Abstract: High blood pressure leads to greater risk of cardiovascular disease morbidity and mortality. Our aim was to determine the prevalence of hypertension in a cohort of people attending a rural university health screening program in response to community advertisements. In all, 674 individuals attended the screening program at our university health clinic in Albury. The presence and treatment of diagnosed hypertension were reported by 37.3% of participants. Antihypertensive medications were used in 42.9% of the known hypertensives, and fewer than half of these patients on antihypertensive agents achieved a normal blood pressure. New hypertension in accordance with the AusDiab criteria that is not diagnosed and treated was identified in 20.8% of participants. We conclude that the rates of antihypertensive treatment were low in this rural population, and that in those who were treated, a large portion still remained hypertensive. The management and monitoring of hypertension in this rural community needs to be improved to capture the additional people with hypertension and to reduce blood pressure to recommended levels.
Identification of hypertension and efficacy of treatment in a rural university-based health clinic

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Abstract

High blood pressure leads to greater risk of cardiovascular disease morbidity and mortality. Our aim was to determine the prevalence of hypertension in a cohort of people attending a rural university health screening programme in response to community advertisements. 675 individuals attended the screening programme at our university health clinic in Albury. Presence of diagnosed hypertension and treatment was reported by 37.3% of participants. Antihypertensive medications were used in 42.9% of the known hypertensives and less than half of these patients on antihypertensive agents achieved a normal blood pressure. New hypertension in accordance with the AusDiab criteria that is not diagnosed and treated was identified in 20.8% of participants. We conclude that the rates of antihypertensive treatment were low in this rural population and that in those who were treated, a large portion still remained hypertensive. The management and monitoring of hypertension in this rural community needs to be improved to capture the additional people with hypertension and to reduce blood pressure to recommended levels.

Key words: hypertension, prevalence, barriers, treatment, screening, rural
Introduction

Hypertension (HT) is a major risk factor for coronary heart disease, stroke, heart failure, renal failure and peripheral vascular disease (3,10). It is the main contributor to loss of health in Australia, accounting for nearly 18% of the total disease burden (8). The Australian Diabetes, Obesity and Lifestyle Study 2000 (AusDiab) found that in 1999-2000 the prevalence of hypertension in the Australian population ≥25 years of age was 28.6% (3). 13.4% of these were treated and 15.2% untreated. A more recent study showed that the prevalence of hypertension in adult Australians was approximately 30% with no significant differences between urban and rural areas (2).

Despite advances in pharmacological therapy for hypertension, only 25% of treated patients achieve target blood pressure which is below 140 mmHg systolic and/or 90 mmHg diastolic (15). However, the AusDiab study reported that 39.7% of the treated patients had normal blood pressure (3). Failure to diagnose high blood pressure in clinics and hospitals, inadequate treatment regimens, side effects of antihypertensive medications, poor patient adherence to medications and lifestyle choices are contributing to the low success rate of blood pressure control which in turn leads to greater risk of cardiovascular disease morbidity and mortality (12).

The primary aims of the study were to establish the prevalence of hypertension in a rural population on the border of the state of New South Wales and Victoria in Australia, and to investigate the awareness and management of hypertension in these patients.

Patients and Methods

Ethics clearance was obtained from the Charles Sturt University Human Ethics Committee and all participants signed a consent form indicating they understood the purpose of the research and permitted data to be published. Patients in this study were recruited through public media advertisements on television, radio and the newspaper during 2004. The media releases emphasised that the purpose of the study was to conduct a one stop health check for anyone in the community. A total of 706 individuals attended the health clinic in 2004. Participants filled
out a demographic and clinical history questionnaire including past history of cardiovascular
disease, smoking (smoking >5 cigarettes/day), alcohol intake (>2-3 standard drinks/day) and
physical activity (self-reported weekly exercise; none, low, moderate and high). Clinical data
recorded included age, gender, body mass index (BMI; low <20 kg/m$^2$ normal <25 kg/m$^2$
overweight 25-30 kg/m$^2$ and obese >30 kg/m$^2$), diabetes mellitus (self-reported use of
hypoglycaemic medication, or fasting blood glucose reading ≥7.0 mmol/L or glucose reading
anytime ≥11.1 mmol/L using the AccuChek Advantage II device (Roche Australia P/L),
hyperlipidaemia (total cholesterol >6.0 mmol/L or low-density lipoprotein cholesterol level >4.0
mmol/L, or self-reported use of lipid lowering medication). A comprehensive list of prescription
medications was provided by each patient.

Blood pressure (BP) measurements were taken using a standard mercury sphygmomanometer
and a cuff of appropriate size after the individual had rested for at least 5 minutes in a supine
position when possible. BP was recorded in a sitting position in five individuals (7.6%) with the
arm supported at heart height as this was more comfortable. For this project BP measurements
were taken on a single occasion in line with previous studies and the mean of two readings, one
minute apart, were recorded. Classification of blood pressure was according to the Guidelines
of the National Heart Foundation of Australia (10).

Hypertension was deemed present if the individual was using antihypertensive medication or
had systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg in accordance with the Australian
guidelines (4). For the population prevalence this study followed the protocol of the AusDiab
study, which relied on one blood pressure reading only. Participants were categorised into those
with HT and those without HT. The hypertensive group was further divided into treated or
untreated depending on the self-reported use of antihypertensive medication. In addition gender
and age differences were investigated. Achievement of treatment goals was considered
successful if a blood pressure of <140 mmHg systolic and <90 mmHg diastolic was recorded.
Data are expressed as mean±SD. Chi-square analysis was used to determine whether there is a significant difference in incidence between categorical variables such as gender, age or hypertension categories. A student t-test was used to determine the difference between the level of blood pressure between different groups. Statistical significance was set at a p value of 0.05.

Results
General findings
Demographic and clinical information obtained are shown in table 1. Data for BP and self-reported use of antihypertensive medication were available for 675 (95.4%) individuals, 294 (43.7%) males and 380 females (56.3%).

37.3% reported known hypertension in the clinical history questionnaire or receiving medication. This study identified 393 (58.2%) individuals with hypertension. Forty-three participants (6.4%) were not aware that their general practitioner had identified them with hypertension and prescribed antihypertensive medications (Figure 1).

There was no significant difference in the proportion of treated to untreated patients between this and the AusDiab study ($X^2_{1,86.8} = 0.23$, $p = 0.62$). The proportion of individuals separated by gender with and without hypertension and grade of hypertension is shown in Figure 2.

A larger proportion of females had HT in all age groups except for the 80+ age. However no significant differences were observed. The number of those with hypertension increased for
both males and females with age until the seventh decade indicating significant differences between age groups \((p < 0.05)\). 6.7\% of hypertensive individuals being 80 years or over at the time of the study (Table 2).

PUT TABLE 2 HERE

**Treated Hypertension**

206 (30.5\%) individuals were receiving antihypertensive medications in our cohort. Of those treated, 42.7\% had BP readings in the normal to high normal range. 37.9\% were identified with mild, 17\% with moderate and 2.4\% with severe hypertension.

A goodness of fit analysis determined a statistically significant greater number of females (225, 33.3\%) with hypertension compared to males (168, 24.8\%) in the treatment group \((X_{1,393}, 8.26, p = 0.004)\). The percentage of treated males and females with respect to HT categories is shown in Figure 3.

PUT FIGURE 3 HERE

The number of females in each HT category was greater than males except for the severe HT category: mild (17.0\% vs 14.2\%), moderate2 (7.3\% vs 5.5\%) and severe (0.3\% vs 0.9\%). However there was no significant difference between males and females with respect to HT category \((X_{2,305} = 3.01, p = 0.22)\). When good blood pressure control was defined as <140 mmHg systolic and <90 mmHg diastolic, there was also no significant difference between males and females although a trend of a greater number of females in the normal and high normal categories was seen as compared to males (8.3\% vs 5.8\%, \(X_{1,95} = 3.04, p = 0.08\)).

**Untreated Hypertension**

There was a significant difference for mean blood pressure between the treated (mean±standard deviation: systolic 140.8±19.1 mmHg; diastolic 80.3±13.1 mmHg) and
untreated group (systolic $149\pm15.7$ mmHg, $p < 0.001$; diastolic $87.8\pm8.9$ mmHg, $p < 0.001$) (Table 3).

PUT TABLE 3 HERE

187 (27.7%) of individuals with BP > 140 mmHg or >90 mmHg were untreated at the time of the study. Of these individuals, 19.7% had mild, 7.5% had moderate and 0.44% had severe hypertension. Overall 6.8% (2.8% males; 4% females) were aware that they had high blood pressure from previous visits to their general practitioner but were not taking medication (Figure 4).

PUT FIGURE 4 HERE

Discussion

Prevalence of hypertension has been reported by various agencies in Australia to vary from 28.6% to 42% depending on the age group (1,2,4). The 2002 New South Wales Adult Health Survey reported a significantly higher prevalence of HT in rural residents (22.2 %) compared to urban residents (19.3 %) but no significant difference within the rural health areas (11). The present study demonstrates a higher HT prevalence in the present rural population as compared to reports by the AusDiab study (4). The reasons for the higher prevalence in our population are unclear but our study consists of an older population who may have a higher hypertension prevalence. In addition, our recruitment was based on public announcements with no exclusion criteria specified, which may have caused certain bias in patient selection. In addition the sample was self selected and contained a large proportion of people with diabetes. Finally, white coat syndrome may have contributed to the higher prevalence in our patients. The prevalence of white coat syndrome is approximately 20 to 30% of people attending general practice including in those with identified clinical hypertension (14). Assessment of BP in general practice or other health care facility including our university-based research programme
may lead to BP readings that differ to the values obtained outside of these facilities. However, Howes points out that home BP monitoring does not reduce the percentage of patients classified as having isolated systolic hypertension (ISH) (5). Early studies have reported that people with white coat syndrome show a relatively low risk for morbid events compared to those with sustained hypertension, although an increased prevalence of cardiovascular metabolic syndrome among those with white coat syndrome has also been reported (6,13). Of importance in the current study is the percent in the cohort that are untreated with known hypertension and the number of these with extremely high blood pressure readings.

Elevated BP in patients on antihypertensive medications and in those with undiagnosed high blood pressure needs to be carefully monitored and treated. Substantial evidence supports the value of treating ISH with SBP exceeding 160mm Hg. ISH should be considered controlled when their global CVD risk is reduced to below the average for their age (7). Our results indicate that 2.4% of those with no reported hypertension and 5.2% of those being treated had a SBP above 160 mmHg.

Nationally the proportion of females with hypertension exceeded that of males reported by the Australian Bureau of Statistics for 2002 (males 12.8%, females 13.9%) (1). However, more recent data available for Australia (males 32%, females 27%) and New South Wales (males 20.9, females 19%) indicated the opposite. Our study in a rural community showed that the proportion of males with hypertension is lower than females, which is in line with the Australian national data (2,4). 6.8% of participants with known hypertension did not seek treatment, which was higher than that reported in the New South Wales Adult Health Survey that reported (11).

We found the proportion of individuals receiving treatment in our study to be greater compared to the AusDiab study. Of concern in our study is that 52.4% of the individuals being treated did not achieve recommended target levels. Five (1.3%) of these were in the severe category. In addition, 27.7% of individuals had BP >140mmHg systolic and/or >90mmHg diastolic and who were not aware of having hypertension and not receiving pharmacotherapy. This percentage
would be considerable higher if the cut-off values for diabetes were to be used (9). However since this was a population study we retained the cut-off for reaching treatment goals at 140/90 mmHg. A future study can also investigate the influence of socio-economic background.

**Conclusion**

This prospective study in a rural Australian community has demonstrated that a large proportion of patients are not aware of the presence of the illness. The rate of pharmacological therapy remains low and in those who received antihypertensives, the percentage of patients achieving target level of blood pressure is suboptimal. There is a need for enhanced education to both patients and their primary care physicians in the management of hypertension in this region.

**Acknowledgements**

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References


Figure 1: Subgroups of individuals with hypertension attending the health screening.
**Figure 2:** Incidence of males and females with and without hypertension.
Figure 3: The percentage of treated males and females with respect to HT categories.
**Figure 4:** Comparison of males and females for hypertension categories in the untreated group.
Table 1: Demographic data for study group.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants (n)</td>
<td>295</td>
<td>380</td>
</tr>
<tr>
<td>Age (years)</td>
<td>62.2 ± 12.7*</td>
<td>61.3 ± 12.4</td>
</tr>
<tr>
<td>Diabetes</td>
<td>87</td>
<td>88</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28 ± 4.6</td>
<td>28.3 ± 5.8</td>
</tr>
<tr>
<td>LDL (mmol/L)</td>
<td>3.4 ± 1.0</td>
<td>3.1 ± 1.0</td>
</tr>
</tbody>
</table>

* Results are shown as mean ± standard deviation, except for diabetes status.
Table 2: Prevalence of hypertension according to age groups and gender.

<table>
<thead>
<tr>
<th>Age groups (in years)</th>
<th>Males</th>
<th>Females</th>
<th>P value for Gender Difference</th>
<th>Total Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>2.6</td>
<td>2.9</td>
<td>0.89</td>
<td>5.4</td>
</tr>
<tr>
<td>50-59</td>
<td>8.9</td>
<td>11.8</td>
<td>0.52</td>
<td>20.8*</td>
</tr>
<tr>
<td>60-69</td>
<td>11.2</td>
<td>20.1</td>
<td>0.11</td>
<td>31.3*</td>
</tr>
<tr>
<td>70-79</td>
<td>16.9</td>
<td>18.8</td>
<td>0.75</td>
<td>35.8*</td>
</tr>
<tr>
<td>80+</td>
<td>3.8</td>
<td>2.9</td>
<td>0.72</td>
<td>6.7</td>
</tr>
</tbody>
</table>

*Statistically significant difference (p < 0.05) when compared to 40-49 years age group.
Table 3: Mean and standard deviation of blood pressure for males and females in the treated and untreated hypertension groups.

<table>
<thead>
<tr>
<th></th>
<th>Treated HT*</th>
<th>Untreated HT</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systolic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>142.7 ± 19.8</td>
<td>148.5 ± 16.6</td>
<td>0.05</td>
</tr>
<tr>
<td>Female</td>
<td>139.6 ± 18.5</td>
<td>149.5 ± 15</td>
<td>0.001</td>
</tr>
<tr>
<td>Total systolic</td>
<td>140 ± 19.1</td>
<td>149 ± 15.7</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Diastolic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>83.3 ± 14</td>
<td>89.3 ± 8.8</td>
<td>0.01</td>
</tr>
<tr>
<td>Female</td>
<td>78.3 ± 12.1</td>
<td>86.5 ± 8.4</td>
<td>0.001</td>
</tr>
<tr>
<td>Total diastolic</td>
<td>80.3 ± 13.1</td>
<td>87.8 ± 8.9</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*HT = hypertension