

<b>Institution: University of Birmingham</b>
<b>Unit of Assessment: UoA2</b>
<b>Title of case study: Hypertension: Improving routine diagnosis of hypertension in primary care</b>
<p><b>1. Summary of the impact</b></p> <p>High blood pressure (or hypertension) is the major cause of stroke and other cardiovascular disease, and is one of the most important preventable causes of morbidity and mortality in developed and developing countries. In the UK it affects half the population over 60 and costs the NHS £1Bn per year in drugs alone.</p> <p>A University of Birmingham primary care-led study has provided definitive evidence of the superiority of ambulatory blood pressure measurement (ABPM) over clinic and home blood pressure monitoring as a means of diagnosing hypertension. The associated cost-effectiveness study showed that this approach will save the NHS over £10.5M per year. As a result of this research, NICE guidelines have been amended and ABPM has become the reference standard. The research has also influenced public and policy debate in the UK and internationally.</p>
<p><b>2. Underpinning research</b></p> <p>Effective diagnosis of hypertension is critically important. High blood pressure (or hypertension) is the major cause of stroke and other cardiovascular disease and is one of the most important preventable causes of morbidity and mortality in developed and developing countries. At least a quarter of the adult population of the UK has hypertension, and this figure rises to more than 50% in people over the age of 60 years. Hypertension is the commonest chronic disorder seen in primary care with around 1:8 receiving antihypertensive treatment in the UK. Moreover, as the demographics shift towards an older, more sedentary and obese population, the prevalence of hypertension and the requirement for effective treatment will continue to rise.</p> <p>High blood pressure is currently diagnosed in primary care and in hospital clinics using the traditional technique of measurement by a GP or nurse with either a mercury sphygmomanometer and stethoscope or with an automated device. In terms of patient outcomes, these methods compare poorly with ABPM where a cuff connected to a portable monitor is worn continuously by the patient for a period of 24 hours. However, no previous study had attempted to bring together and synthesise the literature on the accuracy of diagnosis of hypertension using different methods of measurement.</p> <p>This research, which forms part of the Birmingham/ Oxford Universities Collaborative BP Monitoring Programme Group, has provided robust evidence of the superiority of ABPM over clinic (CBPM) and home (HBPM) blood pressure monitoring in diagnosing hypertension. In 2009, a group led from Primary Care within the University of Birmingham (Professor Richard <b>McManus</b>, Professor of Primary Care, UoB up to 31 August 2011; Professor Richard <b>Hobbs</b>, Professor of Primary Care, UoB up to 30 April 2011; Dr Pelham <b>Barton</b>, Reader in Economic Modelling, UoB; Dr James <b>Hodgkinson</b>, Research Fellow, UoB; Dr Boliang <b>Guo</b>, Research Fellow, UoB) and working with others in the University of Birmingham (Professor Jon <b>Deeks</b>, Professor of Health Statistics, UoB; Dr Una <b>Martin</b>, Reader in Clinical Pharmacology, UoB [UoA1]) and in the University of Oxford (Mant, Heneghan, Roberts) conducted a systematic review of the worldwide literature and a meta-analysis using hierarchical summary receiver-operating characteristic models. The study was funded by an NIHR Programme Grant for Applied Research (RP-PG-0407-10347, Mant et al, including <b>McManus, Hobbs</b>); <b>Hodgkinson, McManus</b> and <b>Martin</b> extracted the data in conjunction with Mant; <b>Guo, Hodgkinson</b> and <b>Deeks</b> undertook the analysis.</p> <p>The objective of the systematic review was to determine the relative accuracy of clinic measurements and home blood pressure monitoring compared with ambulatory blood pressure monitoring as a reference standard for the diagnosis of hypertension. The research identified that, compared with ambulatory monitoring, neither clinic nor home blood pressure measurements have</p>

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sufficient sensitivity or specificity to be recommended as a single diagnostic test. If ambulatory monitoring is taken as the reference standard, then treatment decisions based on clinic or home blood pressure alone may result in substantial over-diagnosis (and subsequent over-medication and unnecessary cost). For example, if the prevalence of hypertension in a screened population was 30%, there would only be a 56% chance that the clinic measurement would be correct compared with using the ABPM methods. These results suggest that ambulatory monitoring prior to commencement of life-long drug treatment would lead to more appropriate targeting of treatment, particularly around the diagnostic threshold [1]. The review was published in *BMJ* in 2011 and has been cited 45 times.

The research findings had profound implications for the diagnosis of hypertension, particularly as ambulatory monitors are considerably more expensive than clinic BP monitors so, as part of the programme grant, health economists at the University of Birmingham (Dr Sue **Jowett**, Senior Lecturer in Health Economics; Dr Pelham **Barton**, Reader in Economic Modelling) and the National Clinical Guideline Centre (Lovibond, Wonderling) in conjunction with the Birmingham team described above and members of the relevant clinical guidelines group undertook the most detailed cost-benefit analysis ever conducted for ABPM. The UoB health economists supervised the modelling, which was conducted by Lovibond at NICE.

This Markov model-based probabilistic cost-effectiveness analysis of the three different diagnostic strategies for hypertension included a hypothetical primary care population aged  $\geq 40$  years with a screening blood pressure measurement above 140/90 mmHg and risk factor prevalence reflecting the general population. Ambulatory monitoring was identified as the most cost effective strategy for the diagnosis of hypertension for men and women of all ages, and resulted in more quality-adjusted life years (QALYs) for male and female groups aged over 50. Implementation of a diagnostic strategy for hypertension using ambulatory monitoring following an initial raised clinic reading would reduce misdiagnosis and reduce unnecessary treatment costs. Whilst ABP monitors are expensive, the additional costs of ambulatory monitoring are more than offset by cost savings from better targeting of treatment and the study estimated that it use would save the NHS £10.5M per annum. The study indicated that service commissioners should recommend ambulatory monitoring prior to the commencement of anti-hypertensives for the majority of patients. The results showed clearly that the use of ABPM would result in substantial savings to the NHS.

These findings were published in the *Lancet* in 2011 and have been cited more than 30 times [2]. Media coverage included television (ITV central; reach 655,000), print newspapers (Daily Mail, Daily Express; reach 2,434,00) and online (BBC, Forbes; reach 8,352,000).

### 3. References to the research

1. **Hodgkinson J**, Mant J, Martin U, **Guo B**, **Hobbs FDR**, **Deeks JJ**, Heneghan C, Roberts N, **McManus RJ**. Relative effectiveness of clinic and home blood pressure monitoring compared to ambulatory blood pressure monitoring in the diagnosis of hypertension: a systematic review. *BMJ* 2011; 342: d3621 <http://www.ncbi.nlm.nih.gov/pubmed/21705406>
2. Lovibond K, **Jowett S**, **Barton P**, Caulfield M, Heneghan C, **Hobbs FDR**, **Hodgkinson J**, Mant J, **Martin U**, Williams B, Wonderling D, **McManus RJ**. Cost-effectiveness of options for the diagnosis of high blood pressure in primary care: a modelling study. *The Lancet* 2011; 378(9798); 1219-1230 <http://www.ncbi.nlm.nih.gov/pubmed/21868086>

### 4. Details of the impact

The key impacts are as follows:

#### **Impact on public policy**

NICE guidelines are the accepted standard for determining the management of hypertension in UK primary care. As a result of this research, the National Institute for Health and Clinical Excellence

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(NICE) has published a new guideline for the Clinical Management of Primary Hypertension in Adults (CG 127; 24 August 2011). The guideline reported the inaccuracy of CBPM using this research: *“these findings suggest that the current practice of using a series of CBPM alone for the diagnosis of hypertension can lead to inaccurate diagnosis”* and that *“this detailed analysis suggested that the current practice of using CBPM to define hypertension will lead to drug treatment being offered to a substantial number of people who are normotensive according to ABPM”*. The Guideline Development Group *“thus recommended that ABPM should be implemented for the routine diagnosis of hypertension in primary care”* [1]

**Impact on clinical practice and health**

The key to the success of implementing the recommendations of the review is buy-in from clinicians. The original research was widely reported in the national press, including the Daily Telegraph, the Guardian and the GP publication Pulse [2]. At the time of the full publication of the NICE guidelines, it was again widely reported, including on BBC national news and on the BBC website [3]. To encourage adoption, the British Hypertension Society has made a series of videos covering key aspects of the guidance [4]. These, along with the NICE implementation materials (<http://www.nice.org.uk/CG127>), are helping to facilitate dissemination and implementation of this evidence-based evolution of the NICE hypertension guidelines.

As the NICE guidelines are relatively new (2011) it is not possible at this stage to specify impact in terms of changes in patient outcome, however the NICE Primary Care Quality and Outcomes Framework Indicator Advisory Committee recommended that an indicator be piloted to ensure practices use ABPM for all new diagnoses of hypertension; the proposed wording of the indicator is: ‘The percentage of patients with a new diagnosis of hypertension after 1 April 2012 whose diagnosis was confirmed following ABPM.’ [Pulse <http://www.pulsetoday.co.uk/nice-to-pilot-ambulatory-blood-pressure-monitoring-qof-indicator/14101039.article>].

**Economic impact**

The cost-effectiveness analysis of ABPM conducted by the University of Birmingham was reported by the full NICE clinical guidelines *“This analysis suggests that ABPM is the most cost-effective method of confirming a diagnosis of hypertension in a population suspected of having hypertension based on a Clinical BPM screening measurement >140/90 mmHg, compared with further CBPM or HBPM. This conclusion was consistent across a range of age/gender stratified subgroups.”* and impacted on the NICE guideline [1].

The research has also influenced the South African Hypertension guideline of 2011 which recommends that ABPM should be encouraged for clear indications, quoting the economic evidence generated in this research as evidence for this guidance [5]: *“In patients with a raised clinic BP, ABPM was shown to reduce misdiagnosis and save costs (reference, Lovibond et al)”*.

**Impact on education and CPD**

The research is influencing medical education. Members of the research team (**Hodgkinson, McManus, Martin, Wood**) have completed the setting of a Continuing Medical Education version of the BMJ article [6] to support practitioner learning in:

- 1) Appraising the relative effectiveness of different indirect methods of monitoring blood pressure in diagnosing hypertension;
- 2) Evaluating the strength of evidence for these findings; and
- 3) Recognising the potential implications of the study’s findings for clinical practice.

Following the publication of the main research study, they have also been commissioned and will provide a further in-depth learning module for the BMJ, to be published shortly [7]. BMJ Learning offers high-quality (peer reviewed, up-to-date, and evidence-based) continuing medical education in an economical and time efficient manner, for general practitioners, hospital doctors and other healthcare professionals such as practice nurses and practice managers. The modules are accredited by colleges, associations, and authorities from around the world.

Other educational impacts have included the commissioning of an article for The Practitioner (a

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monthly peer review clinical journal for GPs) on diagnosing and managing hypertension in primary care [8] and an international commentary [9].

**5. Sources to corroborate the impact**

1. National Clinical Guideline Centre. Hypertension: management of hypertension in adults in primary care. Clinical Guideline 127. London : National Institute for Clinical Excellence ; 2011. <http://www.nice.org.uk/guidance/CG127/NICEGuidance>
2. Media links for reporting of original research:
  - The Telegraph. Millions of high blood pressure patients are wrongly diagnosed. 22 February 2011 <http://www.telegraph.co.uk/health/healthnews/8339545/Millions-of-high-blood-pressure-patients-are-wrongly-diagnosed.html>
  - The Guardian. Blood pressure testing faces overhaul to reduce misdiagnosis. 22 February 2011. <http://www.guardian.co.uk/society/2011/feb/22/blood-pressure-testing-overhaul?INTCMP=ILCNETTXT3487>
  - Pulse. NICE rewrites rules on hypertension diagnosis. 22 February 2011. <http://www.pulsetoday.co.uk/nice-rewrites-rules-on-hypertension-diagnosis/11053584.article>
3. Media links for alterations to NICE guidance:
  - Pulse. NICE rips up hypertension guidance. 24 August 2011 <http://www.pulsetoday.co.uk/nice-rips-up-hypertension-guidance/12588147.article>
  - BBC. Blood pressure guidelines revised in England and Wales. 24 August 2011. <http://www.bbc.co.uk/news/health-14629425> also national news broadcast
4. British Hypertension Society, September 2011 [http://www.bhsoc.org/index.php/download\\_file/view/404/139/](http://www.bhsoc.org/index.php/download_file/view/404/139/)
5. Seedat YK, Rayner BL. South African Hypertension guideline 2011. *South African Medical Journal* 2012; 102(1): 57-83. <http://www.samj.org.za/index.php/samj/article/view/5373/3798>
6. Continuing Medical Education, June 2011 [http://learning.bmj.com/learning/module-intro/.html?moduleid=10023906&searchTerm="blood\\_pressure"&page=0&locale=en\\_GB](http://learning.bmj.com/learning/module-intro/.html?moduleid=10023906&searchTerm=)
7. Letter from BMJ Learning regarding November 2013 publication of module: BP Measurement Module "Blood pressure: an evidence-based approach to measuring it"
8. Hodgkinson J, Wood S, Martin U, McManus R. ABPM is best for diagnosing hypertension in primary care. *Practitioner* 2011; 255 (1744):21-23 <http://www.ncbi.nlm.nih.gov/pubmed/23251987>
9. Feldman RD. Review: Home and clinic BP have limited accuracy compared with ambulatory BP for diagnosing hypertension *Ann Intern Med* 2011 155(12) :JC6-10; <http://www.ncbi.nlm.nih.gov/pubmed/22184711>