may precipitate renal, cerebral, or

coronary ischemia should be avoided. For this reason, short acting nifedipine is no longer considered acceptable in the initial treatment of hypertensive emergencies or urgencies.

- If this level of BP is well tolerated and the patient is clinically stable, further gradual reduction can be implemented in the next 24 – 48 hours.

## MANAGEMENT OF HYPERTENSION

### Monitoring Schedule for Management of Hypertensive patients

Blood pressure level	Monitoring interval
BP <140/90	Reassess in 3 – 6 months
BP 140 – 159/90 – 99 (Stage 1)	Reassess within 2 months
BP 160 – 179/100 – 109 (Stage 2)	Treat, reassess or refer within 1 month
BP >180/110 (Stage 3)	Treat, reassess or refer within 7 days as necessary
BP >220/120	Treat immediately and reassess within 1 – 3 days as necessary
Malignant hypertensive or emergency patients	Refer for in-hospital treatment immediately
Isolated systolic hypertension (SBP >140, DBP <90)	As for category corresponding to SBP
Isolated systolic hypertension with widened pulse pressure (SBP >160, DBP <70)	As for BP >180/110

Adapted from the following Guidelines:

1. National Heart Foundation of Australia (National Blood Pressure and Vascular Disease Advisory Committee). Guide to Management of Hypertension 2008 AND
2. U.S. Department of Health and Human Services Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. 2004, and
3. Caribbean Health Research Council: Managing Hypertension in primary care in the Caribbean. St. Augustine, Trinidad and Tobago: Caribbean Health Research Council 2007.

**Every visit – measure and record:**

- BP
- Weight (for BMI calculation)
- Positive or adverse effects of medications
- Healthy lifestyle

**Annually – measure and record:**

- BP
- Weight for BMI calculation

- Update medical history
- Lifestyle management
- Laboratory investigation:
  - CBC
  - Electrolytes glucose
  - Fasting lipid profile
  - Microalbuminuria
  - +/- ECG

### **General monitoring**

Consider a practice register to assist in the monitoring of patients with hypertension.

### **STRATEGIES TO IMPROVE ADHERENCE <sup>7,8,9</sup>**

#### **Patient-related factors:**

- Address emotional stresses, financial and personal concerns.
- Educate patient on diet and lifestyle practices to improve hypertension.
- Address alcohol and drug/tobacco use.
- Address any drug interactions and the use of over-the-counter medications that may increase BP.
- Consider white-coat hypertension.
- Dispel myths about hypertension and its treatment by education.
- Address causes of secondary hypertension, i.e., sleep apnoea, chronic pain, etc.
- Consider volume overload – excessive salt intake.

#### **Physician-controlled factors:**

- Use of appropriate cuff-size when measuring blood pressure.
- Use of combinations of medications and dosing.
- Review all medications/drugs being taken at each visit – ask specific questions, and give patients permission to tell the truth without fear of reprimand.

- Simplify drug regimens.
- Recommend drug dispensing containers, or suggest location of pills to increase compliance.
- Write down a proposed schedule of all medications at each visit.
- Address adherence and the barriers to adherence at each visit.
- Encourage patient to measure home BP.
- Take time to build rapport and educate patient, thus engendering trust of the physician and the chosen mode of treatment.
- Consider out-of-office contact (i.e., phone or e-mail) especially during the first three months of therapy.
- Invite the patient to bring a family member to an early discussion about hypertension, and request their help and support of their loved one.
- Encourage cardiac care, dietitian, physiotherapist or psychologist follow-up when necessary.
- Consider use of incentives, financial or otherwise to increase motivation.

## **LIFESTYLE MANAGEMENT**

### **MANAGEMENT**

Adoption of healthy lifestyles by all persons is critical for the prevention of hypertension and is an indispensable part of the management of those with hypertension.<sup>13</sup>

- Observe patients for 3 – 6 months for Stage 1 and 2 Hypertension. Do not hesitate to initiate drug therapy when necessary to meet BP goals.<sup>14</sup>
- For ongoing support and follow-up<sup>15</sup>, consider referral to a Lifestyle Modification Programme. See Appendix I for contact information for Lifestyle Modification Programmes offered on the island.
- An outpatient blood pressure clinic is provided by the Department of Health:
  - Hamilton Clinic – Wednesdays 2 – 4 p.m.
- For Senior Wellness Clinics call 278-6460 or 292-3095 to schedule an appointment. Clinic Times: 2 – 4 p.m.
  - Somerset Clinic – 3rd Tuesday of the month
  - Hamilton Clinic – 2nd and 4th Wednesdays of the month
  - St. George's – 1st Tuesday of the month
- It is recognized that management of hypertension in homeless individuals is an area with many difficulties, refer to free blood pressure clinic and homeless feeding programmes.

### **REGULAR PHYSICAL ACTIVITY**

Prescribe physical activity at moderate intensity, completed in intervals throughout the day:

- 30 – 60 minutes per day most days of the week for children.<sup>10</sup>
- ≥30 minutes per day moderate intensity for adults and for those needing to achieve weight reduction.<sup>15</sup>
- Individuals with Stage 3 Hypertension should be assessed for safety to participate in physical activity programme.<sup>15</sup>

### **DIETARY MODIFICATION**

Referral to a registered dietitian is advised to assist patient with the recommended dietary modifications:

- Adherence to the DASH Diet/Vegetarian Diet<sup>16</sup> – which may include

fruits, vegetables, whole grains, legumes and nuts for a total of 30 – 40 gm fibre / day, lean meats, and low-fat dairy foods.

DASH Diet [www.nhlbi.nih.gov/health/public/heart/hbp/dash/new\\_dash.pdf](http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf)

- Reduction of sodium intake to:
  - 2300 mg per day for prevention of hypertension (equivalent to 1 teaspoon of salt).
  - 1500 mg sodium for hypertensive individuals (equivalent to 2/3 teaspoon of salt).
- Strategies to reduce sodium intake include:
  - Following the DASH diet.
  - Avoiding processed canned and fast foods.
  - Avoiding adding salt during cooking and at the table.
  - Reading food labels to determine sodium content of foods. A food is considered low in sodium if it contains 140 milligrams or less of sodium per serving.
  - Food Label [www.health.gov/bm](http://www.health.gov/bm) (Appendix III).

The following are not recommended:

- Supplementation of potassium, calcium and magnesium is not recommended as prevention or treatment of hypertension.<sup>8</sup>
- There is insufficient evidence to recommend fish oil, supplemental fiber, high protein and low glycemic index diets as a means to lower BP.<sup>10</sup>

## **WEIGHT REDUCTION/MAINTENANCE**

- Hypertensive individuals should be encouraged to reduce their weight to attain a normal BMI <25 (see Appendix IV for BMI Chart). Every 1% reduction in body weight lowers systolic BP by an average of 1 mmHg<sup>9</sup>.
  - Adult BMI can be calculated at <http://www.nhlbisupport.com/bmi>
  - A child and adolescent BMI calculator is available at <http://apps.nccd.cdc.gov/dnpabmri/>.
  - Growth charts are available at <http://www.cdc.gov/growthcharts>
- Waist circumference targets are:
  - <40" men
  - <35" women (see Appendix IV).

- Refer patient to a registered dietitian.
- A multidisciplinary team approach to weight loss is encouraged. Team members should include nurse, dietitian, physiotherapist, and when necessary psychologist/behaviour therapist. The multidisciplinary team is important in establishing weight maintenance over the long term.<sup>17</sup>
- Target weight reduction of 10% body weight should be sought through lifestyle behaviour change to:
  - Reduce calories by decreasing portion sizes and eliminating high calorie beverages.
  - Limit consumption of high fat foods.
  - Decrease sedentary activities.
  - Increase physical activity.
- Reduce age-related weight gain.
- Morbidly obese individuals (BMI >40) may benefit from drug therapy or bariatric surgery.
- Those individuals who undergo bariatric surgery require lifestyle management support post surgery.<sup>17</sup>
- For more detailed information access the *The Practical Guide to the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults* an NIH Publication and NHLBI Obesity Education Initiative from [www.nhlbi.nih.gov/guidelines/obesity/prctgd\\_c.pdf](http://www.nhlbi.nih.gov/guidelines/obesity/prctgd_c.pdf) PDF file

## **ALCOHOL**

Limit drinks to:<sup>5,9</sup>

- 2 drinks/day men.
- 1 drink/day women.
- 1 drink = 1 oz. liquor, 6 oz. wine, 12 oz. beer.<sup>5</sup>
- Caution should be provided regarding medication/alcohol interaction.

## **SMOKING CESSATION**

- Encourage and support a smoke-free environment.
- Advise individual to quit smoking.
- Refer to smoking cessation programme.
- Prescribe nicotine replacement therapy as required.

## **STRESS MANAGEMENT**

In hypertensive clients in whom stress may be contributing to blood pressure elevation, stress management should be considered as an intervention.<sup>8</sup> Refer for counselling as required.

## **PHARMACOLOGICAL MANAGEMENT**

The Task Group recognizes that there are a large number of drugs available to reduce blood pressure. Many large-scale trials have confirmed the effectiveness of the different classes of anti-hypertensive agents, but have not confirmed superiority of any particular class. In addition, up to two-thirds of people will need two or more drugs to meet their target blood pressure.<sup>6</sup>

The British Hypertension Society in collaboration with the National Institute for Clinical Excellence has developed a treatment algorithm to inform the better use of logical combinations of drugs.<sup>6</sup> These recommendations are largely similar to those outlined in other international guidelines, but have the benefit of a straightforward and easily interpreted flowchart. The Bermuda Task Group has thus recommended the adoption of this algorithm for our local guidelines. These guidelines apply to the ‘uncomplicated’ hypertensive patient.

A drug cost comparison including more commonly prescribed anti-hypertensive medications available in Bermuda, has been compiled to assist in making drug choices. The Task Group believes that cost implications for the patient, and the impact on health costs for our island should be considered. This list does not include all hypertensive medications that are available.

### **GENERAL POINTS TO CONSIDER WHEN PRESCRIBING DRUGS**

- Consideration of ethnicity and age in choice of agent.<sup>6</sup>
  - *In hypertensive patients younger than 55*, first choice initial therapy should be an angiotensin converting enzyme inhibitors (ACEI) (or an Angiotensin receptor blocker (ARBs) if an ACE inhibitor is not tolerated).
  - *In hypertensive patients aged 55 and over, or black patients\** of any age, first choice of initial therapy should be either a calcium channel blocker (CCB) or a thiazide-type diuretic.\*\*
  - *Hypertensive patients of South Asian descent* have a higher prevalence of insulin resistance and type 2 diabetes. These risk factors should be taken into consideration when selecting antihypertensives in this group.\*\*

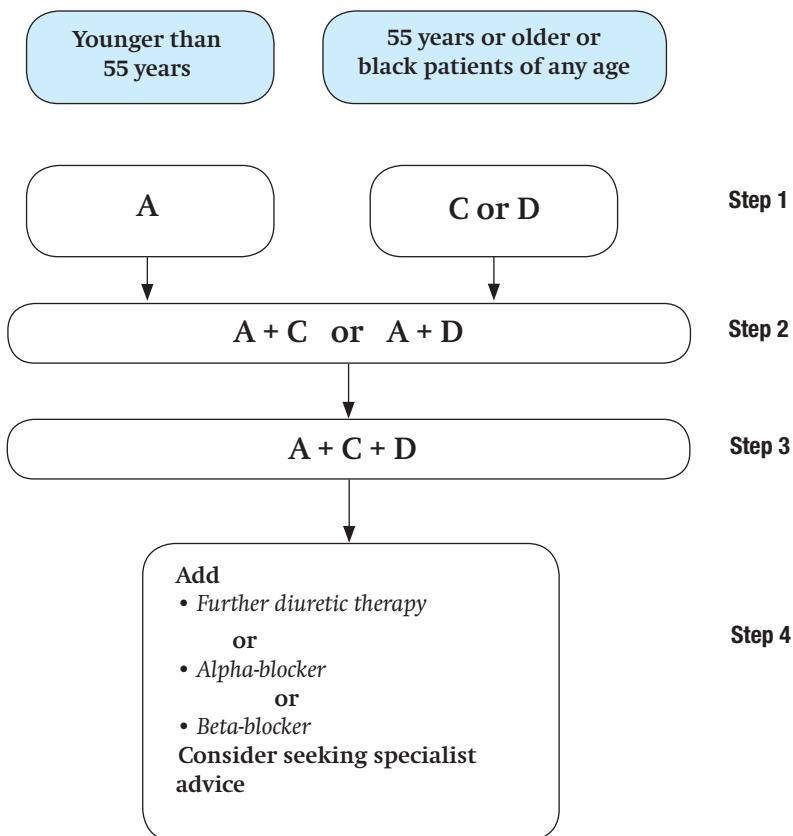
\*Black patients are those of African or Caribbean descent, and not mixed race, Asian or Chinese patients

\*\*Note that thiazides may have a variety of dose-dependent adverse meta-

bolic effects, including hypokalaemia, hyperuricemia, mild elevations in the plasma cholesterol and glucose concentrations, and hyperinsulinemia.<sup>18</sup> If there is a strong family history of diabetes or if the individual has additional risk factors for diabetes, consideration should be given to choosing an alternative first line treatment or using lowest doses to minimize metabolic abnormalities.

- Beta-blockers are not recommended for first line therapy based on evidence that they perform less well than other drugs, particularly in the elderly, and the increasing evidence that suggests that the most frequently used beta-blockers at usual doses carry an increased risk of provoking type 2 diabetes.
- Drugs should be combined according to the algorithm (see Algorithm 2 page 26).
- Low dose initial therapy followed by addition of medications from other classes is preferable to increasing to maximum doses of individual agents. This achieves blood pressure control with a reduced side effect profile.
- Drugs should generally be titrated over four weeks.
- Long acting medications are preferable.
- Combination therapies may be of benefit for some patients but the cost implications should be considered.
- If blood pressure remains uncontrolled on maximum doses of three drugs, consider seeking specialist advice.

**ALGORITHM 2:**  
**CHOOSING DRUGS FOR PATIENTS NEWLY DIAGNOSED WITH HYPERTENSION**



**Abbreviations:**

**A = ACE Inhibitor**

(consider angiotension-II receptor  
if ACE intolerant)

**C = calcium-channel blocker**

**D = thiazide-type diuretic**

Black patients are those of  
African descent, and NOT  
mixed-race, Asian or Chinese  
patients

## Beta-blockers

- Beta-blockers are no longer preferred as a routine initial therapy for hypertension.
- But consider them for younger people, particularly:
  - Women of childbearing potential.
  - Patients with evidence of increased sympathetic drive.
  - Patients with intolerance of or contraindications to ACE inhibitors and angiotension-II receptor antagonists.
- If a patient taking a beta-blocker needs a second drug, add a calcium-channel blocker rather than a thiazide-type diuretic, to reduce the patient's risk of developing diabetes.
- If a patient's blood pressure is not controlled by a regime that includes a beta-blocker (that is, it is still above 140/90 mmHg), change their treatment by following the flow chart on the facing page.
- If a patient's blood pressure is well controlled (that is, 140/90 mmHg) by a regime that includes a beta-blocker, consider long-term management at their routine review. There is no absolute need to replace the beta-blocker in this case.
- When withdrawing a beta-blocker, step down the dose gradually.
- Beta-blockers should not usually be withdrawn if a patient has a compelling indication for being treated with one, such as symptomatic angina or a previous myocardial infarction.

Source: NHS, National Institute for Health and Clinical Excellence: NICE clinical guideline 18: Hypertension: The management of hypertension in adults in primary care. London: Royal College of Physicians, 2008<sup>6</sup>

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## KEY TO DRUG PRICE COMPARISON CHART OVERLEAF

\$: up to \$35

\$\$: \$35-50

\$\$\$: \$50-\$65

\$\$\$\$: \$65-\$100

\$\$\$\$\$ > \$100

‡ Available generic separately but priced as combo product

Please note that medications are less expensive when prescribed for a three-month period.

## DRUG PRICE COMPARISON

Generic Name	Brand Name	Starting Dose	Generic	Cost/ month
<b>ACE Inhibitors</b>				
captopril	Capoten	25 mg bid	Y	\$
enalapril	Vasotec	5 mg qd	Y	\$
lisinopril	Zestril, Prinivil	10 mg qd	Y	\$
ramipril	Altace	2.5 mg qd	Y	\$
<b>Angiotensin II Blockers</b>				
candesartan	Atacand	8 mg qd	N	\$\$\$
irbesartan	Avapro	150 mg qd	N	\$\$\$
telmisartan	Micardis	40 mg qd	N	\$\$\$
valsartan	Diovan	80 mg qd	N	\$\$\$
losartan	Cozaar	50 mg qd	Y	\$
<b>Aldosterone Antagonist</b>				
spironolactone	Aldactone	50 mg qd	Y	\$
<b>Alpha Blockers</b>				
doxazosin	Cardura	1 mg qd	Y	\$\$\$
doxazosin XL	Cardura XL	4 mg qd	N	\$\$\$
terazosin	Hytrin	1 mg qd	Y	\$\$\$
<b>Beta-Blockers</b>				
atenolol	Tenormin	50 mg qd	Y	\$
carvedilol	Coreg	12.5 bid	Y	\$\$\$
carvedilol CR	Coreg CR	40 mg qd	N	\$\$\$
labetolol	Trandate	200 bid	Y	\$
metoprolol	Lopressor	50 mg bid	Y	\$
metoprolol xl (Betaloc)	Toprol XL	50 mg qd	Y	\$
propranolol	Inderal	40 mg bid	Y	\$
propranolol XL	Inderal XL	80 mg qd	Y	\$
nadolol	Corgard	40 mg qd	Y	\$\$
<b>Calcium Channel Blocker</b>				
amlodipine	Norvasc	5 mg qd	Y	\$
diltiazem	Cardizem	30 mg qid	Y	\$\$
diltiazem CD	Cardizem CD	180 qd	Y	\$\$
felodipine SR	Plendil	5 mg qd	Y	\$\$

Generic Name	Brand Name	Starting Dose	Generic	Cost/month
nifedipine SR	Adalat CC	30 mg qd		\$\$
verapamil	Calan	80 mg tid	Y	\$\$
verapamil SR	Calan SR	240 mg qd	Y	\$\$\$
<b>Centrally acting Adrenergics</b>				
clonidine	Catapres	0.1 mg bid	Y	\$
clonidine transdermal	Catapres TTS	1 patch weekly	Y	\$\$\$\$
methyldopa	Aldomet	250 mg bid	Y	\$
<b>Diuretics</b>				
hydrochlorothiazide	HydroDiuril	25 mg qd	Y	\$
indapamide	Lozol	1.25 mg qd	Y	\$\$
metolazone	Zaroxolyn	2.5 mg qd	Y	\$\$\$
furosemide	Lasix	20 mg qd	Y	\$
chlorthalidone	Thalitone	25 mg qd	Y	\$
bendroflumethiazide	Naturetin	2.5 mg qd	Y	\$
<b>Vasodilators</b>				
hydralazine	Apresoline	10 mg qid	Y	\$
minoxidil	Loniten	5 mg qd	Y	\$\$\$
<b>Combination products</b>				
atenolol/chlorthalidone	Tenoretic	50/25 mg qd	Y	\$\$
enalapril/hctz	Vaseretic	10/25 mg qd	‡	\$\$
candesartan/hctz	Atacand HCT	16/12.5 mg qd	N	\$\$\$\$
telmisartan/hctz	Micardis plus	40/12.5 mg qd	N	\$\$\$
losartan/hctz	Hyzaar	50/12.5 mg qd	‡	\$\$\$
spironolactone/hctz	Aldactazide	25/25 mg qd	N	\$\$
triamterene/hctz	Dyazide	37.5/25 mg	Y	\$
olmasartan/hctz	Benicar HCT	20/12.5 mg	N	\$\$\$\$
<b>Erectile dysfunction (4 tablets)</b>				
tadalafil	Cialis		N	\$\$\$
ildenafil	Levitra		N	\$\$\$
sildenafil	Viagra		N	\$\$\$

## **DIABETES**

### **LIFESTYLE MANAGEMENT OF PERSONS WITH DIABETES AND HYPERTENSION:**

- Target BP 130/80<sup>8</sup>.
- Lifestyle modification is recommended to include (see Lifestyle Management section page 20):
  - Regular exercise and increased routine physical activity.
  - Avoidance of tobacco.
  - Moderate alcohol intake.
  - Low sodium <2,300 mg or 2.3 g/day.
- All patients with diabetes should be evaluated for albuminuria at least once a year.<sup>19</sup>

### **DRUG THERAPY MANAGEMENT**

- Most diabetics need two or more drugs for hypertension control in addition to lifestyle change.
- Maximize dose within first month of treatment if BP not at goal.
- Titrate dose to highest tolerated level necessary to achieve goal.
- Use fixed dose combinations wherever possible to improve adherence.
- Start combination of first line therapies if BP >150/90mmHg at diagnosis.<sup>19</sup>

### **WITH KIDNEY DISEASE OR CO-EXISTANT CCF:<sup>5</sup>**

- Use ACEI or ARB first line with consideration if Cr >260mmol/L.
- If renal impairment/oedema, loop diuretic may be required.

### **BLACK SUBJECTS – WITHOUT KIDNEY DISEASE**

- First Line: Thiazide diuretic.
- Second Line: ACEI or ARB
  - are rarely effective on their own in black subjects.<sup>5</sup>
  - are ineffective in older black subjects.
  - should always be added to a thiazide.
  - they may delay proteinuria and help to control potassium (K) balance with a thiazide.
- ACEI are better for renoprotection than ARBs in T1DM.<sup>6</sup>
- ACEI is more effective and less expensive than most CCB.<sup>5</sup>

- ARBs are more effective at reducing CV events compared to atenolol.<sup>6</sup>
- ARBs are better for cardiorenal protection than ACEI in T2DM.
- ARBs can replace ACEI if ACEI ineffective or causes cough.<sup>19</sup>
- Second Line: Consider Long-acting Dihydropyridine Calcium-channel blocker (felodipine, amlodipine).
  - If these drugs are contraindicated or cannot be tolerated, a cardioselective BB or non-dihydropyridine CCB (verapamil, diltiazem) may be substituted.

#### **NON-BLACK SUBJECTS WITHOUT KIDNEY DISEASE:**

- ACEI
- ARB if >55 years with left ventricular hypertrophy (LVH).
  - or long-acting dihydropyridine CCB (felodipine, amlodipine),
  - or thiazide diuretic.<sup>8</sup>
- If these drugs are contraindicated or cannot be tolerated, a cardioselective BB or non-dihydropyridine CCB (verapamil, diltiazem) may be substituted.
  
- If BP >20/10 mmHg above target:<sup>19</sup>
  - Start with ACEI or ARB and use combination with CCB or diuretic.

#### **IFG/IGT**

- In patients with risk factors for developing overt diabetes, choice of antihypertensive agent should take this into account. Beta-blockers and thiazide diuretics are associated with an increased risk of developing new-onset type 2 diabetes compared with other agents. The relative risk of being diagnosed with diabetes is between 1.2 to 1.46 in individuals taking thiazides compared to those not taking thiazides with similar baseline characteristics.<sup>20</sup>
- Baseline predictors of new onset diabetes during treatment with antihypertensives include increasing age, female sex, minority ethnicity, body mass index and waist circumference, elevated fasting and post-prandial glucose, low HDL, presence of left ventricular hypertrophy and the degree of elevation of both diastolic and systolic blood pressures.

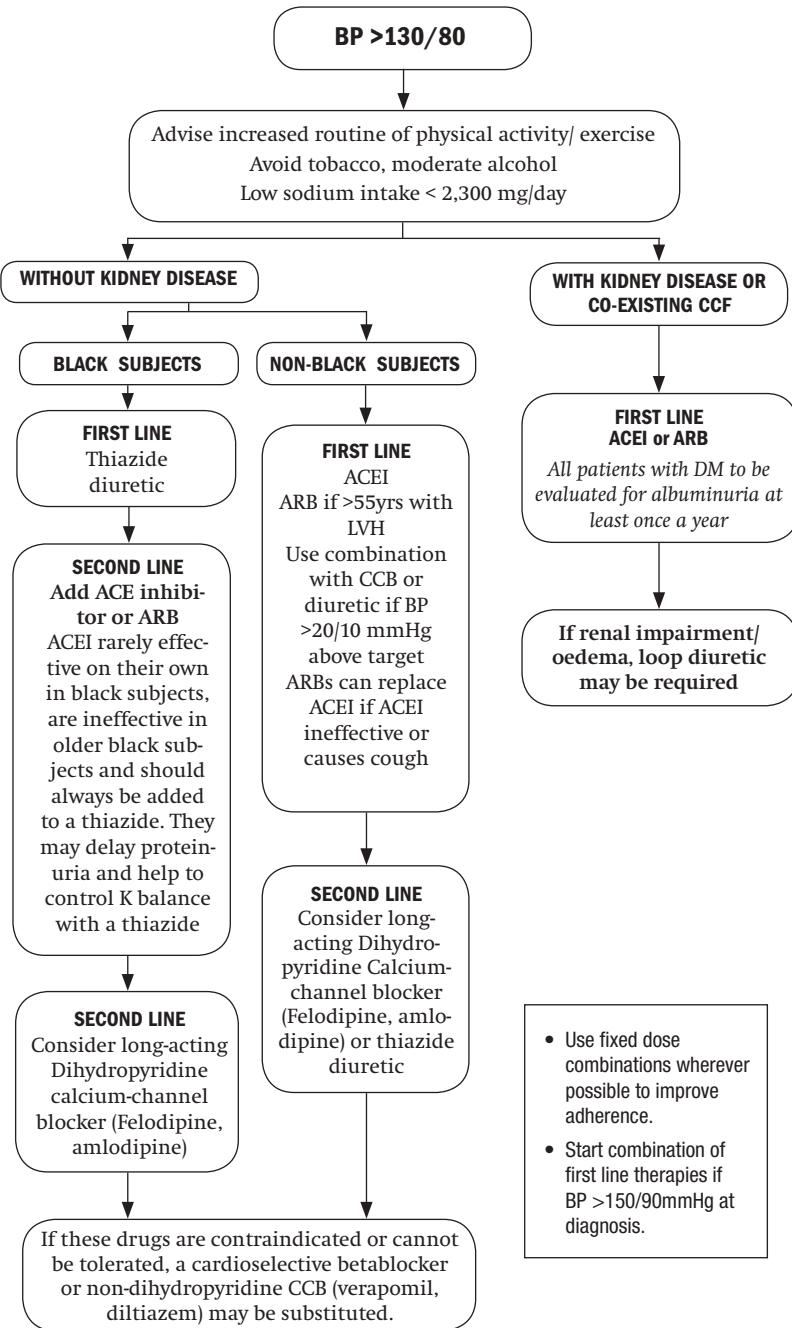
#### **NOTES**

- Thiazide therapy rarely affects glycaemic control at low doses.<sup>5</sup>
- B-blockers may mask symptoms of hypoglycaemia, have negative im-

pact on lipid and glucose metabolism and compromise peripheral circulation<sup>5</sup>.

- ACEI, ARBs and CCBs have beneficial or neutral effects on insulin sensitivity and glycaemic control.<sup>19</sup>
- ACEI, ARBs and renin inhibitors are contraindicated in pregnancy and caution is required in prescribing to women of child bearing potential<sup>7</sup>.
- RAS blockers do not prevent worsening of glycaemic control if given with Thiazide diuretics to obese patients with IFG.<sup>19</sup>
- Alpha blockers:
  - can be used as a 4th or 5th line agent but these cause orthostatic hypotension, which may be very troublesome in diabetics with autonomic neuropathy.
  - should be avoided if there is diabetic neuropathy and substantial fall in BP or symptoms when standing.<sup>19</sup>
  - are not recommended as first line agents for the treatment of hypertension in patients with diabetes.<sup>8</sup>
- Aldosterone Blockade:<sup>19</sup>
  - can be used as 4th line, particularly in obese diabetic patients.
  - Patients with obstructive sleep apnoea and central obesity have demonstrated major benefits of BP reduction with spironolactone. Similar reductions in African-American and Caucasians.
  - BP-lowering response not predicted by baseline plasma/urine aldosterone levels or renin activity, not affected by age, sex, smoking, diabetes. Care with potassium.

**ALGORITHM 3:**  
**TREATMENT ALGORITHM FOR PERSONS WITH DIABETES AND HYPERTENSION**



## **RENAL DISEASE**

Initial evaluation of the patient with hypertension should include assessment for the presence of chronic kidney disease or CKD.<sup>21</sup> Patients with an estimated GFR <60 ml/min/1.73 m<sup>2</sup> or preserved eGFR with presence of albuminuria ( $>/=200$  mg/g on spot urine albumin or total protein to creatinine ratio for  $>3$  months) are considered to have CKD.<sup>7</sup> Progression of CKD to end-stage renal disease (ESRD) is a major public health problem. Hypertension is associated with a more rapid progression to ESRD and thus, this high risk group warrants intensive hypertension management. Studies have shown that aggressive treatment of hypertension in this group of patients does slow decline in GFR.

The goals of therapy in CKD are to lower blood pressure, reduce CVD risk and slow progression of CKD. Goal blood pressure for *all* patients with CKD is  $<130/80$ .<sup>21</sup>

### **INITIAL EVALUATION**

- Blood pressure should be measured in all CKD patients at each visit.
- Serum creatinine and estimated GFR should be measured at initial evaluation and at least yearly. The following website can be used to calculate eGFR: [http://nkdep.nih.gov/professionals/gfr\\_calculators/](http://nkdep.nih.gov/professionals/gfr_calculators/)
- Spot urine total protein (or albumin) to creatinine ratio.
- Urine dipstick and microscopic examination.

### **GENERAL TREATMENT**

- Blood pressure should be *less than* 130/80, unless compelling contraindication exists.
- All patients with diabetic CKD and patients with non-diabetic CKD + proteinuria ( $>/= 200$  mg/g on spot urine total protein: creatinine ratio) should be treated with an ACE inhibitor or an ARB unless contraindicated.<sup>21</sup>
- Monitor K and Cr carefully in patients with CKD prescribed an ACEI or ARB<sup>8</sup>. If potassium elevated ( $>5$  mEq/L) review diet and medications, e.g. NSAIDs before initiating ACEI or ARB.
- Loop diuretics may enable use of ACEI/ARB. Continue ACEI / ARB if potassium level  $</= 5.5$  meq/L.<sup>21</sup>
- Continue ACE/ARB or diuretic if GFR decline is less than 30% from baseline over four months.<sup>21</sup>

- ACEI, ARBs and renin inhibitors are contraindicated in pregnancy, and caution is required in prescribing to women of childbearing potential.<sup>8</sup>
- Referral to nephrologist is indicated in acute renal failure, for full evaluation of etiology and formulation of management plan. Patients should be referred to nephrologist for ongoing care when eGFR is <30 ml/min.

#### **DIABETIC KIDNEY DISEASE (DM-CKD):**

- Goal BP is <130/80.<sup>21</sup>
- Patients with DM-CKD, with or without hypertension, should be treated with an ACEI or an ARB<sup>21</sup>. ACE inhibitors are more effective than other antihypertensives in slowing progression of kidney disease with macroalbuminuria due to DM-1.<sup>21</sup>
- Diuretics may potentiate the effects of ACEI and ARBs in diabetic CKD.<sup>21</sup>

#### **NON-DIABETIC KIDNEY DISEASE (non-DM CKD):**

- Multiple antihypertensive agents are usually required to reach target blood pressure.<sup>21</sup>

#### **CKD with Proteinuria**

BP lowering therapy should focus on reducing proteinuria as well as treating BP to target of <130/80.<sup>19</sup> Reducing to <125/75 may produce additional benefit in CKD with proteinuria.<sup>6</sup>

- ACEI, ARBs and nondihydropyridine CCB have a greater antiproteinuric effect than other classes in non-DM CKD and should be used. Diuretics may potentiate the beneficial effects of ACEI and ARBs in non-DM CKD.<sup>21</sup>
- Dihydropyridine CCB should not be used in non-DM CKD with proteinuria in the absence of ACEI or ARB therapy.
- ACEI and ARB may be used in combination.
- If CrCl <30 ml/min. a loop diuretic should be substituted for a thiazide diuretic, particularly if control of volume is desired.<sup>8</sup>

#### **CKD without Proteinuria**

- Goal BP remains <130/80.
- Any initial agent may be used for attainment of the goal BP, although a diuretic is a good initial agent, depending on GFR.
- In CKD stages 1 – 3, a thiazide, loop or K-sparing diuretic may be used.

- In CKD stages 4 – 5, a loop diuretic is recommended.<sup>19</sup>
- Combination of ACEI and ARB is not recommended for pts with non-proteinuric CKD.<sup>8</sup>

### **Renovascular Disease**

- Clinical clues:
  - Onset of hypertension <30 years old (especially if there is no family history or risk factors).
  - Recent onset of hypertension after age 55.
  - Abdominal bruit.
  - Accelerated (malignant) or resistant (>4drugs) hypertension.
  - Recurrent ‘flash’ pulmonary oedema.
  - CKD of uncertain etiology (especially if bland urine sediment).
  - PMH of ischemic heart disease or peripheral vascular disease.
  - Large elevation of serum Cr, especially with marked BP reduction by ACEI or ARB (>30% increase of Cr).
- Caution with use of ACEI or ARB due to risk of AKI in bilateral disease or unilateral disease with a solitary kidney. Recommend revascularization/stent, if uncontrolled BP or rising Cr.

### **Renal Transplant patients**

- Target blood pressure <130/80.
- No particular class of antihypertensives superior to others. Watch K and Cr with ACEI and ARBs. A  $>1$  mg/dL increase in serum Cr should raise the question of renal artery stenosis.
- Proteinuria after transplantation is a risk factor for graft loss and death. It is reasonable to conclude that control of proteinuria and HTN with ACEI/ARBs may have a favourable outcome on graft survival and mortality.<sup>21</sup>
- Nocturnal hypertension, reversal of diurnal BP rhythm may be present so may need 24h BP to evaluate. Still relative salt and water retention after renal transplant as still some renal impairment.

### **Autosomal dominant Polycystic Kidney Disease (ADPKD):**

- Any antihypertensives may be used. No proven benefit of ACEI/ARB has been proven for reno-protection.

## **HYPERTENSION AND CARDIAC DISEASE**

### **HYPERTENSION AND HEART FAILURE<sup>7</sup>**

Hypertension precedes the development of heart failure in approximately 90% of patients and increases the risk for heart failure by two- to three-fold. Hypertension is especially important in heart failure affecting African-Americans and elderly persons.

Systolic heart failure should generally be treated with an ACE inhibitor. In patients intolerant of ACE inhibitor, angiotensin receptor blockers (ARB) may be used. Carvedilol or metoprolol succinate are also recommended in systolic heart failure, as clinical studies have demonstrated decreased morbidity and mortality plus improvement in heart failure symptoms.

Patients with congestive heart failure (CHF) due to diastolic dysfunction and hypertension should be managed per general guidelines for hypertension management. Black patients with systolic heart failure who remain hypertensive despite a trial of ACE inhibitor and beta-blocker may benefit from adding a combination of hydralazine and nitrates (mortality reduction demonstrated in the “African-American Heart Failure Trial”.<sup>22</sup>)

Loop diuretics are often necessary to control volume retention but should be used with care. There is no evidence that diuretics prevent progression of disease, and diuretics can also increase serum creatinine levels when used in excess. Aldosterone antagonists may provide additional benefit in patients with severe left ventricular dysfunction, usually New York Heart Association class 3 – 4. Studies generally demonstrate reduced mortality by using Aldosterone antagonist in this situation. Hyperkalemia is a risk with Aldosterone antagonist, and therefore these agents should be used only in patients with serum creatinine less than 2.5 mg/dl, with serum potassium monitored closely in all patients.

Blood pressure targets in heart failure have not been firmly established. Systolic blood pressures are generally lowered to the range 110 – 130. Very low blood pressures (systolic blood pressures less than 100) may be desirable in some heart failure patients, to maximize after load reduction, as long as lower blood pressures are tolerated from a symptom standpoint.

### **HYPERTENSION AND ISCHEMIC HEART DISEASE<sup>7</sup>**

Hypertensive patients are at increased risk for myocardial infarction or other major coronary events and may be at higher risk for death following acute myocardial infarction. Lowering both systolic and diastolic blood pressures reduces ischemia in part by reducing myocardial oxygen

demand. However, some studies have shown an apparent increase in coronary risk at low levels of diastolic blood pressure, generally in the range of 60 mmHg or less. Therefore, patients with occlusive coronary disease and or left ventricular hypertrophy should maintain a diastolic blood pressure above 60 mmHg. Systolic blood pressure should be treated to a target of less than 130 mmHg.

Unless contraindicated, pharmacologic therapy should be initiated with a beta-blocker. Beta-blockers will lower blood pressure, reduce symptoms of angina, improve mortality, and reduce myocardial oxygen demand.

If blood pressure or anginal symptoms are not controlled by beta-blocker therapy alone, or beta-blockers are not tolerated, as in the presence of reactive airway disease, severe peripheral arterial disease, or high degree AV block, either long-acting dihydropyridine (amlodipine, nifedipine SR, felodipine SR) or non-dihydropyridine type calcium channel blockers (diltiazem and verapamil) may be used. Diltiazem or verapamil, in combination with a beta-blocker, can cause bradycardia or high degree AV block. Therefore, amlodipine, nifedipine SR, felodipine SR are preferred for combination therapy with beta-blockers. Nitrates may be added as a third agent.

Short-acting nifedipine should not be used because of demonstrated potential to increase mortality, particularly in the setting of an acute myocardial infarction.

## **HYPERTENSION AND SURGERY**

Uncontrolled hypertension is associated with wider fluctuations of BP during induction of anesthesia and intubation, and may increase the risk for peri-operative ischemic events. The Task Group recommends that:

- Sustained hypertension should be controlled prior to elective operative procedures.
- Surgical candidates with controlled hypertension should be maintained on their medications up until the time of surgery.
- Antihypertensive medication should be reinstated as soon as possible post-operatively.
- Hypokalaemia should be corrected in advance of surgery.
- For older patients, consideration should be given to treatment with beta-1 selective beta-blockers before and during the peri-operative period.

Hypertension is very common in the early post-operative period and may be related to increased sympathetic tone and vascular resistance. The

Task Group recommends that in the post-operative setting:

- Consideration is given to factors such as pain and increased intravascular volume.
- If resumption of oral treatment must be interrupted, periodic dosing with intravenous enalapril or transdermal clonidine hydrochloride may be useful.

## HYPERTENSION AND STROKE

### Primary Prevention

Increased blood pressure is the most significant and treatable risk factor for primary stroke and recurrence of stroke even in the very elderly. All five major classes of antihypertensive agents are effective in preventing first ever stroke and can be considered, depending on cost, adverse effect profiles and co morbidities.<sup>6,7,9</sup>

### Secondary Prevention

There is well established evidence that BP-lowering therapy is effective in preventing recurrent stroke and other major vascular events in people with an established history of stroke or TIA.

Even those with BP initially less than 140/90 mmHg benefit from antihypertensive therapy. The benefits appear to be greater in those with a history of intracerebral haemorrhage than in other stroke subtypes.

Antihypertensive therapy should be initiated with caution in the very old or frail, in patients with severe carotid stenosis, and in those with initial BP levels less than 120 mmHg systolic.<sup>6,7,8, 9</sup>

The most direct available evidence for effective secondary prevention of stroke comes from studies using diuretics or combination of ACE inhibitors and diuretics.<sup>6,7,8, 9</sup>

### Acute Stroke

Following acute stroke, BP is often raised and falls spontaneously over the next few days. Both high and low blood pressure levels immediately post stroke are associated with an adverse prognosis.

The American Stroke Association has issued guidelines suggesting that in patients with recent ischemic stroke with systolic >220 or diastolic 120 – 140, cautious reduction of BP by 10 – 15% is suggested.

In situations where thrombolytic agents are to be used, BP needs to be controlled. Systolic BPs >185 or diastolic >110 contraindicate the use of tPA.

The KEMH utilizes the stroke guidelines of the Massachusetts General Hospital (MGH) to treat BP for ischemic stroke and hemorrhagic stroke. Note that the guidelines below for ischemic stroke do not pertain to patients eligible for or undergoing tPA treatment.

#### **MGH ischemic stroke BP management guidelines:**

- Systolic less than or  $\leq$  220 OR diastolic less than or  $\leq$  120
  - Observe unless other end-organ involvement (e.g., aortic dissection, acute myocardial infarction, pulmonary edema, hypertensive encephalopathy).
  - Treat other symptoms of stroke (e.g., headache, pain, agitation, nausea, vomiting).
  - Treat other acute complications of stroke, including hypoxia, increased intracranial pressure, seizures, or hypoglycemia.
- Systolic  $>220$  OR diastolic 121 – 140. Two options:
  - Option 1
    - Labetalol 10 – 20 mg IV for 1 – 2 min.
    - May repeat or double every 10 min. (max. dose 300 mg)
  - Option 2
    - Nicardipine 5 mg/h IV infusion as initial dose; titrate to desired effect by increasing 2.5 mg/h every 5 min. to max. of 15 mg/h.
    - Aim for a 10% – 15% reduction in blood pressure.
- Diastolic  $>140$ :
  - Nitroprusside 0.5 mcg/kg/min. IV infusion as initial dose with continuous blood pressure monitoring.
  - Aim for a 10% – 15% reduction in blood pressure.

#### **MGH hemorrhagic stroke guidelines**

- Blood pressure should be managed according to American Heart Association 2007 *Guidelines for the Management of Intracerebral Hemorrhage*. All patients who require treatment with continuous intravenous antihypertensive therapy should undergo urgent placement of an intra-arterial catheter for blood pressure monitoring and central venous catheter for central venous pressure monitoring as well as administration of IV antihypertensive medications. Once a physician determines that a patient requires treatment with IV antihypertensive therapy, he/she must designate an individual who will remain at the bedside and monitor effectiveness of therapy until blood pressure is controlled.

- Elevated blood pressure (suggested medications in approximate order of preference):
  - Labetalol: 5 – 100 mg/hr. by intermittent bolus doses of 10 – 40 mg or continuous drip (2 – 8 mg/min.)
  - Nicardipine: 5 mg/hr. increased by 2.5 mg/hr. q15 minutes to max. 15 mg/hr.
  - Esmolol: 250 mcg/kg as a load; maintenance use, 25 – 300 mcg/kg/min.
  - Enalapril: 0.625 – 5 mg IV Q6h.
  - Hydralazine: 5 – 20 mg IV Q30 min.
  - Nitroprusside: 0.1 – 10 mcg/kg/min.
- The following suggested algorithm is adapted from the AHA 2007 Guidelines for ICH:
  - If SBP is >200 mmHg or MAP is greater than 150 mmHg, then consider aggressive reduction of blood pressure with continuous intravenous infusion, with frequent blood pressure monitoring every five minutes.
  - If SBP is >180 mmHg or MAP is greater than 130 mmHg and there is evidence of or suspicion of elevated ICP, then consider monitoring ICP and reducing blood pressure using intermittent or continuous intravenous medications to keep cerebral perfusion pressure greater than 60 to 80 mmHg.
  - If SBP is >180 mmHg or MAP is greater than 130 mmHg and there is not evidence of or suspicion of elevated ICP, then consider a modest reduction of blood pressure (e.g., MAP of 110 mmHg or target blood pressure of 160/90 mmHg) using intermittent or continuous intravenous medications to control blood pressure.
  - Any clinical deterioration in association with reduction of BP should prompt reconsideration of ongoing BP management strategy.
- Hypotension
  - The etiology of hypotension must be established. Volume replenishment is the first approach. Isotonic saline or colloids can be used and monitored with central venous pressure. If CVP is normal or elevated in the setting of hypotension, then a pulmonary artery catheter should be placed to monitor pulmonary artery pressures. If hypotension persists after correction of volume deficit, continuous infusions of vasopressors should be considered, particularly for low systolic blood pressure such as less than 90 mmHg.

- Phenylephrine: 2 – 10 mcg/kg/min.
- Dopamine: 2 – 20 mcg/kg/min.
- Norepinephrine: 0.05 – 0.2 mcg/kg/min.

## **WOMEN**

Treating hypertensive women leads to a greater reduction in CVD as compared to men. A recently published study indicates that lowering systolic pressure by 15 mmHg in hypertensive women, reduced CVD by 40 per cent in women compared to 20 per cent in men.<sup>23</sup>

There are additional factors to consider with regard to blood pressure in certain groups of women.

### **Oral Contraceptives<sup>6,7</sup>**

- Monitor BP prior to usage then six monthly as combined oral contraceptives can raise BP levels.
- If already hypertensive, use POP (Progesterone Only Pill).
- Women over 35 years with other coexistent risk factors, e.g. smoking and migraine should not use the combined oral contraceptive.
- For women with stage 1 hypertension who wish to continue oral contraception, monitor BP, recommend salt restriction, and use antihypertensives. Combined oral contraceptives are contraindicated in women with Stage 2 hypertension.

### **Women on Hormone Replacement Therapy (HRT)<sup>6,7</sup>**

- HRT does not cause BP to rise so women with hypertension should not be denied access.

### **PREGNANT WOMEN<sup>6,7,24</sup>**

The following conditions do not necessarily follow a specific order. For example a pregnant woman can have pre-eclampsia and end up with HELLP or have pre-eclampsia and end up with eclampsia. Additionally, HELLP can occur after delivery.

- **Chronic hypertension** is defined as BP >140/90 before the 20th week of pregnancy, or if only measured after 20 weeks gestation, persisting six weeks post-partum.
- **Gestational hypertension** is defined as the development of hypertension in pregnancy without other signs of pre-eclampsia.
- **Pre-eclampsia** is usually diagnosed on the basis of hypertension with proteinuria. Proteinuria is defined as 300 mg/l protein, or 30 mg/mmol creatinine in a random specimen, or an excretion of 300 mg per 24 hr. Hypertension is defined as SBP >140 mmHg or DBP >90 mmHg after 20 weeks in a pregnant woman who was normotensive before 20 weeks gestation.

- **Pre-eclampsia superimposed on chronic hypertension** is regarded as highly likely in women with known hypertension who develop new proteinuria or in women with known hypertension and proteinuria who have sudden increases in BP or proteinuria, thrombocytopenia, or increases in hepatocellular enzymes.
- **HELLP Syndrome** (hemolysis, elevated liver enzymes, low platelet count). Symptoms are headache, nausea and vomiting that gets continuously worse, upper abdominal pain and vision problems.
- **Eclampsia** is often preceded by premonitory signs including headache, visual disturbances, and epigastric pain, constricting sensations in the thorax, apprehension, excitability, and hyperflexia. However, convulsions can occur suddenly and without warning in a seemingly stable patient with no apparent or only minimal elevations of BP.

Pregnant women with pre-eclampsia and hypertension should have their urine checked for protein in addition to vital signs performed at their visits. These patients should be monitored closely with the advice of an obstetrician.

### Treatment

The following drugs are commonly used to treat hypertension in pregnancy:

- Methyldopa first choice.
- CCB's (nifedipine/labetolol) are second choice in resistant hypertension especially in third trimester.
- Beta-blockers are not used because of the risk of intrauterine growth restriction.
- Thiazides are avoided due to potential to reduce circulatory blood volume.
- ACEI are avoided and discontinued in women who are planning pregnancy.
- Magnesium sulphate for pre-eclampsia/eclampsia.
- Low-dose aspirin for prevention is controversial.

## MEN

- Erectile dysfunction (ED) is increasingly more common in men over 50 and even more common if those who are hypertensive.
- Screen for ED annually or more frequently as required (Appendix V)
- A lower risk of ED was reported among men who were physically active, not obese, and non-smokers. Therefore, lifestyle modification should be encouraged to prevent ED.
- If ED appears after institution of antihypertensive drug therapy, the offending agent should be discontinued and treatment restarted with another agent.<sup>7</sup>

## **SENIORS**

- There is broad agreement that postural hypertension is far more prevalent in this population. To this end the following recommendations:
  - Lying, sitting and standing BP measurements are to be taken.
  - Treatment should be titrated to the standing value.
  - Restrict alcohol use.
- Isolated Systolic Hypertension is more prevalent in the elderly and should be treated to reduce risk of stroke.
  - SBP should be the target for diagnosis and management of HTN in the elderly.
- Comorbidities are common; therefore poly-pharmacy is an important factor to consider. Watch for:
  - Adverse drug reactions.
  - Drug interactions (e.g., NSAIDS).

## CHILDREN AND ADOLESCENTS

In children and adolescents BP is determined by body size and age. BP standards based on gender, age, and height provide a precise classification of BP according to body size. This approach avoids misclassifying children who are very tall or very short.

The information in this section is taken largely from The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents.<sup>10</sup>

### DEFINITION

Hypertension is defined as average SBP and/or diastolic BP (DBP) that is  $\geq$ 95th percentile for gender, age, and height on  $\geq$ 3 occasions.<sup>10</sup>

Blood Pressure Category	Definition
Normal	<90th percentile
<i>Pre-hypertension</i>	90th – 95th percentile or $>120/80$ mmHg
<b>Hypertension</b>	
Stage 1	95th – 99th percentile + 5 mmHg
Stage 2	$>$ 99th percentile + 5 mmHg

White-coat hypertension → 95% at physician office and normotensive outside clinical setting

### MEASUREMENT OF BP IN CHILDREN

All children  $>3$  years old who are seen in a medical setting should have their BP measured.<sup>10</sup>

- The preferred method is auscultation.
- Appropriate cuff size – the width of cuff bladder should be  $\frac{3}{4}$  of the length of upper arm. If high blood pressure obtained always verify the width of the cuff in relation to the length of upper arm by direct measurement. Also see the referred table.
- Use standard clinical sphygmomanometer, with bell of stethoscope placed over the brachial artery pulse, proximal and medial to the antecubital fossa, below the bottom edge of the cuff.
- Child should be in comfortable, relaxed position, and seated with his or her back supported, feet on the floor and right arm supported, and at the level of heart.
- Fifth Korotkoff sound defines diastolic BP.

- The right arm is preferred because of the possibility of coarctation of the aorta.

### **Conditions under Which Children <3 Years Old Should Have BP Measured<sup>10</sup>**

- History of prematurity, very low birth weight, or other neonatal complication requiring intensive care.
- Hypertension of placement of any indwelling umbilical catheters.
- Congenital heart disease (repaired or non-repaired).
- Recurrent urinary tract infections, haematuria, or proteinuria.
- Renal disease or urologic malformations.
- Solid-organ transplant.
- Malignancy or bone marrow transplant.
- Treatment with drugs known to raise BP.
- Other systemic illnesses associated with hypertension (neurofibromatosis, tuberous sclerosis, etc).
- Evidence of elevated intracranial pressure.

### **Recommended Dimensions for BP Cuff Bladders**

Age Range	Width, cm	Length, cm	Maximum Arm Circumference, cm*
Newborn	4	8	10
Infant	6	12	15
Child	9	18	22
Small adult	10	24	26

\*Calculated so that the largest arm would still allow the bladder to encircle arm by at least 80%.

*Source:* The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005. *The National Heart, Lung and Blood Institute Information Center.*

### **Blood Pressure Tables**

To accurately assess blood pressures in boys and girls it is recommended to use Tables 3 and 4 from the *Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents* (2005). These tables enable assessment of blood pressure levels by age and height percentile for boy and girls. The tables can be found in Appendices VI and VII (pages 62 – 65).

### **Using the BP Tables<sup>10</sup>**

1. Use the standard height charts to determine the height percentile.
2. Measure and record the child's SBP and DBP.
3. Use the correct gender table for SBP and DBP.
4. Find the child's age on the left side of the table. Follow the age row horizontally across the table to the intersection of the line for the height percentile (vertical column).
5. There, find the 50th, 90th, 95th, and 99th percentiles for SBP in the left columns and for DBP in the right columns.

## Classification of Hypertension in Children and Adolescents, with Measurement Frequency and Therapy Recommendation

	SBP or DBP Percentile*	Frequency of BP Measurement	Therapeutic Lifestyle Changes	Pharmacologic Therapy
Normal	<90th	Re-check at next scheduled physical examination	Encourage healthy diet, sleep, and physical activity	—
Pre-hypertension	90th to <95th or if BP exceeds 120/80 even if <90th percentile	Recheck in 6 months	Physical activity and diet management	None (unless history of chronic kidney disease, diabetes, heart failure, or LVH exist)
Stage 1 hypertension	95th–99th percentile plus 5 mmHg	Re-check in 1–2 weeks or sooner if symptomatic; if persistently elevated on 2 additional occasions, evaluate or refer to source of care within 1 month	Physical activity and diet management	Initiate therapy based on indications as above
Stage 2 hypertension	>99th percentile plus 5 mmHg	Refer to specialist within 1 week or immediately if the patient is symptomatic	Physical activity and diet management	Initiate therapy

*Source:* The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005. The National Heart, Lung and Blood Institute Information Center.

## Clinical Evaluation of Confirmed Hypertension

Study or Procedure	Purpose	Target Population
<b>Evaluation for identifiable causes</b>		
History: including sleep, family, risk factors, diet, and <b>Habits</b> : smoking and drinking alcohol;	History and physical examination help focus subsequent evaluation	All children with persistent BP $\geq 95^{\text{th}}$ percentile
<b>Physical examination</b>		
BUN, creatinine, electrolytes, urinalysis, and urine culture	R/O renal disease and chronic pyelonephritis	
CBC	R/O anemia, consistent with chronic renal disease	
Renal U/S	R/O renal scar, congenital anomaly, or disparate renal size	
<b>Evaluation for comorbidity</b>		
Fasting lipid panel	Identify hyperlipidemia, identify metabolic abnormalities	<ul style="list-style-type: none"> <li>Overweight patients with BP at 90th – 94th percentile</li> <li>All patients with BP <math>\geq 95^{\text{th}}</math> percentile</li> <li>Family history of hypertension or CVD</li> <li>Child with chronic renal disease</li> </ul>
Fasting glucose		
Drug screen	Identify substances that might cause hypertension	History suggestive of possible contribution by substances or drugs
Polysomnography	Identify sleep disorder in association with hypertension	History of loud, frequent snoring

Adapted from: The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005. The National Heart, Lung and Blood Institute Information Center.

Study or Procedure	Purpose	Target Population
<b>Evaluation for target-organ damage</b>		
Echocardiogram	Identify LVH and other indications of cardiac involvement. The presence of LVH is an indication to initiate or intensify antihypertensive therapy	<ul style="list-style-type: none"> <li>Patients with comorbid risk factors<sup>a</sup> and BP 90th – 94th percentile</li> <li>All patients with BP <math>\geq 95^{\text{th}}</math> percentile</li> </ul>
Retinal exam	Identify retinal vascular changes	
<b>Additional evaluation as indicated</b>		
ABPM	Identify white-coat hypertension, abnormal diurnal BP pattern BP load	<ul style="list-style-type: none"> <li>Patients in whom white-coat hypertension is suspected</li> <li>When other information on BP pattern is needed</li> </ul>
Plasma renin determination	Identify low renin, suggesting mineralocorticoid-related disease	<ul style="list-style-type: none"> <li>Young children with stage 1 hypertension</li> <li>Any child or adolescent with stage 2 hypertension</li> </ul>
Renovascular imaging <ul style="list-style-type: none"> <li>Isotopic scintigraphy (renal scan)</li> <li>MRA</li> <li>Duplex Doppler flow studies</li> <li>3-Dimensional CT</li> <li>Arteriography: DSA or classic</li> </ul>	Identify renovascular disease	<ul style="list-style-type: none"> <li>Positive family history of severe hypertension</li> </ul>
Plasma and urine steroid levels	Identify steroid-mediated hypertension	
Plasma and urine catecholamines	Identify catecholamine-mediated hypertension	

*Source:* The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. 2005. *The National Heart, Lung and Blood Institute Information Center.*

### **Indications for Antihypertensive Drug Therapy in Children<sup>10</sup>**

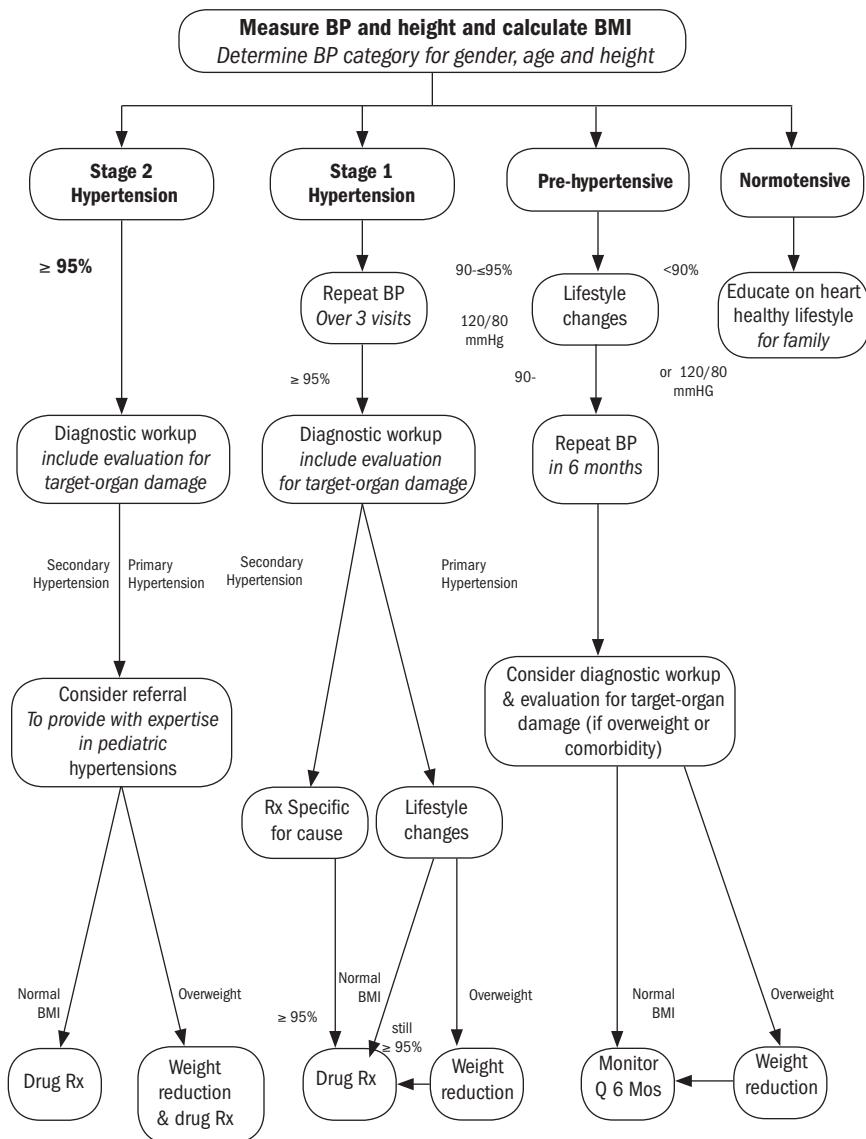
- Symptomatic hypertension
- Secondary hypertension
- Hypertensive target-organ damage
- Diabetes (types 1 and 2)
- Persistent hypertension despite non-pharmacologic measures

### **PHARMACOLOGIC THERAPY OF CHILDHOOD HYPERTENSION<sup>10</sup>**

The goal for antihypertensive treatment is reduction of BP to <95th percentile unless concurrent conditions are present, in which case BP should be lowered to <90th percentile.<sup>10</sup>

- Antihypertensive medications used are similar to adults but smaller in doses.
- ACE-inhibitors and ARBs are used only in children with diabetes, microalbuminuria, and proteinuric renal disease.
- ACE-inhibitors and ARBs should not be used during pregnancy and extreme caution should be taken in teenage girls with effective birth control methods.
- BBs and CCBs are used for children with hypertension and migraine headaches.
- If control is not achieved with 2-drugs consider secondary hypertension.
- Children should not be restricted from physical activity.

**ALGORITHM 4:**  
**MANAGEMENT OF CHILDREN WITH HYPERTENSION**



## **APPENDICES**

## **Appendix I**

Adoption of healthy lifestyles by all persons is critical for the prevention of hypertension and is an indispensable part of the management of those with hypertension.<sup>13</sup>

**For ongoing support and follow-up, consider referral to a lifestyle modification programme such as:**

- Bermuda Heart Foundation/CORE Centre  
87 Front Street (Entry off Chancery Lane)  
Hamilton, HM 12  
232-7812 or 232-CORE  
[www.mybermudaheart.bm](http://www.mybermudaheart.bm)
- CHIP (Coronary Health Improvement Program)/Lifestyle Medicine Institute, Inc., Loma Linda CA.  
Bermuda Directors:  
Pembroke – Pamela Greyson 236-8771 [pgreyson@logic.bm](mailto:pgreyson@logic.bm)  
Somerset – Chirleen Williams 238-3691 [lou@ibl.bm](mailto:lou@ibl.bm)  
Hamilton Parish – Mellonie Furbert 293-5168 [melhoney@logic.bm](mailto:melhoney@logic.bm)

**For support of patients who have undergone angioplasty, or bypass, or have had a heart attack refer to Cardiac Care Programme:**

- The Cardiac Care Programme, KEMH is a nurse-managed programme to assist patients in managing their heart disease at home. It is also a programme to help address risk factors associated with heart disease. Patients who have undergone angioplasty, or bypass, or have had a heart attack should be referred by their physician. Patients with no known heart disease but have risk factors for heart disease will also be accommodated. The Cardiac Care Programme work very closely with the Day Hospitals' Cardiac Exercise Programme to provide a complete Cardiac Rehabilitation Service.

Call Myrian Balitian-Dill, RN, MN, CCN(C) at 239-1219 for more information or e-mail us at [myrian.bakitian-dill@bhb.bm](mailto:myrian.bakitian-dill@bhb.bm)

**DASH diet: Guide to recommended servings**

The Dietary Approaches to Stop Hypertension (DASH) diet can help you control your blood pressure. The DASH diet is rich in grains, fruits, vegetables and low-fat dairy products. It limits fat, saturated fat and cholesterol and provides plenty of fibre, potassium, calcium and magnesium. The DASH diet also limits sodium to between 2,300 milligrams and 1,500 milligrams a day.

Here are the types and amounts of foods recommended in the DASH diet, along with specific examples of serving sizes. Use these details as you plan your own menus.

Food group	Servings for a 2,000-calorie-a-day diet	Servings for a 1,600-calorie-a-day diet	Examples of 1 serving
Grains (mainly whole grains)	<b>6 to 8 a day</b>	<b>6 a day</b>	1 slice whole wheat bread 1 ounce (oz.) dry cereal $\frac{1}{2}$ cup cooked cereal $\frac{1}{2}$ cup cooked rice or pasta $\frac{1}{2}$ English muffin or small bagel (2 oz.)
Fruits	<b>4 to 5 a day</b>	<b>4 a day</b>	$\frac{1}{2}$ cup (4 fluid oz.) 100% fruit juice 1 medium fruit $\frac{1}{2}$ cup fresh, frozen or canned fruit 1/4 cup dried fruit
Vegetables	<b>4 to 5 a day</b>	<b>3 to 4 a day</b>	$\frac{1}{2}$ cup (4 fluid oz.) low-sodium vegetable juice 1 cup raw leafy green vegetables $\frac{1}{2}$ cup cooked vegetables 1 small potato 1 sweet potato
Dairy foods (low-fat or fat-free)	<b>2 to 3 a day</b>	<b>2 to 3 a day</b>	1 cup (8 fluid oz.) milk 1 cup yogurt $1\frac{1}{2}$ oz. cheese

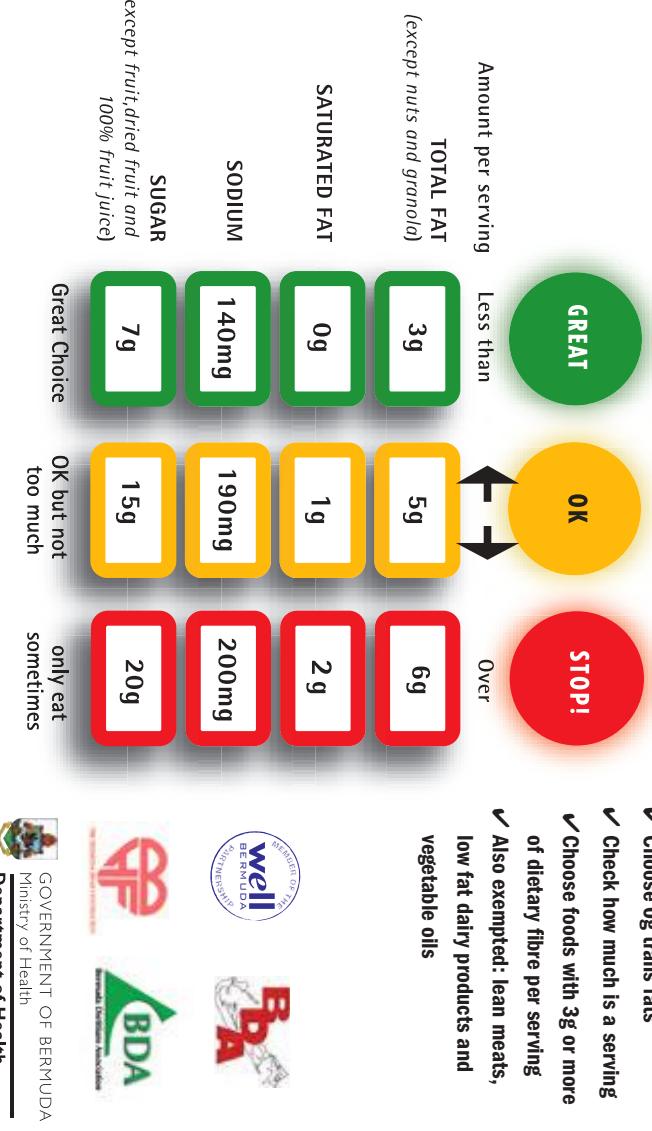
<b>Lean meats, poultry and fish</b>	<b>6 or fewer a day</b>	<b>3 to 6 a day</b>	1 oz. cooked lean meat, skinless poultry or fish 1 egg (no more than 4 a week) 2 egg whites
<b>Nuts, seeds and dry beans</b>	<b>4 to 5 a week</b>	<b>3 a week</b>	1/3 cup (1.5 oz.) nuts 2 tablespoons peanut butter 2 tablespoons (½ oz.) seeds ½ cup cooked dry beans or peas
<b>Fats and oils</b>	<b>2 to 3 a day</b>	<b>2 a day</b>	1 teaspoon soft margarine 1 tablespoon low-fat mayonnaise 2 tablespoons light salad dressing 1 teaspoon vegetable oil
<b>Sweets</b>	<b>5 or fewer a day</b>	<b>0</b>	1 tablespoon sugar 1 tablespoon jelly or jam ½ cup sorbet 1 cup (8 fluid oz.) sugar-sweetened lemonade

This plan is based on Your Guide to Lowering Your Blood Pressure with DASH by the National Heart, Lung, and Blood Institute. [http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new\\_dash.pdf](http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf). This information was accessed 18 March 2010 and adapted by Mayo Foundation for Medical Education and Research.

Ministry of Health  
**Department of Health**  
*Nutrition Services*

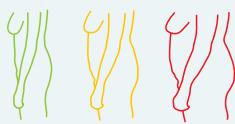
67 Victoria Street  
 P.O. Box HM 1195, Hamilton HM EX, Bermuda  
 Phone: (+1 441) 278-6467/68 • Fax: (+1 441) 292-7627  
 E-mail: [mlbfurbert@gov.bm](mailto:mlbfurbert@gov.bm)

# Check your food labels!



## Appendix IV

# HEALTHY LIVING GUIDE



IDEAL      MEDIUM      HIGH RISK



### YOUR WAIST SIZE

By measuring your waist circumference you can check if you have excess fat around your waist that can put your health at risk. Measure your waist size to see if you are within the recommended range.

To measure your waist size, place a tape measure around the narrowest point of your waist (between your lower ribs and your hip bone), breathe out and measure the circumference.

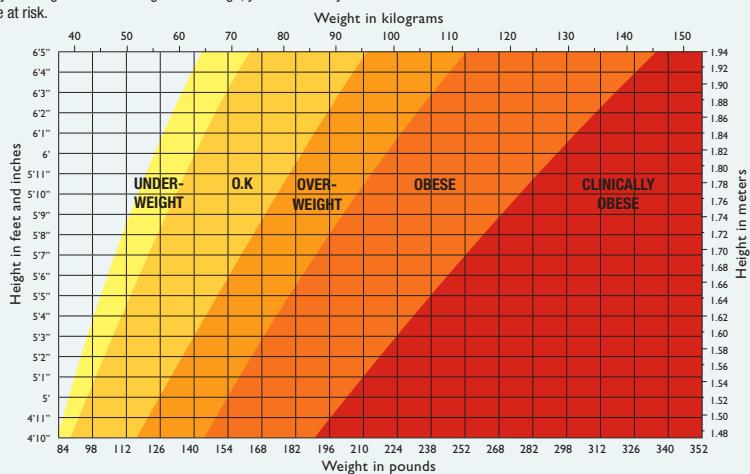
	Ideal to be below	Greatest risk if above
Women	32 inches	35 inches
Men	37 inches	40 inches

Speak to your doctor if you have any concerns

### BODY MASS INDEX (BMI)

Body Mass Index (BMI) is a quick way to check if you have a healthy body weight for height. Check your BMI in the graph below, and speak to your doctor if you have any concerns. If your weight is in the orange to red range, your health may be at risk.

However, BMI may not be accurate if you are an athlete or very muscular (muscle weighs more than fat.). Use BMI together with waist circumference to calculate your risk.



For personalised information go to • [www.cdc.gov/nccdphp/dnpa/bmi](http://www.cdc.gov/nccdphp/dnpa/bmi)

### Want personalised information ?

If you want more information to build a personal healthy living plan, try these reliable web sites:  
[www.mypyramid.gov](http://www.mypyramid.gov) • [www.eatwell.gov.uk](http://www.eatwell.gov.uk) • [www.nhsdirect.nhs.uk/magazine/interactive/calories](http://www.nhsdirect.nhs.uk/magazine/interactive/calories)  
[www.thecaloriecounter.com](http://www.thecaloriecounter.com) • [www.webmd.com](http://www.webmd.com)

## Appendix V

### SEXUAL HEALTH INVENTORY FOR MEN (SHIM)

PATIENT NAME: \_\_\_\_\_

TODAY'S DATE: \_\_\_\_\_

#### PATIENT INSTRUCTIONS

Sexual health is an important part of an individual's overall physical and emotional well-being. Erectile dysfunction, also known as impotence, is one type of very common medical condition affecting sexual health. Fortunately, there are many different treatment options for erectile dysfunction. This questionnaire is designed to help you and your doctor identify if you may be experiencing erectile dysfunction. If you are, you may choose to discuss treatment options with your doctor.

Each question has several possible responses. Circle the number of the response that **best describes** your own situation. Please be sure that you select one and only one response for **each question**.

#### OVER THE PAST 6 MONTHS:

1. How do you rate your confidence that you could get and keep an erection?		VERY LOW	LOW	MODERATE	HIGH	VERY HIGH
		1	2	3	4	5
2. When you had erections with sexual stimulation, how often were your erections hard enough for penetration (entering your partner)?	NO SEXUAL ACTIVITY	ALMOST NEVER OR NEVER	A FEW TIMES (MUCH LESS THAN HALF THE TIME)	SOMETIMES (ABOUT HALF THE TIME)	MOST TIMES (MUCH MORE THAN, HALF THE TIME)	ALMOST ALWAYS OR ALWAYS
	0	1	2	3	4	5
3. During sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?	DID NOT ATTEMPT INTERCOURSE	ALMOST NEVER OR NEVER	A FEW TIMES (MUCH LESS THAN HALF THE TIME)	SOMETIMES (ABOUT HALF THE TIME)	MOST TIMES (MUCH MORE THAN, HALF THE TIME)	ALMOST ALWAYS OR ALWAYS
	0	1	2	3	4	5
4. During sexual intercourse, how difficult was it to maintain your erection from completion of intercourse?	DID NOT ATTEMPT INTERCOURSE	EXTREMELY DIFFICULT	VERY DIFFICULT	DIFFICULT	SLIGHTLY DIFFICULT	NOT DIFFICULT
	0	1	2	3	4	5
5. When you attempted sexual intercourse, how often was it satisfactory for you?	DID NOT ATTEMPT INTERCOURSE	ALMOST NEVER OR NEVER	A FEW TIMES (MUCH LESS THAN HALF THE TIME)	SOMETIMES (ABOUT HALF THE TIME)	MOST TIMES (MUCH MORE THAN, HALF THE TIME)	ALMOST ALWAYS OR ALWAYS
	0	1	2	3	4	5

Add the numbers corresponding to questions 1-5.

TOTAL: \_\_\_\_\_

The Sexual Health Inventory for Men further classifies ED severity with the following breakpoints:

1-7 Severe ED

8-11 Moderate ED

12-16 Mild to Moderate ED

17-21 Mild ED

## Appendix VI

**Blood Pressure Levels for Boys by Age and Height Percentile**

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	80	81	83	85	87	88	89	34	35	36	37	38	39	39
	90th	94	95	97	99	100	102	103	49	50	51	52	53	53	54
	95th	98	99	101	103	104	106	106	54	54	55	56	57	58	58
	99th	105	106	108	110	112	113	114	61	62	63	64	65	66	66
2	50th	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	90th	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	95th	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	99th	109	110	111	113	115	117	117	66	67	68	69	70	71	71
3	50th	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	90th	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	95th	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	99th	111	112	114	116	118	119	120	71	71	72	73	74	75	75
4	50th	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	90th	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	95th	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	99th	113	114	116	118	120	121	122	74	75	76	77	78	78	79
5	50th	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	90th	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	95th	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	99th	115	116	118	120	121	123	123	77	78	79	80	81	81	82
6	50th	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	90th	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	95th	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	99th	116	117	119	121	123	124	125	80	80	81	82	83	84	84
7	50th	92	94	95	97	99	100	101	55	55	56	57	58	59	59
	90th	106	107	109	111	113	114	115	70	70	71	72	73	74	74
	95th	110	111	113	115	117	118	119	74	74	75	76	77	78	78
	99th	117	118	120	122	124	125	126	82	82	83	84	85	86	86
8	50th	94	95	97	99	100	102	102	56	57	58	59	60	60	61
	90th	107	109	110	112	114	115	116	71	72	72	73	74	75	76
	95th	111	112	114	116	118	119	120	75	76	77	78	79	79	80
	99th	119	120	122	123	125	127	127	83	84	85	86	87	87	88
9	50th	95	96	98	100	102	103	104	57	58	59	60	61	61	62
	90th	109	110	112	114	115	117	118	72	73	74	75	76	76	77
	95th	113	114	116	118	119	121	121	76	77	78	79	80	81	81
	99th	120	121	123	125	127	128	129	84	85	86	87	88	88	89
10	50th	97	98	100	102	103	105	106	58	59	60	61	61	62	63
	90th	111	112	114	115	117	119	119	73	73	74	75	76	77	78
	95th	115	116	117	119	121	122	123	77	78	79	80	81	81	82
	99th	122	123	125	127	128	130	130	85	86	86	88	88	89	90

## Blood Pressure Levels for Boys by Age and Height Percentile (Continued)

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
11	50th	99	100	102	104	105	107	107	59	59	60	61	62	63	63
	90th	113	114	115	117	119	120	121	74	74	75	76	77	78	78
	95th	117	118	119	121	123	124	125	78	78	79	80	81	82	82
	99th	124	125	127	129	130	132	132	86	86	87	88	89	90	90
12	50th	101	102	104	106	108	109	110	59	60	61	62	63	63	64
	90th	115	116	118	120	121	123	123	74	75	75	76	77	78	79
	95th	119	120	122	123	125	127	127	78	79	80	81	82	82	83
	99th	126	127	129	131	133	134	135	86	87	88	89	90	90	91
13	50th	104	105	106	108	110	111	112	60	60	61	62	63	64	64
	90th	117	118	120	122	124	125	126	75	75	76	77	78	79	79
	95th	121	122	124	126	128	129	130	79	79	80	81	82	83	83
	99th	128	130	131	133	135	136	137	87	87	88	89	90	91	91
14	50th	106	107	109	111	113	114	115	60	61	62	63	64	65	65
	90th	120	121	123	125	126	128	128	75	76	77	78	79	79	80
	95th	124	125	127	128	130	132	132	80	80	81	82	83	84	84
	99th	131	132	134	136	138	139	140	87	88	89	90	91	92	92
15	50th	109	110	112	113	115	117	117	61	62	63	64	65	66	66
	90th	122	124	125	127	129	130	131	76	77	78	79	80	80	81
	95th	126	127	129	131	133	134	135	81	81	82	83	84	85	85
	99th	134	135	136	138	140	142	142	88	89	90	91	92	93	93
16	50th	111	112	114	116	118	119	120	63	63	64	65	66	67	67
	90th	125	126	128	130	131	133	134	78	78	79	80	81	82	82
	95th	129	130	132	134	135	137	137	82	83	83	84	85	86	87
	99th	136	137	139	141	143	144	145	90	90	91	92	93	94	94
17	50th	114	115	116	118	120	121	122	65	66	66	67	68	69	70
	90th	127	128	130	132	134	135	136	80	80	81	82	83	84	84
	95th	131	132	134	136	138	139	140	84	85	86	87	87	88	89
	99th	139	140	141	143	145	146	147	92	93	93	94	95	96	97

BP, blood pressure

\* The 90th percentile is 1.28 SD, 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

For research purposes, the standard deviations in Appendix Table B-1 allow one to compute BP Z-scores and percentiles for boys with height percentiles given in Table 3 (i.e., the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles). These height percentiles must be converted to height Z-scores given by (5% = -1.645; 10% = -1.28; 25% = -0.68; 50% = 0; 75% = 0.68; 90% = 1.28%; 95% = 1.645) and then computed according to the methodology in steps 2-4 described in Appendix B. For children with height percentiles other than these, follow steps 1-4 as described in Appendix B.

## Appendix VII

**Blood Pressure Levels for Girls by Age and Height Percentile**

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		← Percentile of Height →							← Percentile of Height →						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
1	50th	83	84	85	86	88	89	90	38	39	39	40	41	41	42
	90th	97	97	98	100	101	102	103	52	53	53	54	55	55	56
	95th	100	101	102	104	105	106	107	56	57	57	58	59	59	60
	99th	108	108	109	111	112	113	114	64	64	65	65	66	67	67
2	50th	85	85	87	88	89	91	91	43	44	44	45	46	46	47
	90th	98	99	100	101	103	104	105	57	58	58	59	60	61	61
	95th	102	103	104	105	107	108	109	61	62	62	63	64	65	65
	99th	109	110	111	112	114	115	116	69	69	70	70	71	72	72
3	50th	86	87	88	89	91	92	93	47	48	48	49	50	50	51
	90th	100	100	102	103	104	106	106	61	62	62	63	64	64	65
	95th	104	104	105	107	108	109	110	65	66	66	67	68	68	69
	99th	111	111	113	114	115	116	117	73	73	74	74	75	76	76
4	50th	88	88	90	91	92	94	94	50	50	51	52	52	53	54
	90th	101	102	103	104	106	107	108	64	64	65	66	67	67	68
	95th	105	106	107	108	110	111	112	68	68	69	70	71	71	72
	99th	112	113	114	115	117	118	119	76	76	76	77	78	79	79
5	50th	89	90	91	93	94	95	96	52	53	53	54	55	55	56
	90th	103	103	105	106	107	109	109	66	67	67	68	69	69	70
	95th	107	107	108	110	111	112	113	70	71	71	72	73	73	74
	99th	114	114	116	117	118	120	120	78	78	79	79	80	81	81
6	50th	91	92	93	94	96	97	98	54	54	55	56	56	57	58
	90th	104	105	106	108	109	110	111	68	68	69	70	70	71	72
	95th	108	109	110	111	113	114	115	72	72	73	74	74	75	76
	99th	115	116	117	119	120	121	122	80	80	80	81	82	83	83
7	50th	93	93	95	96	97	99	99	55	56	56	57	58	58	59
	90th	106	107	108	109	111	112	113	69	70	70	71	72	72	73
	95th	110	111	112	113	115	116	116	73	74	74	75	76	76	77
	99th	117	118	119	120	122	123	124	81	81	82	82	83	84	84
8	50th	95	95	96	98	99	100	101	57	57	57	58	59	60	60
	90th	108	109	110	111	113	114	114	71	71	71	72	73	74	74
	95th	112	112	114	115	116	118	118	75	75	75	76	77	78	78
	99th	119	120	121	122	123	125	125	82	82	83	83	84	85	86
9	50th	96	97	98	100	101	102	103	58	58	58	59	60	61	61
	90th	110	110	112	113	114	116	116	72	72	72	73	74	75	75
	95th	114	114	115	117	118	119	120	76	76	76	77	78	79	79
	99th	121	121	123	124	125	127	127	83	83	84	84	85	86	87
10	50th	98	99	100	102	103	104	105	59	59	59	60	61	62	62
	90th	112	112	114	115	116	118	118	73	73	73	74	75	76	76
	95th	116	116	117	119	120	121	122	77	77	77	78	79	80	80
	99th	123	123	125	126	127	129	129	84	84	85	86	86	87	88

## Blood Pressure Levels for Girls by Age and Height Percentile (Continued)

Age (Year)	BP Percentile ↓	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		↔ Percentile of Height →						↔ Percentile of Height →							
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
11	50th	100	101	102	103	105	106	107	60	60	60	61	62	63	63
	90th	114	114	116	117	118	119	120	74	74	74	75	76	77	77
	95th	118	118	119	121	122	123	124	78	78	78	79	80	81	81
	99th	125	125	126	128	129	130	131	85	85	86	87	87	88	89
12	50th	102	103	104	105	107	108	109	61	61	61	62	63	64	64
	90th	116	116	117	119	120	121	122	75	75	75	76	77	78	78
	95th	119	120	121	123	124	125	126	79	79	79	80	81	82	82
	99th	127	127	128	130	131	132	133	86	86	87	88	88	89	90
13	50th	104	105	106	107	109	110	110	62	62	62	63	64	65	65
	90th	117	118	119	121	122	123	124	76	76	76	77	78	79	79
	95th	121	122	123	124	126	127	128	80	80	80	81	82	83	83
	99th	128	129	130	132	133	134	135	87	87	88	89	89	90	91
14	50th	106	106	107	109	110	111	112	63	63	63	64	65	66	66
	90th	119	120	121	122	124	125	125	77	77	77	78	79	80	80
	95th	123	123	125	126	127	129	129	81	81	81	82	83	84	84
	99th	130	131	132	133	135	136	136	88	88	89	90	90	91	92
15	50th	107	108	109	110	111	113	113	64	64	64	65	66	67	67
	90th	120	121	122	123	125	126	127	78	78	78	79	80	81	81
	95th	124	125	126	127	129	130	131	82	82	82	83	84	85	85
	99th	131	132	133	134	136	137	138	89	89	90	91	91	92	93
16	50th	108	108	110	111	112	114	114	64	64	65	66	66	67	68
	90th	121	122	123	124	126	127	128	78	78	79	80	81	81	82
	95th	125	126	127	128	130	131	132	82	82	83	84	85	85	86
	99th	132	133	134	135	137	138	139	90	90	90	91	92	93	93
17	50th	108	109	110	111	113	114	115	64	65	65	66	67	67	68
	90th	122	122	123	125	126	127	128	78	79	79	80	81	81	82
	95th	125	126	127	129	130	131	132	82	83	83	84	85	85	86
	99th	133	133	134	136	137	138	139	90	90	91	91	92	93	93

BP, blood pressure

\* The 90th percentile is 1.28 SD, 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.

For research purposes, the standard deviations in Appendix Table B-1 allow one to compute BP Z-scores and percentiles for girls with height percentiles given in Table 4 (i.e., the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles). These height percentiles must be converted to height Z-scores given by (5% = -1.645; 10% = -1.28; 25% = -0.68; 50% = 0; 75% = 0.68; 90% = 1.28%; 95% = 1.645) and then computed according to the methodology in steps 2–4 described in Appendix B. For children with height percentiles other than these, follow steps 1–4 as described in Appendix B.

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