## Blood Pressure Teaching and Learning Pack

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BLOOD PRESSURE

Why is BP important?

- Raised BP is usually asymptomatic, but is a risk factor for several serious medical conditions, including those listed below:
  - Cerebrovascular disease
  - Coronary disease
  - Renal disease
  - Premature mortality
- Systematic identification of people with raised BP and their appropriate management and follow up will reduce morbidity and premature mortality.
- Identification and appropriate clinical management remains a longstanding challenge, but is expected of all doctors in line with Good Medical Practice – the document that outlines the duties of all doctors registered with the GMC.

Figure 1: Definitions of hypertension

Cardiovascular National Service Framework target for BP = 140/85

But NSF audit target for BP is <150/<90 – recognising the challenge of achieving the NSF target.

Measuring blood pressure

- BP follows a normal distribution – and is a continuous variable.
- There is variation in BP – within person (over time or in either arm); inter-observer; between people; racial/ethnic differences
- How do we know what normal BP is? BP distribution has been measured and the normal range developed from measurements from thousands of people.
- Normal range: the definition of raised BP has evolved over time, as studies have detected increased risks of CVD at lower BP than had earlier been assumed.
- Even with these caveats, it seems that at least 25% of the adult population in many Western countries studied has hypertension; in China the prevalence has been estimated at 14% and rising.
- Special considerations:
  - Pregnancy
  - Renal disease
  - Diabetes

Raised BP alone usually causes no symptoms. We know it affects adversely the prevalence of many diseases. Thresholds for treating high blood pressure have shifted
Blood pressure can be elevated in two main circumstances:

- Essential hypertension is usually idiopathic, and may indicate a) risk for or b) the existence of another disease – notably CHD, CVD, renal disease, diabetes.
- It may also be raised secondarily, as part of another disease process or as a consequence of medication:
  - Drugs eg NSAIDs, OCP
  - Renal disease
  - Phaeochromocytoma
  - Conn’s syndrome
  - Coarctation
  - Cushing’s syndrome

**Interventions**

Reducing BP reduces the risk of serious clinical diseases for which hypertension is a risk factor. Interventions fall into two categories.

a) Lifestyle
b) Medication

**Disadvantages of active interventions:**

- ‘Treating’ high blood pressure may turn asymptomatic, well people into patients with a diagnosis. Some will adopt the ‘sick role’ or suffer anxiety. This is usually considered to be outweighed by the benefits of treatment
- Lifestyle and Insurance implications
- Side effects attributable to medications – for example:
  - Quality of life (impotence, fertility)
  - Symptoms (cough)
  - Inconvenience (diuretic effect)

For people with normal BP, there may be a misplaced complacency: their overall risk of CVD is important and may be high despite a BP below the threshold for treatment. A holistic approach to CVD prevention is proposed in a recent HTA report and recent Lancet paper.

**Current target treatment goals according to BHS and NICE:**

- For general population <140/ <85

A third to a half of people with raised BP are unaware of it
Of those who are aware, around a half are on antihypertensive therapy.
Antihypertensive agents reduce BP at any level, but have greater effect at higher levels of BP.
• For people with diabetes, chronic renal disease or established CVD: target is lower <130/ <80

‘White Coat’ hypertension:
• Raised BP reading in doctor’s surgery or hospital may be artefactual. This affects women more than men.
• Prevalence and incidence data for raised BP therefore often take into account more than one reading.
• For individual patients, more than one BP reading is mandatory before diagnosis.
• Ambulatory BP monitoring can be helpful in evaluating the ‘white coat’ effect, in the diagnosis and follow up of hypertensive patients.

Epidemiology

The prevalence of hypertension varies with several factors

• Geography - In the USA, 15-20% of the general adult population had H/T in the1990s, according to the National High Blood Pressure Education Programme. Prevalence in the US and Egypt is now estimated at c.25%, while in China 14.4%, but rising. In Latvia a prevalence of 46% was found in 25-64 year olds. Globally the burden of hypertension is estimated at 25% of the population and rising.

• Age - In most developed and developing countries, BP increases with age – probably due to increasing arterial stiffness as elastin is replaced by collagen in large arterial walls. The decreased arterial compliance causes aortic lengthening and dilatation – elevation of BP compensates for these physiological changes.

In older people, BP measurement may more often than in younger adults be misleadingly raised due to a) vascular stiffness and b) white coat syndrome. However, isolated systolic hypertension is more common than diastolic hypertension in older people; systolic BP is a better predictor of adverse consequences than diastolic. Pulse pressure is probably the best predictor of adverse events, but systolic is convenient to measure and more acceptable as a way of monitoring and treating H/T in older people.

• Gender differences
  o The prevalence of hypertension is greater in men than women until the sixth decade of life [3].
  o Systolic BP is lower in young women than men.
  o Throughout adulthood, BP rises with age – and the rate increases more sharply in women, so by 60 years of age, raised BP is more common in women than men.
  o Diastolic BP averages lower for women than men, increases in both sexes with age, and then declines in the 40s and 50s.
  o The risk of adverse events is greater in women with H/T:

• Obesity – Central abdominal obesity [waist >34ins women, >39ins men] is particularly associated with an increased risk of hypertension. The Framingham
studies demonstrated that for every 10% weight gain there was a rise of 6.5mm Hg in systolic BP. Conversely, a Scottish intervention study showed that modest (10%) weight loss leads to 10mmHg decrease in systolic BP and 20mmHg decrease in diastolic BP.

- **Ethnicity** - Prevalence varies among ethnic and racial groups. For example, amongst American males aged 65-74, the prevalence of hypertension was:
  - African Americans: 72%
  - Whites: 53%

African Americans have a 2-4 fold risk of developing hypertension compared with Caucasians. Their onset of hypertension is earlier and the adverse impacts in terms of cardiovascular disease, endstage renal disease and mortality are more pronounced. In the UK, African Caribbeans are at particularly high risk: their relative risk for H/T is 1.49 compared with the general population, while South Asians have a lower than average relative risk.

Racial and ethnic differences are likely to be caused by a combination of:
- Genetic
- Pathophysiological
- Environmental
- Dietary
- Psychosocial factors

- **Socioeconomic factors** - Hypertension prevalence is higher in social classes IV and V than in other social classes. There is a correlation with lifestyle factors, including smoking prevalence, lack of exercise, obesity, and dietary salt intake. Observed probably relevant differences comparing soc classes IV and V with the general population:
  - Higher consumption of processed foods
  - Higher alcohol consumption
  - Low intake of fruit and veg
  - Physical inactivity
  - Low birthweight and slow weight gain
  - Adult weight gain
Smoking does not appear to cause hypertension, but it is such an important risk factor for CHD that anyone at increased risk of CHD (arguably anyone who smokes) should be advised to stop smoking.

**Lifestyle modifications**

Changes in lifestyle can prevent or help to manage hypertension in some people. For example, lifestyle modifications can decrease systolic BP by 6-10mm Hg and diastolic BP by 2-6mm Hg. Even with medication, lifestyle modifications may still reduce the dosage or number of medications required.

**Modifications may include:**
- Stop smoking
- Reduce dietary intake of saturated fat and cholesterol
- Attain normal body weight
- Limit alcohol intake to not more than 30ml [c.3 units] ethanol/day (for men - half for women)
- Increase aerobic physical activity
- Reduce sodium intake to not >2.4g Na or 6g NaCl
- Maintain adequate dietary intake of K, Ca and Mg

**Sodium intake**

Amongst overweight people, high sodium intake was associated with raised risk of incidence and mortality from stroke, cardiovascular disease mortality and mortality from all causes, in comparison with non-overweight people, in whom dietary sodium was not found to be significantly associated with cardiovascular disease risk.

**Tea intake**

In China, the risk of developing hypertension among the Chinese population has been shown to be significantly reduced through consumption of 120ml/day or more of moderate strength green or oolong tea for one year. Consumption of 600ml/day or more conferred greater protection. Tea consumption for more than one year was not associated with further reduction in hypertension risk.

**Compliance**

Compliance with lifestyle modifications is often poor, both by individuals trying to prevent or manage hypertension, and for populations hearing health promotion advice. Getting people to take seriously the idea of lifestyle modification in order to prevent a problem that they may not perceive as important or dangerous is problematic.

Of those people who have raised BP, many do not receive adequate treatment and under half will not know they have raised BP (see Fig 2). In England, of those who are treated, just over half will be receiving adequate treatment.

**Common diseases associated with hypertension**

- **Coronary heart disease** – This is an important cause of serious morbidity and premature death. It is more associated with elevated systolic BP than diastolic, especially in older people. Treatment of hypertension – especially systolic – reduces risk of MI and CCF.

- **Left ventricular hypertrophy** - 50% of patients with hypertension have some degree of LVH. Antihypertensive treatment reduces LVH by reducing afterload.

- **Cerebrovascular disease** – Alongside other risk factors such as smoking and elevated cholesterol, hypertension is an important risk factor for stroke. Controlling blood pressure reduces risk of stroke AND reduces risk of subsequent stroke in patient who has already had a stroke. Hypertension may be a direct cause of haemorrhagic stroke; it is thought to indirectly cause thrombotic stroke by potentiating the cardiovascular causes of stroke (LVH, CCF).

It is estimated that a 5-6mm reduction in diastolic BP and 10-12mm in systolic BP would reduce annual stroke incidence from 7% to 4.8%: NNT of 45 to avoid one stroke per year.

- **Diabetes** - 30% of patients with T1DM eventually develop hypertension. This usually reflects the development of end organ damage, such as diabetic nephropathy. The mortality rate of patients with concurrent diabetes and hypertension is 2x higher than those without.

Hypertension does not directly cause diabetes; diabetes does not directly cause hypertension. Both are multifactorial. But the presence of one compounds the adverse effects of the other. Because of the strong association between hypertension and DM, BP goals for diabetics are set lower than for the general population. Standards for management of diabetes in England are set out in the NSF (2001 and 2003).
• **Renal disease** - Renal disease progression is associated with diastolic BP>90mmHg. As for diabetics, BP goals are lower for patients with renal disease than the general population.

Hypertension causes raised glomerular blood flow, leading to raised glomerular filtration, leading to glomerular sclerosis. Sclerosis leads to proteinuria and cascade towards renal failure. Renal failure can occur with normal BP, but hypertension accelerates progression. In patients with renal disease, 25-28% will progress to end-stage renal disease because of H/T

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**Management of BP in the non-hypertensive population**

For people with so-called ‘normal’ BP - and their doctors - there may be a misplaced complacency: their overall risk of CVD is important and may be high despite having a BP below the threshold for treatment.

At blood pressure ranges prevalent in Western populations, lowering blood pressure from any initial value reduces the risk of CVD. An holistic approach to CVD prevention for the whole population is therefore proposed in a recent HTA report. This would result in far greater numbers of normotensive people being treated with antihypertensive (perhaps in this context better named blood pressure lowering) medication. The authors argue that selected treatments have few adverse effects and low cost. To date, this strategy has not been adopted in any country.
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- Special considerations:
  - Pregnancy
  - Renal disease
  - Diabetes

Raised BP alone usually causes no symptoms. We know it affects adversely the prevalence of many diseases. Thresholds for treating high blood pressure have shifted
over time, and have gradually become lower as benefits of risk reduction have become apparent. Everyone has a BP, no-one is aware of it unless it is measured using instrumentation. Such equipment is now easy to use and available relatively inexpensively over the counter.

**Figure 2: The Rule of Halves**

- A third to a half of people with raised BP are unaware of it
- Of those who are aware, around a half are on antihypertensive therapy.
- Antihypertensive agents reduce BP at any level, but have greater effect at higher levels of BP.

Blood pressure can be elevated in two main circumstances:
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For people with normal BP, there may be a misplaced complacency: their overall risk of CVD is important and may be high despite a BP below the threshold for treatment.

**Relevant English health policy**

**Our Health, Our Care, Our Say: A New Direction for Communities**

White Paper published in 2006, setting out a vision to provide people with good quality social care and NHS services in the communities where they live  

**Saving Lives: Our Healthier Nation**

Government action plan published in 1999 aimed at tackling poor health particularly for those who are worst off in society. The targets set aim to reduce deaths caused by the four main killers, cancer, CHD and strokes, accidents and mental illness.  

**National Service Framework for Coronary Heart Disease**

The National Service Framework for Coronary Heart Disease (NSF CHD), published in March 2000, set out a strategy to modernise CHD services over ten years. It details 12 standards for improved prevention, diagnosis, treatment and rehabilitation and goals to secure fair access to high quality services.  
Choosing Health
Government paper from 2004 setting out the key principles for supporting the public to make healthier and more informed choices in regards to their health.

NICE Guidelines
Guidance on the management of hypertension in adults in primary care.
http://www.nice.org.uk/Guidance/CG34

Bibliography/Further Reading for Students

**British Hypertension Society**
A medical and scientific research forum for sharing cutting edge research in order to understand the origin of high blood pressure and improve its treatment
www.bhsoc.org/

**British Heart Foundation**
Charity providing funding for research and prevention activity, as well as ensuring quality care and support for people living with heart disease.
www.bhf.org.uk/

**Blood Pressure Association**
Charity dedicated to lowering the nation's blood pressure, in order to prevent unnecessary death and disability from heart disease, heart attacks and stroke.
http://www.bpassoc.org.uk/Home
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BLOOD PRESSURE – BEDSIDE TEACHING

The Patient can be any adult non-emergency, non-pregnant patient OR could be ‘the man in the street,’ including one or more of the students themselves.

1. We do we always measure a patient’s BP?

2. What do we mean by normal BP? Raised BP? Low BP?

3. Consider relevance to this patient – if their BP is
   - normal
   - raised
   - low

   Should they know his/her BP? Why? If not why not?

Management of raised blood pressure

4. Past medical history:
   - Is there an underlying identifiable cause?
   - Does the patient have established CHD? CVD? Diabetes? Renal disease?
   - If not, does s/he have primary [essential] hypertension?

   Confirm the diagnosis of H/T – if the patient is on treatment, you may have to assume that the correct diagnosis was made using appropriate criteria.

   If not previously diagnosed, consider the implications for the patient of being told s/he has raised BP

5. Consider social factors contributing to hypertension - how does each of these factors relate to blood pressure?
   - Alcohol
   - Diet
   - Exercise
   - Smoking

6. Does the patient have risk factors other than raised BP for any of the following conditions?
   - CHD
   - CVD
   - Diabetes?
   - Renal disease

   Figure 1: Factors affecting blood pressure over which we have no control

   - Age
   - Gender
   - Ethnicity
   - Altitude and climate
7. Does the patient have a family history of hypertension, stroke, renal disease, or heart disease?

8. What non-drug interventions might improve raised blood pressure?
   - Dietary modifications, various
   - Tackle overweight, obesity
   - Exercise
   - Stress reduction
   - Control of concurrent conditions listed above

The size of the problem

9. Hypertension is very common. How do we know?

   Ecological studies, cohort studies etc

10. Hypertension is often poorly controlled – why?
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12. What do we mean by normal BP? Raised BP? Low BP?

13. Consider relevance to this patient – if their BP is
   • normal
   • raised
   • low

   Should they know his/her BP? Why? If not why not?

Management of raised blood pressure

14. Past medical history:
   o Is there an underlying identifiable cause?
   o Does the patient have established CHD? CVD? Diabetes? Renal disease?
   o If not, does s/he have primary [essential] hypertension?

15. Consider social factors contributing to hypertension - how does each of these factors relate to blood pressure?
   o Alcohol
   o Diet
   o Exercise
   o Smoking

16. Does the patient have risk factors other than raised BP for any of the following conditions?
   o CHD
   o CVD
   o Diabetes
   o Renal disease

Figure 1: Factors affecting blood pressure over which we have no control

- Age
- Gender
- Ethnicity
- Altitude and climate

17. Does the patient have a family history of hypertension, stroke, renal disease, or heart disease?
18. What non-drug interventions might improve raised blood pressure?

_The size of the problem_

19. Hypertension is very common. How do we know?

20. Hypertension is often poorly controlled – why?
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BLOOD PRESSURE – TOP TIPS

- Raised blood pressure is an important risk factor for CVD, CHD, renal disease
- Raised BP occurs in about 25% of adults in Western populations
- Prevalence of hypertension shows marked social gradient – most common in social classes IV and V
- Obesity is associated with hypertension – and weight loss with reduced BP
- BP should be viewed as one element of an individual’s overall cardiovascular risk – not in isolation
- Hypertension can occur as a consequence of diabetes, CVD, CHD, renal disease
- Causes of hypertension: idiopathic (commonest), renal disease, phaeochromocytoma, aortic coarctation, Conn’s, Cushing’s
- Iatrogenic causes of hypertension: NSAIDs, OC, liquorice, sympathomimetics – often acquired as over the counter self-medication
- High salt intake is associated with increased risk of CVD in overweight people
- Treatment aims for adults at any age: <140/<85; for diabetics: <130/<80
- Lifestyle measures alone might control mild hypertension or reduce requirement for medication
- Multiple medication may be required for adequate BP control; note racial differences in responses to drugs