GUIDELINES FOR
BLOOD PRESSURE MONITORING AND EDUCATION
THROUGH NOVA SCOTIA DIABETES CENTRES

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INTRODUCTION

This paper discusses the Diabetes Care Program of Nova Scotia (DCPNS) recommendations regarding implementation of standard blood pressure measuring, recording, reporting, and educational initiatives for persons attending Diabetes Centres (DCs) in Nova Scotia (NS). These recommendations support the self-management component of the chronic care model in keeping with chronic disease management and are consistent with national guidelines.

Hypertension is a significant problem for residents of Nova Scotia; and most specifically those living with diabetes. Rates of hypertension in persons with diabetes are more than twice that of the general population and affects all age groups. Younger age groups are affected disproportionately as compared to similar age groups in the general population. Gender and ethnic differences highlight the need for gender and culturally appropriate screening, education, and management. Higher rates of hypertension in persons of Aboriginal, African, and South Asian descent increase the risks for cardiovascular disease and stroke in these populations. In persons with diabetes, hypertension represents a significant problem contributing to the development and progression of a number of diabetic complications including among others cardiovascular disease, retinopathy, and nephropathy.

For hypertension to be detected, it must be accurately measured. Blood pressure is measured routinely in all persons attending NS DCs. Recent analysis of DCPNS Registry data (2007) indicated on average 50% of adult follow-up cases with Type 1 and 2 diabetes attending DCs had blood pressure within target (<130/80 mmHg). This is markedly improved from DCPNS survey data taken from 2000/01; when only 26% had blood pressure values within the 1998 recommended target (≤130/85 mm Hg). The current 2008 Canadian Diabetes Association (CDA) Clinical Practice Guidelines blood pressure target remains unchanged from the 2003 guidelines of < 130/80 mm Hg.

Diabetes educators should promote early and more aggressive management of blood pressure in persons with diabetes through a focus on lifestyle and modifiable risk factors. Hypertension requires the same degree of emphasis as that placed on glycemic control.

This guideline document makes recommendations for diabetes educators in NS DCs to measure and record blood pressure at each patient visit, report results to care providers, and work with these providers to develop individualized plans for those whose blood pressure remains above target values. It is also recommended DCs have a variety of cuff sizes and electronic blood pressure monitors available to accurately measure and to help standardize blood pressure collection. Although there are costs involved in purchasing equipment, the potential of intensifying blood pressure management will save the system greatly by decreasing diabetes complications and associated morbidities.

A multidisciplinary approach including culturally appropriate lifestyle modifications and ethnicity specific community based programs are effective in reducing blood pressure and cardiovascular risk. The effects of hypertension can be reduced by programming that targets a healthy diet (respectful of cultural food preferences), physical activity, smoking cessation, reductions in dietary sodium, and stress management. Programs should consider various learning styles, language and education levels; and incorporate local traditions, and culture. DCPNS continues to stress the importance of lifestyle interventions. Self-management of hypertension as part of chronic disease management is strongly encouraged. The DCPNS will continue to support and assist DC staff in collecting and analyzing blood pressure data and support initiatives aimed at hypertension management.
LITERATURE REVIEW

Introduction

Hypertension is a common but challenging comorbid condition in diabetes. The World Health Organization identifies hypertension as one of the most significant, preventable causes of premature morbidity and mortality in developed countries. Higher rates of hypertension in persons of Aboriginal, African, and South Asian descent increase the risks of cardiovascular disease and stroke in these populations. Systolic blood pressure increases with age in both men and women and in most ethnic groups.

Magnitude of the Problem in Nova Scotia and Canada

Hypertension is reported in 28% of Nova Scotian residents, aged 20+. It is slightly higher in females as compared to males in all age categories and varies by age group; peaking in the 75+ age groups at over 75%. In persons with diabetes, close to 70% have hypertension. Again, rates are higher in females than males across all age categories. Hypertension rates reach over 85% in females with diabetes between the ages of 70-79 and ≥ age 85. In younger age groups, 30-39 and 40-49, hypertension is present in 27% and 44%, respectively.

Hypertension continues to be a leading cause of cardiovascular morbidity and mortality, and recommended blood pressure levels are seldom achieved. The Hypertension Optimal Treatment (HOT) trial indicates less than 30% of hypertensive patients have their blood pressure <140/90 mm Hg. In the Canadian Heart Health Survey 43% of people (ages 18-74 years) had an optimal blood pressure (<120/80 mm Hg); and of those with a diagnosis of hypertension, only 13% were below target (defined as 140/90 mm Hg). A 1999 study found 57% of men and 42% of women in Halifax County diagnosed with hypertension did not have adequately controlled blood pressure. Recent analysis of DCPNS Registry data (2007) indicated on average 50% of adult follow-up cases with Type 1 and 2 diabetes attending DCs had blood pressure within target (<130/80 mmHg). Hypertensive medications were used in 80% of these cases.

Risk Factors

There are notable gender differences in diagnosis, treatment and control of hypertension. Blood pressure is not regularly measured in those that are male, of a younger age, have no family doctor, are of a visible minority ethnic background or are of Aboriginal descent. The Canadian Heart Health Survey showed men aged 18 to 34 years old had the highest rate of never having their blood pressure measured. As well, close to 50% of Canadians with known hypertension aged 20 to 39 years were not on antihypertensive medication, regardless of the number of other risk factors. Women who are aware and treated for hypertension are less likely to reach target blood pressure control as compared to men.

As well, people of African descent are more likely to have hypertension, and more likely to receive drug therapy; but less likely to achieve blood pressure control as compared to the Caucasian population. People of African or South Asian descent are 3 times more likely to have hypertension than Caucasian people. As well, people of South Asian descent are Canada’s fastest growing immigrant population. People of African descent have higher rates of morbidity and mortality from diabetes as compared to the general population. Persons of African decent respond better to thiazide, thiazide-like diuretics or calcium channel blockers than to beta blockers, ACE inhibitors or angiotension receptor blockers.
Hypertension and Cardiovascular Disease

Hypertension is a significant risk factor for cardiovascular disease and the microvascular complications of diabetes. Cardiovascular disease rates are 2 to 4 times higher in persons with diabetes than in matched non-diabetes populations. Microvascular complications lead to significant morbidity and mortality; however, the greatest cause of death in people with diabetes is CVD. The HOT trial reports for people aged 40 to 70 years, that for each incremental increase of 20mm Hg in systolic BP or 10 mm Hg in diastolic BP there is a doubling effect of risk for CVD. Up to 80% of people with Type 2 diabetes will develop or die of macrovascular disease. However, clinical trials of blood pressure control in diabetes have shown a dramatic effect in preventing such serious outcomes. The HOT trial indicates a diastolic blood pressure target of 80 mm Hg significantly reduced risk for cardiovascular death and major cardiovascular events compared to a target of 90 mm Hg.

Hypertension and Diabetes Mellitus

The United Kingdom Prospective Diabetes Study (UKPDS) clearly demonstrated the need for tight control of blood pressure in persons with Type 2 diabetes. In this study, “tight” blood pressure control reduced the risk of multiple diabetes endpoints: 32% decrease in deaths related to diabetes; 44% decreased risk of stroke; and a 34% decrease in risk of all macrovascular diseases; as well as, a significant decrease in the development of retinopathy and proteinuria. This landmark study changed the emphasis of focusing mainly on glycemic control to prevent diabetes complications to a combined metabolic and cardiovascular risk factor control.

The UKPDS 10-year follow up established early intensive blood glucose control in people with Type 2 diabetes has sustained and significant effects not only for major diabetes end points; but also for risk on myocardial infarction and death from any cause. This large post trial study demonstrated a 13% reduction in all-cause mortality and a 15% reduction in MI; as well as, a significant decline in microvascular disease.

The ADVANCE trial clearly established a systolic blood pressure goal of 135mm Hg for people with Type 2 diabetes. In this recent study tight systolic blood control showed a 14% reduction in total mortality, a 18% reduction in cardiovascular death and a 14% reduction in total coronary events; as well as, a significant decline in total renal events.

Hypertension in children and youth with diabetes

In children and youth, hypertension with the presence of any comorbidity associated with hypertension increases the potential risk for cardiovascular disease and microvascular disease, particularly diabetic nephropathy. Approximately 16% of adolescents with type 1 diabetes have hypertension. As in hypertension among adults, effective treatment of hypertension among children and youth includes culturally appropriate lifestyle modifications, incorporating individual and family education; and may require antihypertensive medication.
Conclusion

Hypertension has historically been inadequately controlled in NS. Lowering blood pressure adequately can significantly reduce diabetes related macro and microvascular complications. This concern becomes even greater as the rates of Type 2 diabetes are projected to continue to rise.

Traditional health care programs often lack culture relevance or culturally appropriate approaches, education techniques, and support. When designing any community based program, community traditions, cultural dynamics and influence on the management of chronic disease needs to be considered. The influences of ethnic disparity in hypertension may include socioeconomic resources, health literacy, and barriers to accessing care.

The 2008 CDA Clinical Practice Guidelines17 and the 2009 Canadian Hypertension Education Program Guidelines30 have made clear and consistent evidence-based recommendations. Diabetes educators, working in a patient-centered team, aiming to lower blood pressure values to target should evaluate blood pressure in an accurate, standard way and report the values to physicians. It will be important to track blood pressure values aggregately to determine the need for targeted population interventions. “A multifaceted, comprehensive approach is proposed because there is no one intervention that will accomplish the goal of improving the health of Canadians through high blood pressure prevention and control.”31
RECOMMENDATIONS

The following are recommendations to assist with blood pressure monitoring and education through NS DCs:

1. Diabetes educators should measure the blood pressure of all adults seen in their DC at every visit following standard technique (see Appendix 1). Blood pressure should be measured and recorded at least twice annually in children and adolescents with diabetes.

2. Diabetes educators should report blood pressure findings to the referring care provider responsible for the management of the individual’s hypertension. Highly elevated values should be reported by phone/fax (see Appendix 2 and 3 for BP action algorithm). For the pediatric population, the report should include the blood pressure value and document whether the value (systolic or diastolic) is above or below 90th percentile (see Appendix 4 for pediatric percentile tables).

3. Diabetes educators should provide written and verbal blood pressure results to all persons with diabetes attending the DC. These results should be provided on a standardized tool (see Appendix 5 and 6 for sample forms) and be accompanied by recommended target goal. Where possible, goal setting and action plans should address modifiable risk factors for blood pressure management.

4. A variety of cuff sizes should be available in DCs to fit all arm sizes to accurately measure blood pressure in all persons; including child cuff sizes, if applicable (See Appendix 1.)

5. DCs should use electronic blood pressure measuring devices for use to improve consistency, efficacy, and accuracy in blood pressure measurement, as well as standardize data collection.**

6. Servicing/calibration of blood pressure machines by biomedical engineers must be done routinely (as per facility/district Quality Assurance standards) to ensure reliability.

7. Adult persons with diabetes should be allowed to measure and record their own blood pressure using electronic blood pressure measuring devices during their DC visit as a means of encouraging self-care.

8. All DCs should incorporate a community-based, culturally appropriate blood pressure education module focused on patient self-care, emphasizing appropriate lifestyle modification and community supports. As a part of a chronic disease management approach, this should be delivered at both facility and community levels.

9a. Diabetes educators will review aggregate blood pressure values from the DCPNS Registry data or other audit sources at least annually, reflective of age, gender, and ethnicity, where possible.

9b. Results of blood pressure audit will be reported annually to the DC manager, referring care providers, and district senior management team.

9c. When indicated, additional program interventions and approaches should be implemented to improve population blood pressure values.
10. In persons with diabetes where blood pressure values remain above target, diabetes educators will initiate a refined case management approach and communicate (see Appendix 2 and 3 for BP action algorithm) with the primary care provider or specialist and other team members to develop an individualized care plan.

11. Diabetes educators should form partnerships with groups or services in the facility or community to introduce blood pressure initiatives. Persons with diabetes should be provided with information on resources available to assist them with their blood pressure management.

*As per the CDA 2008 Clinical Practice Guidelines. 17

**As of April 2009, the approximate cost for an electronic measuring device, stand, and three cuffs of varying sizes was $1,500 to $2,500. (Prices quoted in Tridistrict Health Authority 1, 2 & 3 Western region of Nova Scotia.)
RATIONALE

The following are rationale for implementing the guidelines for blood pressure monitoring and education in NS DCs:

- These guidelines conform to the CDA Clinical Practice Guidelines\textsuperscript{17}, as well as the Canadian Hypertension Education Program Guidelines\textsuperscript{25}.

- If treatment is effective, there is potential for decreasing the risk of cardiovascular disease and preventing or slowing the progression of diabetic nephropathy and retinopathy; thus reducing costs to the individual and the health care system.

- If hypertension is detected and routinely reported then treatment by non-pharmacologic and pharmacologic means will be started at an appropriate time. In the former, diabetes educators can play a major role in facilitating lifestyle change through individual and group education focused on understanding blood pressure, its management, and self-care.

- Blood pressure data can be captured and trends monitored to assess effectiveness and target further initiatives where necessary.

- By becoming aware of hypertension and the various treatment modalities, the person can be more engaged in the management of this modifiable cardiovascular risk factor.

- There are opportunities to have cost savings, through partnerships and integration across chronic disease management programs.

- These revised guidelines build on best practice guidelines previously recommended in 2004; therefore, minimal changes to the operation of the Diabetes Centre may be required to implement these guidelines.

It is noted there is cost involved in purchasing blood pressure machines and cuffs in various sizes; as well, as space required for self-assessment of blood pressure.
REFERENCES


APPENDIX 1

PRACTICAL GUIDELINES FOR MONITORING BLOOD PRESSURE IN DC

The recommended technique for measurement of blood pressure, according to the 2009 Canadian Hypertension Education Program Recommendations is outlined below:

- Have the patient sit calmly for at least 5 minutes, his or her back well supported, and bare arm supported at the level of the heart. Feet should be flat on the floor and legs should not be crossed. The patient should be instructed not to talk prior to and during the procedure.

- Use a validated electronic device, a recently calibrated aneroid or a mercury manometer.

- Select an appropriate cuff size (see Table 1). The inflatable bladder must go around the arm and cover 80%-100% of the cuff circumference. The width of the cuff must be at least 40% of the circumference of the arm. Position the centre of the inflatable bladder directly over the brachial artery 3 cm above the antecubital fossa.

- For assessment by auscultation:
  - Inflate the cuff rapidly to 30 mmHg over systolic pressure, identified by the disappearance of the radial pulse. Stethoscope is placed over the brachial artery.
  - Deflate cuff 2 mmHg per second or heartbeat.
  - Note the systolic pressure at first appearance of a clear tapping sound (phase I of Korotkoff).
  - Note the diastolic value when the repeating sound disappears (phase V of Korotkoff). However, for children, the recommendation is to hold until phase IV when the sounds are muffled. For patients in whom the sound does not disappear, use phase IV as the reference. Record the blood pressure to the nearest 2 mmHg.
  - If inflation is required again, deflate quickly and wait 60 seconds to eliminate venous congestion as a source of reading errors.
  - If the Korotkoff sounds are weak, ask the patient to raise his or her arm and flex and extend his or her hand five to ten times; a new reading can be taken once the arm has been lowered.
  - Blood pressure should be taken in both arms on at least one visit and if one arm has a consistently higher pressure, that arm should be used for BP measurement. When recording blood pressure, document the arm used for measurement.
  - Take two blood pressure measurements 1 minute apart; additional measurements if the first two differ considerably.

Reference:
Table 1: Recommended Cuff Dimensions Based on Arm Circumference

<table>
<thead>
<tr>
<th>Circumference of Adult Arm (cm)</th>
<th>Size of Cuff (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 to 26</td>
<td>9 x 18 (standard child’s model/ small adult)</td>
</tr>
<tr>
<td>26 up to 33</td>
<td>12 x 23 (standard adult model)</td>
</tr>
<tr>
<td>33 up to 41</td>
<td>15 x 33 (large)</td>
</tr>
<tr>
<td>More than 41</td>
<td>18 x 36 (extra large/ thigh/ obese adult)</td>
</tr>
</tbody>
</table>

Reference:

The seated blood pressure is used to determine and monitor treatment decisions. The standing blood pressure is used to test for postural hypotension.
NOTE:

- Encourage follow up with family physician for any elevated BP values.
- Provide reassurance to patient if BP values elevated; avoid alarming patient.
- *Symptoms may include (but are not limited to) headache, blurred vision, confusion, shortness of breath, chest pain, severe anxiety, nausea/vomiting.
- According to the Canadian Hypertension Society, hypertensive crisis is rare and BP values are usually \( \geq 210/120 \text{ mmHg} \).

Differing reporting values may be determined at the facility or district level. These values should be shared with local physicians.

**Value derived from Canadian Hypertension Society classification of “severe hypertension” and the Mayo Clinic definition of extremely high blood pressure.

APPENDIX 3

DIABETES CENTRE PEDIATRIC POPULATION ACTION ALGORITHM

Measure height and weight and calculate BMI and weight/height percentiles. Obtain blood pressure (BP) measurement – BP goal based on Pediatric Blood Pressure Tables (see Appendix 4)

GOAL
< 90th %ile or < 120/80 mmHg

YES
< 90th %ile or < 120/80 mmHg

NO
> 90th %ile or > 120/80 mmHg

Repeat BP measurement 2 times with auscultation, obtain new %ile from average

NORMOTENSIVE

Prehypertensive
< 95th %ile, but > 90th %ile or 120/80 mmHg

Stage 1 Hypertensive
> 95th %ile, to 5 mmHg above 99th %ile

Stage 2 Hypertensive
> 5 mmHg above 99th %ile or Persistent Stage 1

• Repeat BP next visit.
• Record in care provider report.

• Repeat BP in 6 months by care provider.
• Record in care provider report.

• Repeat BP 2 x within one month by care provider.
• Record in care provider report.

• Phone or fax care provider.
• Recommend a complete diagnostic work up.

Encourage Healthy Lifestyle

Therapeutic Lifestyle

NOTE:
• Encourage follow up with family physician for any elevated BP values.
• Provide reassurance to patient if BP values elevated; avoid alarming patient.
• *Normal BP in pediatrics is defined as BP < 90th %ile or < 120/80 and varies by age, gender, and height. See Appendix 4 for Pediatric Blood Pressure Tables.
• ** Therapeutic Lifestyle Changes: Weight Reduction; Regular Physical Activity; Nutrition Modification; Family-based intervention

APPENDIX 4

PEDIATRIC BLOOD PRESSURE TABLES

How to Use the Pediatric Blood Pressure Tables

- Use the standard height charts to determine the height percentile.
- Measure and record the child’s systolic and diastolic blood pressure.
- Locate the correct gender table.
- 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).
- Find the 50th, 90th, 95th blood pressure readings for systolic and diastolic blood pressure.
  - Blood pressure < 90th percentile is normal
  - Blood pressure between the 90th and 95th percentile is prehypertension
- In adolescents, blood pressure ≥120/80 mm Hg is prehypertension, even if this figure is < 90th percentile.
  - Blood pressure > 95th percentile may be hypertension.
- If the blood pressure is > 90th percentile, the blood pressure should be repeated twice at the same office visit, and an average systolic and diastolic blood pressure should be used.

Reference:
**Blood Pressure Values for Boys by Age and Height Percentile**

<table>
<thead>
<tr>
<th>Age, y</th>
<th>BP Percentile</th>
<th>SBP, mm Hg</th>
<th>DBP, mm Hg</th>
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**NOTE:** If either systolic or diastolic above 90th percentile or >120/80, BP is considered elevated and a repeat measure is needed.

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Guidelines for Blood Pressure Management and Education

DCPNS October 2009
### Blood Pressure Values for Girls by Age and Height Percentile

<table>
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<th>Age, y</th>
<th>BP Percentile</th>
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