

SCREENING AND PREVENTION

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ABSTRACT

Hypertension is a leading risk factor for stroke, congestive heart failure, coronary heart disease, ruptured aortic aneurysm, retinopathy, and renal disease. Adults aged 18 years and older who are at high risk for hypertension should be screened. These include those with high normal blood pressure, a family history of hypertension, overweight or obesity, a sedentary lifestyle, excess intake of dietary sodium, insufficient intake of potassium, or excess consumption of alcohol. Screening is done opportunistically and the timing of subsequent check-ups will depend on the blood pressure at the initial check. The issues in prevention are the need to recognize many are undiagnosed; there is a need to change the mindset of individuals towards adopting preventive measures; the use of all opportunities to check the blood pressure; and a system for follow-up. The six intensive targeted strategies to prevent high blood pressure in those at risk of hypertension are: exercise, weight loss, alcohol containment, sodium regulation in the diet, potassium regulation, and adopting a DASH (Dietary Approaches to Stop Hypertension) eating plan.

INTRODUCTION

This study unit will cover

- κ Screening for Hypertension
- κ Issues in Prevention
- κ Non-pharmacological treatment

SCREENING FOR HYPERTENSION

Justification for screening

- κ Hypertension has been shown to be a leading risk factor for stroke, congestive heart failure, coronary heart disease, ruptured aortic aneurysm, retinopathy, and renal disease (USPSTF, 1996).
- κ Effective treatments are available
 - Treatment for blood pressure has contributed to a 59% reduction in age-adjusted stroke mortality and a 50% reduction in mortality from coronary artery disease since 1972 in the United States (U.S. Department of Health and Human Services, Public Health Service, 1998).
 - Meta-analyses of hypertension treatment trials suggest that the greatest benefit is from reductions in cerebrovascular mortality but there have been large reductions in coronary heart disease mortality too.

The Singapore National Health Survey conducted in 1998, showed that hypertension is on the rise. In 1992, 22.2% of adults in Singapore were hypertensive. In 1998, the figure rose to 97.3% (MOH, 1999). The financial and social burden in terms of direct and indirect costs of subsequent morbidity and mortality is likely to be substantial. Because of the enormity of the disease morbidity and the proven treatment benefits, it is necessary for attending physicians to be diligent in opportunistic screening activities, diagnosis and institution of appropriate blood pressure control treatment.

Who to screen and when to screen?

Adults

The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, in its 6th report (JNC6), had the following recommendations for adults:

- κ Screening blood pressure measurement should be obtained from any patient 18 years of age or older when first seen and also at every health care encounter
- κ A diagnosis of hypertension is not typically made based on the first elevated blood pressure reading. Wide fluctuations in readings are common, even in normotensive individuals
- κ After any elevated reading, a second measurement should be performed during the same patient visit
- κ Elevated blood pressure readings should be confirmed on the contralateral arm and the higher level used for management guidance
- κ The diagnosis of hypertension is based on the average of two or more elevated blood pressure readings taken at each of two or more visits after an initial screening
- κ The intervals for follow-up measurements are given in Table 1
- κ If the systolic and diastolic categories are different, the recommendations for the shorter follow-up should be utilized e.g. 160/86 mm Hg should be evaluated or referred to source of care within 1 month
- κ Unusually low readings should be evaluated for clinical significance
- κ Scheduling of follow-up should be modified by reliable information about past blood pressure measurements, other cardiovascular risk factors or target-organ disease.

Further evaluation is necessary once screening has lead to a diagnosis of hypertension to include a history, physical examination and diagnostic laboratory procedures. These are necessary to accurately determine blood pressure stage and risk group stratification for appropriate management.

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Table 1: Initial Blood Pressure Measurement and Recommended Follow-Up Interval

Initial Blood Pressure Measurement		Recommended Follow-up Interval
Systolic	Diastolic	
<130	<85	Recheck in 2 years
130-139	85-89	Recheck in 1 year *
140-159	90-99	Confirm within 2 months*
160-179	100-109	Evaluate or refer within 1 month
>180	>110	Evaluate or refer immediately or within 1 week depending on the clinical situation

Footnote (*) provide advice on lifestyle modifications.

Source: Sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, 1997.

Other medical bodies have similar recommendations:

- κ The Canadian Task Force on the Periodic Health Examination recommends that all persons aged 21 and over receive a blood pressure measurement during any visit to a physician
- κ The National High Blood Pressure Education Program (NHBPEP) of the National Heart, Lung, and Blood Institute recommends blood pressure measurements to be performed on adults at least every 2 years and at each patient visit if possible. Patients with diastolic blood pressures of 85 to 89 mmHg should have their blood pressure rechecked within 1 year
- κ U.S. Preventive Services Task Force recommends that adults should have their blood pressure measured periodically, with the optimal interval left to clinical discretion (USPSTF, 1996).

Children

- κ The American Academy of Pediatrics (AAP) and Bright Futures recommend blood pressures be measured in children at 3,4,5,6, and 8 years of age and annually beginning at 10 years of age
- κ The National Heart, Lung and Blood Institute Task Force on Blood Pressure Control in Children recommends blood pressure measurements annually beginning at 3 years of age
- κ The American Academy of Family Physicians recommends periodic blood pressure measurement after 18 months of age.

ISSUES IN PREVENTION

The first issue in prevention is to recognize the large number of hypertensives who remain undiagnosed. The Singapore National Health Survey showed that 53.0% of hypertensives had not been previously diagnosed. More of Malays were also found to have moderate or severe hypertension compared to Chinese and Indians (10.2% compared to 6.2% and 4.1% respectively).

The second issue in prevention is the need to change the mindset of those at risk of hypertension to take the necessary preventive measures. Time set aside for explanation and counselling is needed.

The third issue in prevention is the need for the attending physician to make use of all available opportunities to check the pressure of adult patients as well as to follow up on those at risk and to motivate them to continue with preventive measures.

The fourth issue in prevention is that screening for diabetes in patients who have hypertension or hyperlipidemia should be part of an integrated approach to reducing cardiovascular risk because the recommended approach has more intensive control of raised blood pressure in people with diabetes (USPSTF, 2003).

NON-PHARMACOLOGICAL MANAGEMENT

Hypertension results in target organ damage (TOC) and clinical cardiovascular disease. The primary prevention of hypertension and the attendant sequelae lie in lifestyle modification. For those with hypertension, lifestyle modification is an important adjunctive treatment besides drug therapy.

In some individuals, the adoption of lifestyle modification may be enough to bring the blood pressure down without the need for drug therapy. The impact of various non-pharmacological measures on blood pressure reduction is shown in Table 2.

Table 2: Impact of Interventions on Blood Pressure

Intervention	Mean reduction in blood pressure (mmHg)
Lifestyle interventions:	
4 kg weight loss if BMI 25-37	5/7
Halving salt intake (10/day to 5 g/day)	5/3
Regular exercise	10/10
Increase from 2 to 7 portions of vegetables/day	7/3
Increased vegetables and reduction saturated fat:	
In hypertensive patients	11/6
In normotensive patients	4/2
Drug treatment:	
Thiazide	15.6/6
Beta blockers	10.3/5.7
Calcium channel blockers	10/5

Source:

<http://bmj.com/cgi/content/full/324/7350/1375/DC1>. BMI=body mass index.

The National High Blood Pressure Education Program Coordinating Committee published its first statement on lifestyle modification as the primary prevention of hypertension in 1993. This statement has been updated by the 2002 paper (Whelton et al, 2002).

Current recommendations for primary prevention of hypertension involve a population-based approach and an intensive targeted strategy focused on individuals at high risk for hypertension. These 2 strategies are complementary.

1) Population-Based Strategy

A small decrement in the distribution of systolic blood pressure results in a substantial reduction in the burden of blood pressure-related illness (Stamler, 1991; Whelton et al, 2002) (Figure 1). In an analysis based on Framingham Heart Study experience, Cook et al, 1995 reported that a 2-mm Hg reduction in the population average of diastolic blood pressure for white US residents aged between 35 to 64 years of age would result in a 17% decrease in the prevalence of hypertension, a 14% reduction in the risk of stroke and transient ischemic attacks, and a 6% reduction in the risk of coronary heart disease.

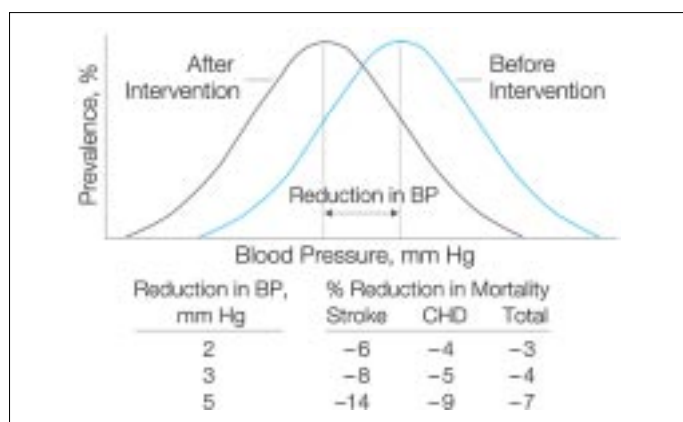


Fig 1

Public health approaches, such as lowering sodium content or caloric density in the food supply, and providing attractive, safe, and convenient opportunities for exercise are ideal population-based approaches for reduction of average blood pressure in the community. Enhancing access to appropriate facilities (e.g. parks, walking trails, bike paths) and to effective behaviour change models are useful strategies for increasing physical activity in the general population.

2) Intensive Targeted Strategy

More intensive targeted approaches, aimed at achieving a greater reduction in blood pressure in those who are most likely to develop hypertension, complement the previously mentioned population-based strategies for prevention of hypertension. Groups at high risk for hypertension include those with high normal blood pressure, a family history of hypertension, overweight or obesity, a sedentary lifestyle, excess intake of dietary sodium, insufficient intake of potassium, or excess consumption of alcohol. The preventive measures are shown in Table 3.

Table 3: Lifestyle Modifications for Primary Prevention of Hypertension

- o Engage in regular aerobic physical activity such as brisk walking (at least 30 minutes per day, most days of the week)
- o Maintain normal body weight for adults (body mass index, 18.5-24.9 kg/m²)
- o Limit alcohol consumption to no more than 1 oz (30 ml) of ethanol (eg, 24 oz [720 ml] of beer, 10 oz [300 ml] of wine, or 2 oz [60 ml] of 100-proof whiskey) per day in most men and to no more than 0.5 oz (15 ml) of ethanol per day in women and lighter-weight persons
- o Reduce dietary sodium intake to no more than 100 mmol/d (approximately 6g of sodium chloride or 2.4g of sodium per day)
- o Maintain adequate intake of dietary potassium (>90 mmol [3500 mg] per day)
- o Consume a diet that is rich in fruits and vegetables and in low-fat dairy products with a reduced content of saturated and total fat in the DASH (Dietary Approaches to Stop Hypertension) eating plan.

Source: Whelton et al, 2002.

Increased Physical Activity

A meta-analysis by Whelton et al, 2002 – in which the experience of 1108 normotensive persons enrolled in 27 randomised controlled trials was included – identified a 4.04-mmHg (95% CI, 2.75-5.32) reduction in systolic blood pressure in those assigned to aerobic exercise compared with the control group.

The magnitude of the intervention effect appears to be independent of the intensity of the exercise program. In the surgeon general's report on physical activity and health, it is recommended that persons exercise for at least 30 minutes on most, if not all, days of the week (Physical Activity and Health: A Report of the Surgeon General, 1996).

Weight Loss

He et al, 2000 (Whelton, 2002) reported on the experience of 181 normotensive persons who have participated in phase I of the Trials of Hypertension Prevention. During their initial 18 months of active intervention, those assigned to the weight-loss group reduced their body weight by 7.7 lb (3.5 kg) and their systolic and diastolic blood pressures by 5.8 and 3.2 mm Hg, respectively. After 7 years of follow-up, the incidence of hypertension was 18.9% in the weight-loss group and 40.5% in the control group. These findings suggest that weight loss interventions produce benefits that persist long after the cessation of the active intervention.

In phase II of the Trials of Hypertension Prevention, the 595 participants assigned to a weight loss counselling intervention experienced a 21% reduction in hypertension incidence compared with 596 counterparts assigned to usual care (Trials of Hypertension Prevention, 1997). Weight loss participants who were able to lose 9.7 lb (4.4 kg) or more and sustaining this weight loss through the 36-month period of follow-up experienced average reduction in systolic and diastolic blood pressure of 5.0 and 7.0 mmHg, respectively (Steven et al, 2001; Whelton, 2002).

Dietary Sodium Reduction

At least three meta-analyses of the efficacy of reduced sodium intake in lowering blood pressure have been published since 1993 (Whelton et al, 2002). In all 3 reports, sodium reduction was associated with a small but significant reduction in systolic blood pressure in normotensive persons.

In a meta-analysis of 12 randomized controlled trials conducted in 1689 normotensive participants, Cutler et al, 1997(Whelton, 2002) estimated that an average reduction of 77 mmol/d in dietary intake of sodium resulted in a 1.9-mmHg (95% confidence interval [CI], 1.2-2.6 mmHg) decrement in systolic blood pressure and a 1.1-mmHg (95% CI, 0.6-1.6 mmHg) decline in diastolic blood pressure.

In a randomised controlled trial (the Dietary Approaches to Stop Hypertension [DASH]-Sodium Trial) conducted in 412 persons with an average systolic blood pressure of 120 to 159 mmHg and an average diastolic blood pressure of 80 to 95 mm Hg, a reduction in sodium intake from a high level (mean urinary sodium excretion, 142 mmol/d) to an intermediate level (mean urinary sodium excretion, 107 mmol/d) reduced systolic blood pressure by 2.1 mmHg ($P<.001$) during consumption of a usual American control diet and by 1.3 mmHg ($P=.03$) during consumption of a DASH diet that was high in fruits and vegetables and low-fat dairy products (Sacks et al, 2001; Whelton, 2002).

Reducing sodium intake from the intermediate level to a lower level (mean urinary sodium excretion, 65 mmol/d) resulted in an additional reduction in systolic blood pressure of 4.6 mmHg during consumption of the control diet ($P<.001$) and 1.7 mmHg reduction during consumption of the DASH diet ($P<.01$). The effects of sodium reduction were greater for those assigned to the typical American diet, compared with those assigned to the DASH diet.

These findings are consistent with current national recommendations for a moderately low intake of dietary sodium (no more than 100 mmol/d: approximately 6 g of sodium chloride or 2.4 g of sodium per day) (JNC6, 1997) and suggest that an even lower level of dietary sodium intake may result in a greater reduction in blood pressure.

In a large, long-term-community-based randomized controlled trial, Whelton et al (Whelton et al, 1998; Whelton, 2002) reported that a moderate reduction of dietary sodium intake resulted in an additional 4.3-mmHg reduction in systolic blood pressure among older persons with hypertension whose blood pressures were already well controlled by a single antihypertensive medication. For those assigned to a combined sodium reduction and weight loss intervention, the corresponding additional reduction in systolic blood pressure was 5.5 mmHg. The need for antihypertensive medication during a subsequent 18-month period of follow-up was reduced by 31% and 53% in those assigned to sodium reduction and combined sodium reduction and weight loss, respectively.

Although not directly relevant to prevention of hypertension, the results of this trial provide additional evidence in support of the role of weight loss and moderate sodium reduction as means to reduce blood pressure, even for persons who have been taking antihypertensive medication.

Moderation Of Alcohol Consumption

In a meta-analysis of 15 randomised controlled trials, Xin et al (Xin et al, 2001; Whelton, 2002) reported that decreased consumption of alcohol (the median reduction in self-reported consumption of alcohol was 76%, with a range from 16%-100%) was associated with a reduction in blood pressure, and that the relationship between reduction in mean percentage of alcohol and decline in blood pressure was dose-dependent. Pooling of the experience of 269 normotensive participants enrolled in 6 randomized controlled trials identified a reduced consumption of alcohol as being associated with a 3.56 mmHg (95% CI, 2.51-4.61 mmHg) lower level of systolic blood pressure and a 1.80 mmHg (95% CI, 0.58-3.03 mmHg) lower level of diastolic blood pressure.

Therefore, it is recommended that alcohol consumption is to be limited to no more than 1 oz (30 ml) of ethanol (e.g. 24 oz [720 ml] of beer, 10 oz [300 ml] of wine, or 2 oz [60 ml] of 100-proof whiskey) per day in most men and to no more than 0.5 oz (15 ml) of ethanol per day in women and lighter-weight persons (Whelton, 2002).

Potassium Supplementation

Clinical trials and meta-analyses indicate that potassium supplementation lowers blood pressure in both hypertensive and normotensive persons. In a meta-analysis of the results from 12 trials with 1049 normotensive participants, Whelton et al, 1997 reported that potassium supplementation (median, 75 mmol/d) lowered systolic blood pressure by 1.8 mmHg (95% CI, 0.6-2.9) and diastolic blood pressure by 1.0 mmHg (95% CI, 0.0-2.1). The effects of potassium supplementation appeared greater in those with higher levels of sodium intake (Whelton, 2002).

Modification Of Whole Diets

The DASH and DASH-Sodium trials used dietary interventions that incorporated several nutritional recommendations for lowering blood pressure (Graudal et al, 1998; Appel et al, 1997; Whelton, 2002). In the 8-week DASH trial, study participants with a systolic blood pressure of less than 160 mmHg and a diastolic blood pressure between 80 and 95 mmHg were randomly assigned to one of the following dietary groups: (1) a control diet that was low in fruits, vegetables, and dairy products, with a fat content typical of the average diet in the United States, (2) a similar diet that was rich in fruits and vegetables, or (3) a DASH diet that was rich in fruits, vegetables, and low-fat dairy products but reduced in saturated and total fat. Among the 326 normotensive DASH participants (blood pressure <140/90 mmHg), the DASH diet reduced systolic blood pressure by 3.5 mmHg ($P<.001$).

In a subsequent DASH-Sodium study, normotensive persons assigned to the DASH diet and a low level of urinary sodium excretion (67 mmol/d) reduced their systolic blood pressure by 7.1 mmHg (7.2 mmHg for blacks and 6.9 mmHg for others) compared with counterparts who were assigned to the control diet and a high level of urinary sodium excretion (141 mmol/d) (Sacks et al, 2001; Whelton, 2002). A significant reduction in diastolic blood pressure was also observed. Furthermore, the beneficial effects of the DASH diet and the DASH diet with reduced sodium occurred broadly in all major subgroups of the population (Volmer et al, 2001; Whelton, 2002).

Table 4: DASH Eating Plan

The DASH eating plan is rich in various nutrients believed to benefit blood pressure and in other factors involved in good health. The amounts of the nutrients vary depending on how much you eat. If you eat about 2,000 calories a day on the plan, the nutrients you will get include:

4,700 milligrams of potassium
500 milligrams of magnesium
1,240 milligrams of calcium
90 grams of protein
30 grams of fibre

The DASH plan shown below is based on 2,000 calories a day. The number of daily servings in a food group may vary from those listed depending on your caloric needs. (Table 5)

Table 5: DASH Eating Plan for 2000 calories a day

Food Group	Daily Servings (except as noted)	Serving Sizes
Grains & grain products	7-8	1 slice bread 1 cup ready-to-eat cereal* 1/2 cup cooked rice, pasta, or cereal
Vegetables	4-5	1 cup raw leafy vegetable 1/2 cup cooked vegetable 6 ounces vegetable juice
Fruits	4-5	1 medium fruit 1/4 cup dried fruit 1/2 cup fresh, frozen, or canned fruit 6 ounces fruit juice
Low fat or fat free dairy foods	2-3	8 ounces milk 1 cup yogurt 1 1/2 ounces cheese
Lean meats, poultry, and fish	2 or less	3 ounces cooked lean meats, skinless poultry, or fish
Nuts, seeds, and dry beans	4-5 per week	1/3 cup or 1 1/2 ounces nuts 1 tablespoon or 1/2 ounce seeds 1/2 cup cooked dry beans
Fats & oils**	2-3	1 teaspoon soft margarine 1 tablespoon low fat mayonnaise 2 tablespoons light salad dressing 1 teaspoon vegetable oil
Sweets	5 per week	1 tablespoon sugar 1 tablespoon jelly or jam 1/2 ounce jelly beans 8 ounces lemonade

(*) Serving sizes vary between 1/2-1 1/4 cups. Check the product's nutrition label.

(**) Fat content changes serving counts for fats and oils: For example, 1 tablespoon of regular salad dressing equals 1 serving; 1 tablespoon of a low fat dressing equals 1/2 serving; 1 tablespoon of a fat free dressing equals 0 servings.

Table 6: DASH Diet Servings For Other Calorie Levels

Food Group	Servings/Day at 1,600 calories/day	Servings/Day at 3,100 calories/day
Grains & grain products	6	12-13
Vegetables	3-4	6
Fruits	4	6
Low fat or fat free dairy foods	2-3	3-4
Meats, poultry, and fish	1-2	2-3
Nuts, seeds, and dry beans	3/week	1
Fat & oils	2	4
Sweets	0	2

Take Home Messages

- Hypertension has been shown to be a leading risk factor for stroke, congestive heart failure, coronary heart disease, ruptured aortic aneurysm, retinopathy and renal disease (USPSTF, 1996).
- Adults 18 years and older at high risk for hypertension should be screened. These include those with high normal blood pressure, a family history of hypertension, overweight or obesity, a sedentary lifestyle, excess intake of dietary sodium, insufficient intake of potassium, or excess consumption of alcohol.
- Screening is done opportunistically and the timing of subsequent check-ups will depend on the blood pressure at the initial check. For example, those who have a normal pressure need to be checked only two years later.
- The issues in prevention are the need to recognize many are undiagnosed; there is a need to change the mindset of individuals towards adopting preventive measures; the use of all opportunities to check the blood pressure; and a system for follow-up.
- The six intensive targeted strategies to prevent high blood pressure in those at risk of hypertension are: exercise, weight loss, alcohol containment, sodium regulation in the diet, potassium regulation, and adopting a DASH (Dietary Approaches to Stop Hypertension) eating plan.

REFERENCES

1. Whelton PK et al. Primary Prevention of Hypertension: Clinical and Public Health Advisory From the National High Blood Pressure Education Program. *JAMA*. 2002; 288:1882-8.
2. USPSTF. Guide to Clinical Preventive Services; Report of the U.S. Preventive Services Task Force, 2nd Ed., Williams & Wilkins, 1996, pp.39-51.
3. USPSTF. Screening for Type 2 Diabetes Mellitus in Adults, 2003 (<http://www.ahcpr.gov/clinic/3rduspstf/diabscr/diabscrwh.htm>).
4. Put Prevention into Practice; Clinician's Handbook of Preventive Services, 2nd Ed, U.S. Department of Health and Human Services, Public Health Service, 1998, pp.187-92.
5. MOH. National Health Survey, 1998. MOH:Singapore, 1999.
6. MOH. Clinical Practice Guidelines on Hypertension, 2000.
7. Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. The sixth report of the Joint National Committee on Prevention, Detection and Treatment of High Blood Pressure (JNC 6). *Arch Intern Med* 1997; 157:2413-46.