Pressure points in primary care: A study of blood pressure in 532,050 patients in Australia from 2005 to 2010

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## Abbreviations

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<tbody>
<tr>
<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
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<tr>
<td>BP</td>
<td>Blood pressure</td>
</tr>
<tr>
<td>CHD</td>
<td>Coronary heart disease</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular disease</td>
</tr>
<tr>
<td>DBP</td>
<td>Diastolic blood pressure</td>
</tr>
<tr>
<td>DoHA</td>
<td>Department of Health and Ageing</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
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<td>GPRN</td>
<td>General Practice Research Network</td>
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<td>HCN</td>
<td>Health Communication Network</td>
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<tr>
<td>NHFA</td>
<td>National Heart Foundation of Australia</td>
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<tr>
<td>PBS</td>
<td>Pharmaceutical Benefits Scheme</td>
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<tr>
<td>SBP</td>
<td>Systolic blood pressure</td>
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</table>
Executive Summary

This report is an analysis of blood pressure (BP) measurements in patients being managed in primary care in Australia between 2005 and 2010. It provides important insights into the optimal monitoring and management of hypertension and provides underlying clinical and public health messages for health professionals and the broader community.

The importance of undertaking large-scale analyses to monitor trends in BP levels should not be underestimated. Coronary heart disease (CHD) and stroke, two of the few potential risks associated with hypertension, are the leading killers of Australians resulting in 46,000 deaths in 2007, or 33% of all deaths (AIHW, 2010). Hypertension accounted for 42% of the cardiovascular disease (CVD) burden in 2003 and 7.6% of the total disease burden (Begg, et al., 2007). Hypertension contributes to more years of lost “healthy life” due to disability and disease from CVD relative to any other biomedical risk factor in Australia (Begg et al., 2007). Therefore, lowering BP can proportionally reduce the risk of death from CVD (Lewington, Clarke, Qizilbash, Peto, & Collins, 2002).

In view of the large burden of CVD in Australia and significant investment in anti-hypertensive therapies, we sought to understand the contemporary pattern of BP levels and management from a primary care perspective. To achieve this aim, we accessed an Australian longitudinal patient-based database created by General Practitioners (GPs) of the research division of the Health Communications Network (HCN) who provide de-identified personal health information of their patients for research and statistical purposes (HCN, 2011). In this report, information from a total of 532,050 patients was collected by 733 GPs from 286 primary care clinics across Australia between 2005 and 2010.

Key findings

- Average BP levels in both men and women showed no change between 2005 and 2010.

- Since 2006, at least 25% of patients attending a primary care physician had BP levels that exceeded the historical ideal target of 140/90 mmHg. Overall, 36% of patients had elevated BP and/or were prescribed anti-hypertensive medication in 2010.

- Men had consistently higher BP levels than women at all ages, except from 65 years onwards, and a greater proportion of men exceeded the BP target level of 140/90 mmHg.

- The proportion of young adult men (aged 23 to 34 years) with BP levels which exceeded 140/90 mmHg was 3-fold higher compared to young adult women (15% vs. 5%).

- There was a gradient in BP levels across Australian states and territories with the highest levels recorded in Tasmania and the lowest in the Northern Territory.

- There were no apparent trends in average BP levels according to region (urban vs. rural/remote) and socioeconomic status (low vs. high income areas) in the time between 2005 and 2010, although a higher proportion of people living in rural/remote areas and lower socioeconomic areas had BP levels that exceeded the historical target of 140/90 mmHg.

- Average BP levels were higher in patients prescribed anti-hypertensive therapy and 41% of people treated had BP levels that exceeded the historical target of 140/90 mmHg.

- Overall, 59% of higher risk patients with established CVD, 48% of patients without CVD and 19% of patients not prescribed anti-hypertensive therapy had BP levels above their individualised targets according to national guidelines.

- There were no mean changes in BP levels over contiguous annual visits except for an initial improvement in patients with elevated BP above 140/90 mmHg which was evident after two annual GP visits.

- People prescribed anti-hypertensive therapy did not show any greater improvement in BP levels over contiguous annual visits compared to those not prescribed such therapy.
Conclusions

Elevated BP remains to be a public health priority for action. BP management in Australia is sub-optimal with about one quarter of men and women attending general practice and over 40% of those receiving treatment for hypertension having BP above recommended levels of 140/90 mmHg. There have not been significant gains in the community control of hypertension since 2005. Overall, these data provide an impetus for greater efforts to improve BP levels in Australia in order to subsequently reduce highly preventable (and often fatal) CVD events.

Suggested strategies to improve BP levels in Australia

Key recommendations to ultimately optimise BP levels include:

For individuals

- Adopt a healthy lifestyle approach for primary and secondary prevention of CVD in order to achieve desirable BP levels, including dietary modifications to restrict excessive salt intake and high alcohol consumption, physical exercise and weight control.
- Know your individual BP targets and concentrate on reaching these levels or better.
- Have regular BP checks and attain a copy of the results for ongoing comparison and monitoring.
- Understand what BP is and the impact of elevated levels for your heart health.
- Remember to take medications regularly (if prescribed) to help optimise your BP levels.
- Work with your GP to develop a long-term plan to treat and monitor your BP levels in order to reach and maintain your individual ideal targets.

Note: Also refer to the Blood Pressure and Your Health brochure for tips on how to lower your BP (Appendix 1).

For health professionals:

- Utilise current guideline recommendations of an absolute risk approach and undertake a thorough clinical investigation to identify who may benefit most from intervention.
- Initiate cost-effective risk factor management strategies.
- Choose effective anti-hypertensive therapies and consider intensive dose titrations (including combination therapy) in order to reach targets, particularly more stringent targets in higher risk individuals.
- Acknowledge that there may be variations in the response and preference to therapy and a change to one of a number of anti-hypertensive agents may be required to help optimise BP levels and minimise side effects.
- Emphasise the need for a long-term and intensive strategy to provide continuity of care in managing sub-optimal BP levels, including the development of an agreed action plan with your patient.

For health care policy and planning:

- Develop educational campaigns for school children and the broader public that provide an understanding of the importance of BP control in preventing CVD.
- Introduce wider policies that promote heart health in the community through healthy lifestyle approaches.
- Consider the need to more closely monitor the overall impact of costly treatments designed to optimise BP levels and associated risk factors.
Introduction

High blood pressure or hypertension can be caused by a number of factors which include, but are not limited to an excessive salt intake, obesity, alcohol abuse and genetic disposition. Potential consequences of hypertension include serious damage to the body which can affect the heart, brain and kidneys.

What is BP?

When the heart pumps, blood is pushed from the heart into the arteries creating pressure on the vessel walls – this is referred to as blood pressure (BP). BP measurements are commonly described by two separate numbers; the first value refers to the highest pressure, known as systolic blood pressure (SBP), that occurs in the aorta (the largest artery that carries blood away from the heart) when the heart contracts. The second value refers to the lowest pressure, called diastolic blood pressure (DBP), which occurs as the heart relaxes before its next contraction.

How is BP measured?

Since we cannot access the aorta directly to measure BP as blood is being pumped from the heart, it is generally estimated indirectly through the arteries located in the arm. This used to be done using a mechanical device called a sphygmomanometer and an inflatable cuff to resist blood flow. Using a stethoscope, health professionals would listen for the appearance of heart sounds upon deflation of the cuff to indicate SBP and the disappearance of heart sounds to indicate DBP. Nowadays, BP is more commonly measured using automated BP devices without the need to listen for heart sounds.

What influences BP?

The regulation of BP occurs through both short and long term processes. In the short term, BP depends on the volume of blood pumped by the heart, heart rate, blood vessel resistance as well as automatic reflexes and various hormonal systems. The kidneys are capable of influencing BP in the long term by controlling fluid balance, consequentialy affecting blood volume.

The impact of hypertension

Hypertension over an extended period of time can promote atherosclerosis (the narrowing and hardening of arteries due to the build-up of fatty deposits) via a cascade of events caused by injury to the cells in the walls of the arteries. Elevated BP appears to cause plaques to crack, resulting in an ‘injury’ requiring platelets to clot it and prevent the loss of blood. The injury site extends from the artery wall into the blood vessel, obstructing the normal flow of blood. This increases the vulnerability to heart attack and stroke. Chronic hypertension also affects the elasticity of arteries, making them become less flexible and resulting in increased arterial stiffness.

In other circumstances, increased BP can place stress on and therefore weaken artery walls (commonly in the brain). Over time, this pressure can cause a section of the artery wall to enlarge and form a bulge (aneurysm). If an aneurysm develops and eventually grows large enough to rupture in a major artery (e.g. the large artery leading from the heart to the lower body - known as an abdominal aortic aneurysm) the consequences range from a steady blood loss (leakage) to life-threatening internal bleeding. If an aneurysm develops in the brain the consequences are particularly severe given the lack of room to accommodate any swelling or bleeding (known as a “haemorrhagic” stroke) from the aneurysm.

Uncontrolled and prolonged elevation of BP also has negative consequences for other organs of the body such as the atria and ventricles of the heart (especially the left ventricle). For example, in order to continue beating against a higher resistance, the heart becomes stronger and enlarged, called cardiac hypertrophy. This increase in muscle mass reduces the volume of blood in the left ventricle, causing the heart to pump less efficiently and restricting oxygen to the coronary arteries. Eventually, an overwhelmed heart will wear out and fail and develop heart failure. At the same time, the atria (top chambers) of the heart may also become enlarged, disrupting its normal electrical conduction system designed to maintain a slow, regular and coordinated heart beat leading to fast and irregular heart beats (arrhythmias). The most common of these, affecting more than 1 in 10 adults aged over 65 years is atrial fibrillation - a fast irregular heart beat that not only impairs the ability of the heart to pump effectively.
(leading to, or contributing to underlying heart failure) but, due to the development of blood clots in the atria, conveys a high risk for developing a debilitating or fatal "embolic" stroke.

Uncontrolled hypertension also commonly causes damage to the blood vessels in the kidney and impairs the filtration of waste, resulting in kidney failure. Kidney failure not only elevates BP further (leading to more damage) but contributes to the development of heart failure and in turn strokes. At the same time, high BP damages the sensitive blood vessels in the vision structures of the eye (retina) resulting in potential vision loss or blindness over time.

Recommended BP levels

Due to the many causes of hypertension and the various conditions it is associated with, defining a single BP level to aim to achieve for the treatment of hypertension is complicated. To guide health professionals in this regard, the National Heart Foundation of Australia (NHFA, 2008) identify three different BP targets depending on clinical presentation: < 125/75, < 130/80 and < 140/90 mmHg or lower if tolerated (Table 1). It can be seen that higher risk individuals have lower BP targets. Therefore, investigation of risk factors and analysis of patient histories is required to accurately manage hypertension.

Table 1: Treatment BP targets in Australian adults

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>Target (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>People with proteinuria &gt; 1 g/day (with or without diabetes)</td>
<td>&lt; 125/75</td>
</tr>
<tr>
<td>People with associated condition/s or end-organ damage:*</td>
<td>&lt; 130/80</td>
</tr>
<tr>
<td>• Coronary heart disease</td>
<td></td>
</tr>
<tr>
<td>• Diabetes</td>
<td></td>
</tr>
<tr>
<td>• Chronic kidney disease</td>
<td></td>
</tr>
<tr>
<td>• Proteinuria (&gt; 300 mg/day)</td>
<td></td>
</tr>
<tr>
<td>• Stroke/TIA</td>
<td></td>
</tr>
<tr>
<td>People with none of the following:</td>
<td>&lt; 140/90 or lower if tolerated</td>
</tr>
<tr>
<td>• Coronary heart disease</td>
<td></td>
</tr>
<tr>
<td>• Diabetes</td>
<td></td>
</tr>
<tr>
<td>• Chronic kidney disease</td>
<td></td>
</tr>
<tr>
<td>• Proteinuria (&gt; 300 mg/day)</td>
<td></td>
</tr>
<tr>
<td>• Stroke/TIA</td>
<td></td>
</tr>
</tbody>
</table>

* Specific lower BP targets have not been established for other high-risk groups (e.g. those with peripheral arterial disease, those with familial hypercholesterolaemia or those at high absolute risk of cardiovascular disease) due to the current lack of evidence from clinical trials. Targets will be set when evidence becomes available.

Source: National Heart Foundation of Australia (NHFA, 2008)
**BP levels in Australia**

Hypertension contributes to more years of lost “healthy life” due to disability and disease from cardiovascular disease (CVD) relative to any other biomedical risk factor in Australia (Begg, et al., 2007). Hypertension accounted for 42% of the CVD burden in 2003 and 7.6% of the total disease burden (Begg, et al., 2007). Coronary heart disease (CHD) and stroke, two of the few potential risks associated with hypertension, are the leading killers of Australians resulting in 46,000 deaths in 2007, or 33% of all deaths (AIHW, 2010). High BP is the most important risk factor for stroke.

Based on available population data for long-term BP trends and using the WHO definition of BP of >140/90 mmHg or prescribed anti-hypertensive treatment, the prevalence of high BP in Australia has approximately halved in adults aged 25 to 64 years between 1980 and 1999-2000 (Figure 1). The prevalence of men with elevated BP decreased from 47% to 21% and women from 32% to 16% (AIHW, 2010).

In the short-term however, Figure 1 shows that the prevalence of elevated BP among Australian adults has not changed significantly between 1995 (31%) and 1999-2000 (30%) (AIHW, 2010). Elevated BP levels due to age and an ageing population will undoubtedly lead to more hypertension in the future, however people aged >65 years are commonly excluded from population estimates.

No population based survey of BP levels has been carried out since 2000 (AIHW, 2010). The most recent “snapshot” of the BP profile of adult Australians was determined by the National Blood Pressure Screening Day in 2007 with a total of 13,825 participants in metropolitan and regional areas of every State and Territory (Carrington, Jennings, & Stewart, 2010). Overall, in accordance with the WHO definition of hypertension (>140/90 mmHg or prescribed anti-hypertensive treatment), 44% of individuals had hypertension with a greater proportion of men (51%) relative to women (39%) (Carrington, et al., 2010). This was not a random sample but if these data are a true reflection of the level of hypertension among the Australian adult population, it implies that BP levels have increased after a relatively steady period in the mid 1990s.

![Figure 1: Proportion of adults with elevated BP, 1980 to 1999-2000](image)

*Source: Australian Institute of Health and Welfare (AIHW, 2010)*
Treatment for hypertension

Effective treatment of elevated BP requires a combination of diet and lifestyle modifications and potentially anti-hypertensive drug treatment. In conjunction with this, regular contact with GPs is required to maintain BP within recommended target levels. In Australia, 10 in every 100 primary care encounters for men and 7 in 100 for women were related to hypertension (approximately double that of lipid disorder management) ((AIHW), 2010).

Diet and lifestyle modifications

Diet and lifestyle modifications for the reduction of BP focus on the importance of exercise and minimising key risk factors including obesity, excessive salt intake and high alcohol consumption. The NHFA recommends at least 30 minutes of moderate-intensity activity to lose excess body fat for a healthy body weight, limited salt and alcohol intake and the maintenance of an appropriate waist measurement through both exercise and dietary changes (NHFA, 2008) (refer to Appendix 1).

If diet and lifestyle modification proves ineffective in lowering BP levels, initiation of pharmacological treatment may be warranted. The decision to intervene and determine the optimal management plan is based on a thorough clinical investigation and assessment of absolute cardiovascular risk (NHFA, 2008). As part of this, smoking cessation is recommended since smoking, in addition to BP, is a major determinant of absolute risk (NHFA, 2008). Anti-hypertensive therapy may also be prescribed in situations whereby patients are in immediate need for treatment (in addition to diet and lifestyle modifications) to maintain BP levels at or below those which are consistent with the patient’s identified target BP group (refer Table 1).

Pharmacological treatment

There are five major classes of drugs that are used to treat hypertension (see below). Physicians have the option of selecting four drug classes for first-line therapy for ‘uncomplicated hypertension’; the NHFA no longer recommends β-blockers due to the risks associated with developing diabetes. Patients that suffer from co-morbid or associated conditions add complexity to treatment regimes, therefore drug interactions and contra-indications must be considered.

- **ACE inhibitors and Angiotensin II receptor antagonists:**
  These reduce the resistance to blood flow around the body and improve salt and water balance to reduce BP.

- **Beta (β) blockers:**
  These reduce heart rate and the volume of blood returned to the heart which decreases BP. β-blockers also have therapeutic benefits similar to ACE inhibitors and Angiotensin II receptor antagonists.

- **Thiazide diuretics:**
  These affect salt and water balance to decrease BP.

- **Calcium channel blockers:**
  These reduce the resistance to blood flow around the body and the volume of blood being pumped by the heart which reduces BP.

Approximately 50-75% of patients with hypertension will not reach their BP targets with a single drug, in which case combination therapy is advised (NHFA, 2008). Health professionals may select between various drug combinations that not only reduce BP but also confer advantage when treating heart failure and CHD or minimise adverse effects.

Structured management strategies

A multi-faceted intervention involving regular visits and a stepped-care approach towards drug administration is proposed to be effective in helping patients reach BP targets (Glynn, Murphy, Smith, Schroeder, & Fahey, 2010). Following regular reviews, physicians are encouraged to up-titrate drug doses and utilise combination therapy if BP targets are not being met over time. Early findings from the Valsartan Intensified Primary Care Reduction of Blood Pressure Study (VIPER-BP), a randomised control trial comparing usual primary care management to an intensive BP management strategy, support the pressing need to rigorously manage BP (Stewart, Carrington, Swemmer, Kurstjens, & Jennings, 2011).
Benefits of treatment for hypertension

Lowering BP can proportionally reduce the risk of death from CVD, irrespective of the starting level of BP prior to treatment. A meta-analysis of 61 observational studies involving approximately one million adults quantified the strong, continuous, graded, independent relationship between hypertension and CVD mortality. In adults aged 40–69 years with no previous CVD, each difference of 20 mmHg in SBP or approximately 10 mmHg in DBP was associated with double the risk of death from CVD (Lewington, et al., 2002). This association was consistent for the entire range of BP studied, from 115/75 to 180/110 mmHg.

BP drugs offer the same protection in patients with or without a history of CVD (Law et al, 2009). This highlights the importance and benefits of BP management to the whole spectrum of patients that present with elevated BP and not only those with pre-existing hypertension or CVD.

Generally, all anti-hypertensive drug classes have similar effects in reducing CVD related events for a given reduction in BP (Law et al, 2009). Notable exceptions include ß-blockers which exert additional protective effects when used shortly after a heart attack and calcium channel blockers which may have a greater preventive impact on stroke. Combination therapy offers greater benefit to risk reduction; one standard dose of hypertensive therapy lowered the risk of CHD and stroke by 25% and 35% respectively, while three drugs at half standard dose lowered risks by 45% and 60%.

Cost of hypertension

In the year ending June 2010, three of the top fifteen ranked highest volume drug groups listed on the Pharmaceutical Benefits Scheme (PBS) included anti-hypertensive drug therapy (DoHA, 2010). Agents acting on the renin-angiotensin system, ß-blockers and calcium channel blockers totalled 33.5 million prescriptions at a cost in excess of $812 million. These figures do not include thiazide diuretics or non PBS subsidised prescriptions, nor is the cost of monitoring BP levels accounted for.

The Australian Health Care system spends 11% of its annual expenditure on managing CHD and stroke, both of which are linked to antecedent hypertension as a major causative risk factor, totalling approximately $16.3 billion dollars a year (AIHW, 2010). Thus, improved management of elevated BP could significantly reduce these costs.
Objectives

Given the large burden of CVD in Australia of which elevated BP is a prime contributor, the enormous investment in hypertension treatments and the paucity of data to determine their practical application and potential efficacy of management, we sought to understand the contemporary pattern of BP levels and management of hypertension from a primary care perspective.

This report is an analysis of BP measurements in patients being managed in primary care in Australia between 2005 and 2010. It provides important insights into the optimal monitoring and management of hypertension and provides underlying clinical and public health messages for health professionals and the broader community.

There are two key aspects which are addressed:

**Part I:**
Broad trends in BP levels in patients seeking primary care across Australia.

**Part II:**
The effect of regular GP reviews and active management on BP levels across contiguous GP visits (on an annual basis).

SBP and DBP levels are presented and compared according to a number of sub-groups of interest that include:

- **Sex (men vs. women)**
- **Age (young adult/middle aged men vs. young adult/middle aged women)**
- **States and Territories**
- **Region (urban vs. rural dwelling individuals)**
- **Socio-economic status (low income vs. high income area)**
- **Treatment (hypertensive therapy vs. no hypertensive therapy)**

* Median household income (per week) was determined using postcode data of GP clinic locations in order to infer socio-economic status. This is a technique commonly applied to measure the relative prosperity of populations in different geographical locations.*
Methods used to evaluate BP levels and management of hypertension

**Data source**

This report was compiled using data from the research division of the Health Communications Network (HCN), the General Practice Research Network (GPRN).

HCN is the leading provider of the Medical Director clinical software package used by more than 17,000 clinicians in Australian (HCN, 2011). The GPRN is a national network of Australian GPs from which a panel of participating GPs supply de-identified data each week through Medical Director (after removal of patient’s name, address, telephone number, Medicare number or any other information that could “reasonably” identify the person) to support research and development in general practice. As such, the GPRN is a leading electronic provider on the use of medicines in general practice. Typical uses for the data include quality assurance assessments and research activities of government, academic institutions and industry for educational and research initiatives. The GPRN aims to maintain an active panel of 300 GPs with replacement of drop-outs.

To date, more than 1,065 GPs have contributed to the creation of a longitudinal patient-based database containing almost 29 million scripts in excess of 30 million encounters of more than 3 million patients (HCN, 2011).

Available data from the GPRN includes:

- GP demographics
- Patient demographics
- Prescriptions
- Reason for visit
- Reason for prescription
- Pathology and radiology requests
- Clinical measurements (e.g., height, weight, BP)
- Other data from Medical Director

**Consent**

The information provided is collected in accordance with privacy guidelines (refer to HCNs patient privacy policy) (HCN, 2011). Upon giving informed consent to use the information for research and statistical purposes, de-identified data are provided to the HCN (hence the de-identification process begins with the GP/Specialist). However, HCN provides an information statement policy for display at the point of care outlining for the consumer the possible uses of the information and data and also the de-identification process. Both the GP/Specialist and consumer retain the right to refuse the use of any personal health information for research and statistical purposes.

The use of these data has been approved by the Alfred Hospital Human Research Ethics Committee.
Limitations

These data have a number of important limitations. They were collected as part of routine clinical practice and not in a systematic and prospective manner for the purposes of this report. For example, although a patient may have had their BP tested, the results may not have been entered into their electronic records. Furthermore, due to the de-identified nature of data (both from a patient and GP perspective), we are unable to determine if individual patients consulted another GP and therefore included twice in the data-set. In addition to having to apply a series of conservative assumptions to standardise between individual comparisons (for example we only accepted records where the age and gender of individuals were clearly identifiable), we have no way of verifying the veracity of individual data. Moreover, these data describe a specific primary care patient cohort and caution should be applied when making extrapolations (i.e. beyond within cohort comparisons) to the wider patient population being managed within primary care in Australia and, indeed, the wider Australian population.

The well described phenomenon of white coat hypertension cannot be discounted in contributing to the proportion of patients with elevated BP levels recorded at the time of visit (Mancia, Bombelli, Seravalle, & Grassi, 2011).

Nevertheless, there are many positive aspects to the utilisation of these data in this report. These include a) the standardised manner in which these data were collected, b) the broadly representative nature of contributing GPs and their patients, and c) the overall size of available records (over half a million records over six years). Thus, this report represents an important “barometer” of BP levels in Australia and our ability to cost-effectively improve BP levels to reduce highly preventable hospital admissions and deaths due to CHD.

GP characteristics

Figure 2 shows the distribution of primary care clinics in Australia with the overall number of BP measurements recorded for each State and Territory. Information from a total of 532,050 patients was collected by 733 GPs from 286 primary care clinics across Australia.

Figure 2. Number of primary care clinics per State and Territory contributing to patient BP measurements, 2005 to 2010
Patient characteristics

Only individuals aged over 18 years and with basic demographic data (age and sex) were included in data analyses for this report. Table 2 shows the breakdown per year of males and females who had a BP measurement recorded. Overall, there were 45% of men and 55% of women who visited their GP between 2005 and 2010 and had their BP taken.

Table 2. Number of gender-specific BP records by year, 2005 to 2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Males (n=240,525)</th>
<th>Females (n=291,525)</th>
<th>Total (n=532,050)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>69,491</td>
<td>82,903</td>
<td>152,394</td>
</tr>
<tr>
<td>2006</td>
<td>39,037</td>
<td>48,066</td>
<td>87,103</td>
</tr>
<tr>
<td>2007</td>
<td>40,730</td>
<td>50,746</td>
<td>91,476</td>
</tr>
<tr>
<td>2008</td>
<td>37,761</td>
<td>47,094</td>
<td>84,855</td>
</tr>
<tr>
<td>2009</td>
<td>29,360</td>
<td>34,972</td>
<td>64,332</td>
</tr>
<tr>
<td>2010</td>
<td>24,146</td>
<td>27,744</td>
<td>51,890</td>
</tr>
</tbody>
</table>

Figure 3 shows the age distribution of the total number of men and women who contributed BP measurements. As can be seen, there were more women than men under 34 years of age yet more men between 45 and 74 years of age.

Figure 3. Age and gender-specific records of BP measurements, 2005 to 2010
Part I.
BP levels of first patient encounters

This initial set of analyses used only patient records of the first BP measurements within the six years of available data. In instances where patients had multiple BP measurements taken over this time period, only their first recorded results were utilised.

Overall trends in BP levels

Based on 532,050 BP measurements between 2005 and 2010, Figure 4 shows that BP levels did not significantly change from an average of approximately 129/78 mmHg.

Figure 4. Average BP levels of first patient records, 2005 to 2010
Note: Standard error bars are contained within data points due to the very small variability.

Figure 5 shows the percentage of patients with elevated BP >140/90 mmHg who were or were not prescribed anti-hypertensive medication. Aside from a decrease in 2006, approximately 25% of patients had high SBP and/or DBP and a total of 36% had elevated SBP and/or DBP and/or were receiving anti-hypertensive medication.

Figure 5. Percentage of patients with elevated BP or on anti-hypertensive therapy, 2005 to 2010
Gender differences in BP levels

In Figure 6 below, results from 240,532 men and 291,525 women between 2005 and 2010 showed that BP levels were relatively unchanged and on average 5 (SBP) and 2 (DBP) mmHg higher in men (132/79 mmHg) than women (127/77 mmHg). Overall, 27% of men and 21% of women had high SBP and/or DBP (> 140/90 mmHg).

Figure 6. Average BP levels in men and women, 2005 to 2010
Note: Standard error bars are contained within data points due to the very small variability.

Age and gender differences in BP levels

Figure 7 shows the average SBP (panel A) and DBP (panel B) levels by decade of age. SBP progressively increased by approximately 10 mmHg for men and 25 mmHg for women from 18 to ≥ 75 years of age. DBP increased by approximately 9 mmHg for men and women up to 64 years of age before decreasing thereafter. Overall, younger men had higher SBP and DBP and a progressively smaller gap in BP than women up to 65 years of age. After this age, this trend reversed and women had higher SBP and DBP than men.

Figure 7. Age and gender specific average BP levels, 2005 to 2010
A cohort of 91,344 young adults (64% women) aged 23 to 34 years old were identified from the dataset. Consistent with overall differences between men and women of all ages, Figure 8 shows that average BP levels were very similar between 2005 and 2010 and there was no apparent BP reduction for either men or women. BP was consistently higher in young adult men (126/76 mmHg) compared to their female counterparts (115/72 mmHg). For SBP in particular, this gap appeared to widen from 2005 (8 mmHg difference) to 2010 (12 mmHg difference). The proportion of young adult men with BP levels which exceeded 140/90 mmHg was 3-fold higher compared to young adult women (15% vs. 5%).

![Figure 8. Average BP levels in young adult men and women, 2005 to 2010](image)

Note: Standard error bars are contained within data points due to the very small variability.

A cohort of 199,301 middle-aged adults (51% women) 45 to 64 years old were identified from the dataset. As per overall sex differences irrespective of age, BP levels were relatively unchanged and there was no apparent BP reduction for either men or women from 2005 to 2010 (Figure 9). BP was consistently higher in middle-aged men (133/82 mmHg) compared to their female counterparts (129/79 mmHg). The proportion of middle-aged men with BP levels which exceeded 140/90 mmHg was higher compared to middle-aged women (29% vs. 24%).

![Figure 9. Average BP levels in middle-aged men and women, 2005 to 2010](image)

Note: Standard error bars are contained within data points due to the very small variability.
**Location differences in BP levels**

Figure 10 shows the average SBP (panel A) and DBP (panel B) levels for each Australian State and Territory. Overall, average BP levels were highest in Tasmania (130/79 mmHg) and lowest in the Northern Territory (127/77 mmHg) with the correspondingly highest proportion of adults with a BP >140/90 mmHg in Tasmania (25%) and lowest in the Northern Territory (17%).

A total of 27% of rural/remote patients and 22% of urban patients had high SBP and/or DBP (> 140/90 mmHg).

In Figure 11 below, results from 374,338 urban and 157,712 rural/remote residents between 2005 and 2010 showed that BP was relatively unchanged and slightly higher for SBP but not DBP in patients from rural/remote areas (131/78 mmHg) compared to urban areas (129/78 mmHg). A total of 27% of rural/remote patients and 22% of urban patients had high SBP and/or DBP (> 140/90 mmHg).

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**Figure 10. Average BP levels in each Australian state and territory, 2005 to 2010**

**Figure 11. Average BP levels in urban and rural/remote residents, 2005 to 2010**

Note: Standard error bars are contained within data points due to the very small variability.
Socioeconomic differences in BP levels

Results from 267,811 patients who visited a GP clinic from a low income area and 264,239 from a high income area between 2005 and 2010 are shown in Figure 12 below. BP remained unchanged across this time and marginally higher (for SBP only) in patients visiting GPs in low (130/78 mmHg) than high income areas (128/78 mmHg). In total, 25% and 22% of patients whose GP was in a low or high income area, respectively, had high SBP and/or DBP (> 140/90 mmHg).

Figure 12. Average BP levels in low compared to high income areas, 2005 to 2010

Note: Standard error bars are contained within data points due to the very small variability.
Treatment differences in BP levels

Note: Anti-hypertensive treatment was documented by the presence of an anti-hypertensive script within the year of visit, otherwise anti-hypertensive therapy was not confirmed.

There was evidence for a total of 133,802 patients (25%) who were receiving anti-hypertensive therapy when the first recorded BP measurements were analysed. Figure 13 shows that the BP level of those prescribed anti-hypertensive medication (139/81 mmHg) was significantly higher than the BP level of patients not on anti-hypertensive treatment (126/77 mmHg).

Figure 14 shows the types of anti-hypertensive therapy recorded for patients. The most common class used to treat hypertension were thiazide diuretics (42%) followed closely by Angiotensin II receptor blockers and ACE inhibitors, prescribed for 39% and 37% of patients, respectively. Calcium channel blockers and β-blockers were next popular, prescribed in 28% and 25% of cases, respectively. A small proportion of patients (5%) were prescribed other anti-hypertensive treatment such as α2 agonists. Typically, the proportion of patients prescribed a single versus combination anti-hypertensive treatment was equally distributed over the study period (data not shown).

Figure 13. Average BP levels in treated and untreated patients, 2005 to 2010
Note: Standard error bars are contained within data points due to the very small variability.

Figure 14. Proportion of patients prescribed each class of anti-hypertensive therapy, 2005 to 2010
ARB: Angiotensin II receptor antagonists; ACE: Angiotensin converting enzyme; CCB: Calcium channel blocker.
Figure 15 shows the percentage of patients with elevated BP >140/90 mmHg who were or were not receiving anti-hypertensive medication. Irrespective of treatment, there was an increase in the percentage of patients who had high SBP and/or DBP in 2007 which was maintained until 2010. The proportion of patients prescribed anti-hypertensive therapy with BP levels which exceeded 140/90 mmHg was consistently (over the 6 years) more than double the proportion of those not prescribed the same treatment (41% vs. 18%).

A cohort of 116,222 patients (22% prescribed anti-hypertensive treatment) from 2009 and 2010 were identified from the dataset to assess adherence to the latest NHFA guidelines (NHFA, 2008). Figure 16 shows that a disappointing 59% of higher risk patients with established CVD or CVD-related conditions had BP levels which exceeded their target of 130/80 mmHg. The proportion of patients without CVD or associated conditions but receiving anti-hypertensive therapy who had BP levels which exceeded recommended levels of 140/90 mmHg was 48%. An additional 19% of patients not prescribed anti-hypertensive therapy had BP levels above 140/90 mmHg.

Figure 15. Percentage of patients with elevated BP according to treatment, 2005 to 2010

Figure 16. Percentage of patients who exceed individualised NHFA BP targets, 2005 to 2010

Ref: National Heart Foundation of Australia (NHFA, 2008)
Part II. Frequency of visits and impact on BP levels

This second set of analyses used patient records with a repeat annual BP measurement. All of the Figures in Part II of this report show average BP levels over consecutive yearly visits for patients with 2, 3, 4, 5 or 6 visits. For these analyses, records whereby patients had longer periods between visits (over 1 year gap) were discarded and not included in data analyses. In instances where patients had more than one sequence of contiguous visits over the course of the 6 years of available data, the largest set was taken.

Trends in BP levels across contiguous annual visits

Figure 17 illustrates that BP levels showed minimal change across annual contiguous visits which varied in time from 2 to 6 successive years. There were no greater reductions in BP levels in those who had more frequent GP visits over time. However, BP remained below the historical recommended target of 140/90 mmHg and for DBP was lower than recommended at around 80 mmHg.

![Figure 17. Average BP levels of contiguous patient visits, 2005 to 2010](image)

Note: Standard error bars are contained within data points due to the very small variability.
**Trends in BP levels across contiguous annual visits in patients with elevated BP**

A cohort of 51,721 patients who had elevated BP above 140/90 mmHg at the first contiguous visit were identified. Figure 18 shows that aside from an initial improvement in BP after two GP visits were undertaken, there were no greater improvements identified in patients who had more regular GP visits.

![Figure 18. Average BP levels over contiguous visits in patients with elevated BP, 2005 to 2010](image)

*Note: Standard error bars are contained within data points due to the very small variability.*

Figure 19 shows the average BP levels over contiguous annual visits by anti-hypertensive medication in patients with elevated BP. A cohort of 15,503 patients who were not prescribed anti-hypertensive therapy (panel A) and 36,218 patients prescribed anti-hypertensive therapy (panel B) at their final GP visit were identified. Consistent with overall differences in patients with elevated BP, there was an initial improvement in BP after two yearly GP visits without any further improvements for patients who either had more frequent GP visits or who were prescribed anti-hypertensive therapy.

*Note: Anti-hypertensive treatment was documented by the presence of an anti-hypertensive script within 6 months prior and 3 months after the date of visit of BP measurement. Otherwise, anti-hypertensive therapy was not confirmed.*

**A) Not on anti-hypertensive treatment**

**B) On anti-hypertensive treatment**

![Figure 19. Average BP levels according to treatment over contiguous visits in patients with elevated BP, 2005 to 2010](image)

*Note: Standard error bars are contained within data points due to the very small variability.*
Conclusions

This report outlines the results of Australia’s largest study of BP levels utilising primary care data. Reporting on over 500,000 patients being managed by more than 700 GPs from throughout Australia during 2005 to 2010, it provides important insights into the most important risk factors detrimental for the development of CVD - hypertension.

These data confirmed a number of previous observations relating to key differentials in BP levels according to age, sex, region, socioeconomic status and place of residence. Of concern, we found the well documented lack of achievement of BP target levels in patients being treated for hypertension. Given the enormous investment in managing hypertension (close to $1 billion per annum) (DoHA, 2010), we believe it is critical to apply a more systematic approach to screening via BP testing followed by regular review and referral to determine if we are maximising the potential of anti-hypertension treatments. If these data are a true indication of BP management in primary care (we have no reason to suspect they are not), they indicate that little has changed in terms of addressing one of Australia’s most significant contributor to CVD. They also reinforce calls for a more intensive approach to BP management in primary care to ensure patients are reaching their ideal BP targets.

Overall, average BP levels in both men and women showed no change from 2005 to 2010 with at least one in four patients having BP levels that exceeded the historical ideal target of 140/90 mmHg. Despite the expected gradients in elevated BP with age, it is of concern that 15% of young adult men and 5% of young adult women had BP levels which exceeded 140/90 mmHg. This is a timely reminder that early detection and ongoing protection from Australia’s biggest contributor to CVD remains a public health priority.

As expected, we found some potentially important differences in the proportion of patients achieving their ideal BP targets on the basis of region (urban vs. rural/remote), socioeconomic location of their GP (low vs. high income areas) and place of residence. Unfortunately, we observed no longer term benefits from contiguous annual visits, with initial BP lowering gains remaining static beyond the first year of follow-up.

Given the enormous cost and effort of treating patients with hypertension, it is concerning to consider the relative lack of impact of BP control with 2 in 5 patients having BP levels which exceeded 140/90 mmHg. BP levels were unable to be improved by regular visits to GPs or the prescribing of anti-hypertensive therapy suggesting treatment adherence may not be ideal or more intensive pharmacotherapy is required to address the treatment gap. The inability to achieve the outdated recommended target of 140/90 mmHg could be considerably worse if individualised BP targets were applied (NHFA, 2008). Although there are a broad range of pharmacological treatments with proven efficacy to reduce BP in clinical trials, it is clear that translation into the “real world” is more challenging. This reinforces our contention that more trials to evaluate real world effectiveness management strategies are required to better apply proven BP lowering treatments (Stewart, et al., 2011). Moreover, there should be greater application and utilisation of government funding mechanisms to support not only pharmacotherapy, but proven and integrated management strategies with the capacity to significantly reduce death and disability from CVD via more effective risk reduction.

We conclude that elevated BP represents a major health issue and is a significant pressure point in combating the future burden of CVD within our ageing population. Despite potentially effective treatments, BP levels remain at historically high values. This mandates a more proactive and intensive approach to lower BP to a level where future cardiovascular events are averted. Ultimately, any successful strategies will need to engage government, the health care workforce and consumers to firstly recognise the impact of elevated BP and in turn to work together to reduce dangerously high BP levels within our adult population.
References


Department of Health and Ageing. PBS expenditure and prescriptions twelve months to 30 June 2010. Canberra, ACT.


High blood pressure and salt

Eating too much salt can increase the risk of hypertension because the sodium in salt makes your body retain more water, which leads to swelling of the ankles. The extra water in the blood vessels creates more pressure and the heart has to work harder to pump blood around our bodies.

Our kidneys remove excess sodium from the body. They help keep our blood pressure normal. Too much salt can gradually damage our kidneys, making them become less able to remove the excess sodium.

You can get your daily recommended requirement from the natural salt in fresh foods. To avoid adding it to your diet:
- Avoid manufactured or processed foods that have salt added, such as potato chips, sausages and canned soups or packet meals.
- Choose foods labeled ‘no added salt’, ‘low salt’ or ‘salt reduced’, including breads and cereals.
- Don’t add salt to your food at the table or to your cooking.

Important information

If you have kidney disease or are taking other medicines, consult your GP before changing your salt intake. Also, check with your GP before starting an exercise program. Exercises involving lifting heavy weights and body presses should be avoided by people with high blood pressure. If exercise causes you pain or discomfort, stop immediately and see a GP.

Blood Pressure and Your Health

Lowering your blood pressure by modifying your lifestyle and eating habits reduces your risk of cardiovascular disease, including having a fatal heart attack or stroke.

Baker IDI Heart & Diabetes Institute

Baker IDI Heart and Diabetes Institute is Australia’s leading health and medical research institute dedicated to reducing ill health and mortality caused by the effects of cardiovascular disease and diabetes, two insidious and complex diseases wreaking havoc in our community.

Our work extends from the laboratory to wide-scale community studies with a focus on diagnosis, prevention and treatment.

We are proud of our pledge to improve the quality of life for people now and safeguard the health of future generations. This mission drives everything we do.

For more information contact
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The facts
High blood pressure (hypertension) is a leading and highly preventable cause of illness and death due to cardiovascular disease. Almost one third of Australians aged over 50 years have high blood pressure and nearly one out of two Australians have high blood pressure before they reach 70 years of age.

What is blood pressure?
Blood pressure is the force of blood pressing against the walls of the blood vessels (arteries) that deliver oxygen-rich blood from the heart to all parts of the body. Your heart contracts to force blood around the body and rests briefly between each heart beat. So, when someone takes your blood pressure, two measurements are obtained (e.g. 120/80 mmHg, said as “120 over 80”).

Systolic – pressure in the artery as the heart contracts. This is represented by the top, higher number (“120”).

Diastolic – pressure in the artery when the heart is relaxing and being filled with blood. This is represented by the bottom, lower number (“80”).

Monitoring your blood pressure
Since you cannot see your blood pressure, it is important that you have it checked at least yearly, or more frequent checks if you are over 40 years of age, have a history of high blood pressure or any other risk factors for cardiovascular disease.

Individual blood pressure goals can vary widely depending on whether other risk factors for cardiovascular disease are present. Your doctor should discuss your recommended goal levels with you. The following values when your blood pressure is checked by a nurse or doctor can be used as a guide.

<table>
<thead>
<tr>
<th>Classification levels of blood pressure</th>
<th>For people with no cardiovascular disease, diabetes or kidney disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>Systolic (mmHg)</td>
</tr>
<tr>
<td>Normal</td>
<td>Less than 120</td>
</tr>
<tr>
<td>Normal to high</td>
<td>120-139</td>
</tr>
<tr>
<td>High (hypertension*)</td>
<td>140 and above</td>
</tr>
</tbody>
</table>

Note: Specific lower blood pressure targets of less than 120/80 mmHg have been established for people with cardiovascular disease, diabetes or kidney disease.


What causes high blood pressure?
For most people, there is no specific cause for high blood pressure but the risk of serious problems associated with high blood pressure is increased by:

- Smoking
- High blood cholesterol
- Being overweight
- Physical inactivity
- High salt intake
- Diabetes
- Family history of high blood pressure
- High alcohol intake

For a minority of cases (about 10%) high blood pressure is related to another medical condition.

Tips to control your blood pressure
It is recommended to:

- Have your blood pressure checked during routine visits to your doctor.
- Make lifestyle changes to exercise regularly (30 min per day of brisk walking), lose excess body fat for a healthy body weight, reduce your alcohol intake to two or less drinks per day (men) or one per day (women), quit smoking and minimise physical and emotional stress by relaxation and thinking positively.

To follow a healthy eating pattern:

- Eat plenty of fruits, vegetables, wholegrain breads and cereals, lentils and legumes. Also include raw nuts and seeds.
- Choose skinless chicken and lean red meat, removing any visible fat. Also include two serves per week of oily fish.
- Consume reduced fat dairy products or soy products with added calcium.
- Select olive, canola or sunflower oil for cooking. Margarines made from these oils can also be used, but in small amounts.
- Limit foods high in saturated fat, salt and added sugar.
- Control your overall food intake by choosing small to moderate food portions.
- Drink plenty of water and limit your alcohol consumption to two or less drinks per day (men) or one per day (women).

In Australia it is recommended that you eat two servings of fruit and five servings of vegetables per day.

If diet and lifestyle changes are not enough to reduce your blood pressure, you may also require medicines. There are numerous blood pressure medicines and in some instances, a number of them may be required long term.