Use of evidence in hypertension guidelines: should we measure in both arms?

Emily Parker and Paul Glasziou

INTRODUCTION
Hypertension affects approximately 20% of adults worldwide and is a major, but modifiable, contributory factor in cardiovascular disease such as coronary heart disease and stroke.1 Part of the assessment of raised blood pressure should include measurement in both arms, as around 6% of the adult population has at least a 10 mmHg difference between arms.2 This proportion increases with cardiovascular risk factors such as age and diabetes.3

An anatomical explanation for this variability has been proposed but there is now evidence to suggest that inter-arm differences are caused by peripheral vascular disease suggesting a pathological, as opposed to physiological, cause. Peripheral vascular disease is a strong predictor of cardiovascular disease, which suggests that inter-arm differences may also have a prognostic value in predicting cardiovascular events.3 As such, it is very important to measure blood pressure in both arms; failure to do so may lead to:

• a delay in the diagnosis of hypertension;
• inadequate treatment of patients with hypertension; and
• physician confusion by spurious, apparent wide fluctuations during monitoring.

For many years, guidelines have suggested measuring blood pressure in both arms but have rarely given justification for doing so or described the methods of how to do this. Using a model developed by Pathman et al.4 — the awareness-to-adherence model — in order for clinicians to change their practice they must first become aware of a guideline, agree with it in principle, decide it is appropriate and feasible, and then adhere to it. Most GPs are aware of the recommendation to initially measure blood pressure in both arms, but only 30% agree with it and few actually adhere to it.5 It is probable that if guidelines cited evidence as to why measuring blood pressure in both arms is important and how to go about it, adherence to them would be greater.

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This is a full-length article of an abridged version published in print and originally published online first. Cite this version as: Br J Gen Pract 2009 DOI: 10.3399/bjgp09X395012 (abridged text, in print: Br J Gen Pract 2009; 59: 206–208).
Therefore, it was, decided to identify current and historical versions of major hypertension guidelines in the UK, Europe, Canada, US, Australia, New Zealand, Japan, and South Africa to review their inclusion of the issue of measuring in both arms. The researchers also wished to assess the degree to which the guidelines provided a justification, evidence, and a description of measurement techniques.

**METHOD**

To identify guidelines, MEDLINE was searched using the terms hypertension and guideline* in the title; the researchers then tracked back for earlier versions of each guideline. The section on blood-pressure measurement from each of these guidelines was then identified, and it was assessed whether the guideline suggested measurement of blood pressure in both arms and, if so, provided a justification, referred to evidence to support this, and described a method to measure blood pressure in both arms and whether the method is appropriate.

**RESULTS**

In total, 15 guidelines were identified, with several versions for most of these. The oldest found were the 1977 Joint National Committee (JNC) guidelines from the US, which is now in its seventh version. Guidelines were noted for other countries such as Spain and Denmark, but were not available in English and so were considered beyond the scope of the present analysis.

Example text on dual-arm measurement extracted from some guidelines are shown in Box 1 (for all quotes see Appendix 1). In total, 13 out of 15 guidelines mentioned the need to measure in both arms; however, one South African guideline surprisingly stated ‘all measurements should preferably be taken using the same arm’. Further, only seven guidelines gave some justification, with only one quantifying the prevalence of substantial arm differences and only one providing a reference to the evidence. No guideline provided a description of appropriate techniques for reliably measuring blood pressure in both arms. Full results are presented in Appendix 1. Table 1 lists the guidelines included with full details in Appendix 2.

**DISCUSSION**

Most current guidelines advise that blood pressure should be measured in both arms, at least on the initial visit but, for the most part, do not justify why or provide information on the criteria or methods for deciding there is an important difference. Of those that did justify dual-arm measurement, only one referenced primary literature to support the claim, and none of the guidelines described a method of taking blood pressure in both arms.

There are some limitations of this review. All the

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**Table 1. Hypertension guidelines’ reference to measuring initial blood pressure in both arms.**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Justified reason</td>
<td>Nil</td>
<td>Nil</td>
<td>MHRA, ESH, ESH-ESC guidelines, BHS-4, CKS guidelines, Heart Foundation of Australia</td>
</tr>
<tr>
<td>Reference(s) given</td>
<td>Nil</td>
<td>Nil</td>
<td>ESH</td>
</tr>
<tr>
<td>Technique stated</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

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*See Appendices for detailed table and references. Partial justification. AHA = American Heart Association; BHS = British Hypertension Society; CKS = Clinical Knowledge Summaries; EJCPR = European Journal of Cardiovascular Prevention and Rehabilitation; ESC = European Society of Cardiology; ESH = European Society of Hypertension; JNC = Joint National Committee; MHRA = Medicines and Healthcare Products Regulatory Agency; JSH = Japanese Society of Hypertension; NICE = National Institute for Health and Clinical Excellence; WHO/ISH = World Health Organization/International Society of Hypertension.*
Working Party of the British Hypertension Society (BHS) guidelines were found, as were all the guidelines from the Joint National Committee; however, other guidelines may have been missed. In addition, while references cited in each guideline were studied, it is possible that references discussing blood pressure in both arms, justification, and methods could have been missed. Further the BHS referred to extra material (on CD), which may have contained this information.

A recent UK survey showed that most (77%) GPs were aware of the guideline statement to measure blood pressure in both arms, but that only 30% accepted this was worthwhile and less than 13% adhered to it. Without provision of justification or methods, it would appear current guidelines are likely to be ignored by the majority of GPs. If guidelines justified why they recommended blood pressure measurement in both arms and cited primary literature to support the claim, it is probable that a greater percentage of practitioners would agree with those guidelines. Further, if a practical and simple way of accurately measuring blood pressure in both arms was suggested, more practitioners might adopt the practice and adhere to the guidelines.

Many of the guidelines state how blood pressure should be taken and emphasise the importance of positioning of the arm, for example, the Medicines and Healthcare Products Regulatory Agency (2006) states:

‘Muscle contraction in an unsupported arm can raise diastolic BP [blood pressure] by as much as 10%, while raising the arm above heart level leads to an underestimation by as much as 10 mmHg. The arm should be supported in a horizontal position with the cuff at the level of the heart as denoted by the midsternal level.’

With this in mind, taking blood pressure in both arms becomes problematic as, in most consultation rooms, the furniture does not allow both arms to be supported easily. None of the guidelines provide advice on the practicality of measuring blood pressure accurately in both arms in a 10-minute consultation.

GPs appear to be appropriately wary of recommendations unless a justification, together with evidence, is provided. Guideline developers should consider whether users might require additional information to accept and carry out recommendations, and what information this should be.

Competing interests
The authors have stated that there are none

Acknowledgements
We would like to thank Nia Roberts for help with finding guidelines.

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REFERENCES
## Appendix 1. Text on dual-arm blood-pressure measurement from major hypertension guidelines.

<table>
<thead>
<tr>
<th></th>
<th>Quote</th>
<th>Justified reasons</th>
<th>Referenced</th>
<th>Method stated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UK guidelines</strong></td>
<td></td>
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<tr>
<td>BHS recommendations on BP measurement 1986</td>
<td>BP should be measured in both arms in all patients with high BP at the initial assessment, and if a reproducible difference of 20 mmHg for systolic pressure and 10 mmHg for diastolic pressure simultaneous measurements should be performed.</td>
<td>Partial</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BHS-1 1989</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BHS-2 1993, BHS-3 1999</td>
<td>Not mentioned in text directly but refers to BHS recommendations on BP measurement 1986</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>BHS-4 2004</td>
<td>BP should initially be measured in both arms as patients may have large differences between arms</td>
<td>Partial</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>NICE 2006</td>
<td>Measure blood pressure on both of the patient's arms</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>MHRA 2006</td>
<td>BP should initially be measured in both arms ... A difference in BP between the arms can be expected in about 20% of patients</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CKS library, 2007</td>
<td>Initially, measure the BP in both arms, as there can be large differences between arms (greater than 10 mmHg)</td>
<td>Partial</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>US and Canadian guidelines</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>JNC-1 1977, JNC-2 1980</td>
<td>–</td>
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<tr>
<td>JNC-3 1984, JNC-4 1988, JNC-5 1993, JNC-6 1997, JNC-7 2003</td>
<td>The physical examination should include: an appropriate measurement of BP, with verification in the contralateral arm</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>AHA 1980</td>
<td>On the initial examination, one should record the pressure in both arms</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Canadian hypertension education program 2007 and 2008</td>
<td>BP should be taken in both arms on at least one visit.</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>New Zealand, Australian and Japanese guidelines</strong></td>
<td></td>
<td></td>
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<tr>
<td>Heart Foundation of Australia 2008</td>
<td>At the patient’s first BP assessment, measure the BP on both arms, thereafter, use the arm with the higher reading</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Heart Foundation of Australia 2004</td>
<td>Measure BP on both arms at the first visit, particularly if there is evidence of peripheral vascular disease. A variation of up to 5 mmHg in BP between arms can be acceptable</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>New Zealand Cardiovascular Guidelines 2005</td>
<td>Not mentioned</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td>JSH 2003</td>
<td>The BP difference between the arms must be evaluated. If a difference of BP between the arms is apparent, the BP should usually be measured with the arm that shows the higher BP</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>South African Guidelines</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Hypertension Guideline 2003, 2000</td>
<td>All measurements should preferably be taken using the same arm</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hypertension guideline 1995</td>
<td>Not mentioned</td>
<td>–</td>
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<tr>
<td><strong>International guidelines</strong></td>
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<tr>
<td>WHO/ISH 1989</td>
<td>Measure the blood pressure in both arms on the first visit if there is evidence of peripheral vascular disease</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>WHO/ISH 1999</td>
<td>Measure BP in both arms at first visit to detect possible differences due to peripheral vascular disease</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>ESH-ESC practice guidelines 2007, ESH-ESC 2003</td>
<td>… a recent study has shown significant differences in inter-arm differences for systolic and diastolic blood pressure, leading to the recommendation that bilateral measurement should be made on first consultation ...</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ESH 2003</td>
<td>… a recent study has shown significant differences in inter-arm differences for systolic and diastolic blood pressure, leading to the recommendation that bilateral measurement should be made on first consultation ...</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>EJCPR 2003</td>
<td>At the initial visit, BP values from both arms should be obtained to detect patients in whom atherosclerotic plaques in subclavian or more central arteries may be responsible for substantial between-arm discrepancies</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: Justification has been italicised. AHA = American Heart Association; BHS = British Hypertension Society; BP = blood pressure; CKS = Clinical Knowledge Summaries; EJCPR = European Journal of Cardiovascular Prevention and Rehabilitation; ESC = European Society of Cardiology; ESH = European Society of Hypertension; JNC = Joint National Committee; MHRA = Medicines and Healthcare Products Regulatory Agency; JSH = Japanese Society of Hypertension; NICE: National Institute for Health and Clinical Excellence; WHO/ISH = World Health Organisation/International Society of Hypertension.
Appendix 2. List of guidelines.

British guidelines


US and Canadian guidelines


Australian, New Zealand and Japanese guidelines

## Appendix 2 continued. List of guidelines.

### South African guidelines

### International guidelines