Impact of changes to national guidelines on hypertension related workload

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Title: Impact of changes to national guidelines on hypertension related workload

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Abstract

Background
In 2011, National Institute for Health and Care Excellence (NICE) guidelines recommended the routine use of out-of-office blood pressure (BP) monitoring for the diagnosis of hypertension. These changes were predicted to reduce unnecessary treatment costs and workload associated with misdiagnosis.

Aim
To assess the impact of guideline change on rates of hypertension-related consultation in general practice.

Design and Setting

Method
The primary outcome was the rate of face-to-face, telephone and visit consultations related to hypertension with a GP or nurse. Age and sex standardized rates were analysed using interrupted time-series analysis.

Results
In 3,937,191 adults (median follow-up = 4.2 years) there were 12,253,836 hypertension related consultations. The rate of hypertension related consultation was 71.0 per 100 person-years (95% CI 67.8 to 74.2) in April 2006, which remained flat prior to 2011. The introduction of the NICE hypertension guideline in 2011 was associated with a change in yearly trend (change in trend = -3.60 per 100 person-years, 95% CI -5.12 to -2.09). The rate of consultation subsequently decreased to 59.2 per 100 person-years (95% CI 56.5 to 61.8) in March 2017. These changes occurred around the time of diagnosis and persisted when accounting for wider trends in all consultations.

Conclusion
Hypertension-related workload has declined in the last decade, in association with guideline changes. This is due to changes in workload at the time of diagnosis, rather than reductions in misdiagnosis.

Key words
Guideline, general practice, hypertension, blood pressure, workload, consultation
How this fits in

Recommendations for the use of out-of-office blood pressure measurement for the diagnosis of hypertension in the 2011 NICE hypertension guideline were predicted to reduce general practice workload. This analysis shows that these changes were indeed associated with a reduction in hypertension related workload, in particular around the time of diagnosis. Practitioners are likely to benefit from time savings when using out-of-office BP measurement for diagnosis and treatment titration
Introduction

Primary care workload in England increased by 16% between 2007 and 2014, with primary care appearing to reach “saturation” point. A key component of this workload is the diagnosis and management of long-term, chronic conditions. In particular, hypertension (high blood pressure) affects 14% of the population in the United Kingdom (UK) and is a leading risk factor for stroke and coronary heart disease. Identifying and treating hypertension reduces the risk of stroke and coronary heart disease and is cost-effective.

The 2011 National Institute for Health and Care Excellence (NICE) Hypertension Guideline introduced recommendations for the diagnosis of hypertension that included the use of out-of-office measurement for confirmation of an initially raised clinic blood pressure (BP). This change was in response to concerns that using clinic BP may result in approximately 25% of individuals being misclassified due to white coat hypertension. The changes were predicted to reduce workload due to a reduction in the unnecessary treatment of white coat hypertension.

We have already examined the association between these guideline changes and clinical outcomes, demonstrating that changes to guidelines were associated with a levelling-off in the downward trend of hypertension incidence and no change in the rate of cardiovascular events. In this study, we aimed to examine trends in rates of hypertension related workload in general practice from 2006 to 2017 in England. We further aimed to test whether the introduction of the NICE Hypertension guideline in 2011 was associated with a change in these trends.

Method

Study design

The methods used for this study have been fully described previously. Briefly, this was a retrospective open cohort study of adults (aged 18 years and over) registered at English general practices contributing to the Clinical Practice Research Datalink (CPRD) between 1/4/2006 and 31/3/2017. Patients were included if their records were acceptable for research purposes and eligible for data linkage and they entered the study on the date they met all eligibility criteria. Patients were excluded if they had a history of hypertension prior to study entry, but were not excluded if they developed hypertension during follow-up.

Outcomes

The primary outcome was the rate of hypertension related general practice consultation. Consultations and staff roles in CPRD were grouped into types as previously. Our primary analysis concerned face-to-face, telephone or visit consultations with a GP or nurse. A consultation was defined as hypertension-related if it included a clinical code for the diagnosis or management of hypertension, a recording of BP or a prescription for antihypertensive medication (see supplement for details and code lists). We studied total hypertension related consultation time (total length of hypertension-related consultations in minutes) as a secondary outcome. In post-hoc sensitivity analyses, we excluded consultations containing only a BP measurement.

Negative controls were used to determine whether changes in hypertension-related consultation rates were plausibly due to changes in guidance or other factors. These were asthma related consultations (including a clinical code for asthma diagnosis or monitoring, or a prescription for asthma-related medications) and all consultations, regardless of the presenting condition. Asthma...
was chosen because it is primarily managed in primary care, similar to hypertension, but has a
different pathophysiology and completely different diagnosis and treatment pathways. The activities
carried out to manage asthma are therefore unlikely to be affected by changes to hypertension
guidelines.

**Statistical Analysis**

Crude and standardized rates were calculated stratified by age (18–24, 25–44, 45–54, 55–64, 65–74,
75–84, and 85+ years) and gender in each month. Rates were standardized to the English National
Population standard in 2015. We conducted analyses stratified by consultation type and staff role
and subgroup analysis in patients with/ without hypertension from March 2007 onwards (allowing
one year for incident hypertension cases to develop). In post-hoc analyses, we examined
consultation rates relative to the time of diagnosis of hypertension:

1. Greater than 6 months prior to diagnosis,
2. Within 6 six months prior to diagnosis,
3. Within 12 months after diagnosis,
4. Greater than 12 months after diagnosis.

Standardized rates were modelled using interrupted time series analysis (ITSA) with Newey-West
standard errors.\(^8\) We assessed whether the introduction of the NICE Hypertension guideline in 2011
was associated with a step change in consultation rates or a change in trend, by “interrupting” the
time series between 1/4/2011 and 31/3/2012. Analyses were weighted according to the total
person-years of observation contributing to each monthly rate. Lag terms (up to 12 months) were
included in sensitivity analyses. Analysis was conducted using Stata version 14.\(^9\)

**Results**

In total 3,937,191 patients were eligible for inclusion in the study cohort (see Supplementary Figure
S1), totalling 19,088,414 person-years of follow-up (median follow-up = 4.2 years, inter-quartile
range 1.6 to 8.0). The characteristics of the cohort are given in Table 1. There were 12,253,836
hypertension-related consultations across the study period, or an average of 0.64 consultations per
person, per year. Of these, 67.8% were with a GP and 97.0% were face-to-face consultations. The
majority (87%) of consultations included a clinic BP measurement and an antihypertensive
prescription was issued in 21% of consultations (Supplementary Table S1).

**Rate of hypertension related consultation**

The crude rate of consultation (per 100 person-years) was notably higher in women of younger age
compared to men, but increased with age in both men and women (Table S2). The standardized rate
of hypertension-related consultation decreased over the study period from 71.0 per 100 person-
years (95% CI 67.8 to 74.2) in April 2006 to 59.2 per 100 person-years (95% CI 56.5 to 61.8) in March
2017 (Figure 1 and Table 2). The introduction of the NICE hypertension guideline in 2011 was not
associated with a significant change in the consultation rate level (change in rate = -1.90, 95 % CI -
7.20 to 3.39) but was associated with a change in the yearly trend (change in trend = -3.60, 95% CI -
5.12 to -2.09). When excluding consultations containing only a BP measurement, the rate of
hypertension-related consultation was considerably lower, but changes to guidelines in 2011 were
associated with both a change in the consultation rate level and trend (Table S3). When considering
lag-terms, results were unchanged.
Analyses of asthma-related consultation and all consultations showed similar patterns, namely no trend between 2006 and 2011, followed by a downward trend until 2017 (Table S4 and Figures S2 to S3). When we examined the rate of hypertension-related consultations as a proportion of all consultations, we found that hypertension-related consultations accounted for 15.4% of all consultations in April 2006, decreasing to 13.8% in April 2012 and 11.9% in March 2017 (Figure 2). Guideline change in 2011 was associated with an acceleration of the downward trend (Table S5). Whilst the rate of hypertension-related consultation was stable pre-2011, the rate of all-consultations was increasing. After 2011, the rate of hypertension-related consultation decreased at a faster pace than the rate of all consultations.

**Stratified by hypertensive status**

Stratified analyses demonstrated that the rate of hypertension-related consultation was significantly higher in hypertensive compared to normotensive patients (Figure 3 and Table S6). In normotensive patients, the change in guidance in 2011 was not associated with changes in consultation rate level or trend. In hypertensive patients, the rate of consultation fell from 341 per 100 person-years in April 2007 (95% CI 326 to 357) to 166 in March 2017 (95% CI 158 to 174) with a slowing of this downward trend after 2011. Consultation rates were highest in the diagnostic and initial treatment phases across the study period (Figure S4). The guideline changes were only associated with changes in trend (from no trend to downward trend) in the 6 months prior to diagnosis (change in trend = -19.8 (95% CI -36.6 to -3.0)) and 12 months after diagnosis (change in trend = -16.0 (95% CI -23.7 to -8.3), Table S7).

**Stratified by consultation type and staff role**

Observed patterns in consultation rates were driven by face-to-face consultations which were unchanged between 2006 and 2011, and decreased year-on-year between 2012 and 2017 for both GPs and nurses (change in trend in 2011/12= -2.28, 95% CI -3.25 to -1.32; Table S8). The rates of visit consultation with a GP or nurse and telephone consultation with a nurse were unchanged across the entire study period. Conversely, the rate of telephone consultation with a GP increased between 2006 and 2011 and increased at a greater rate after the change in guidance in 2011.

**Rate of hypertension related consultation time**

Hypertension-related consultations accounted for 2.53 million hours of clinical time, equivalent to 7.94 minutes of consultation per person, per year on average. Results for consultation time mirrored those of consultation rates (Figure 4 and Table S9).

**Discussion**

**Summary**

The rate of hypertension related general practice consultation in England was stable between 2006 and 2010 and then fell between 2011 and 2017. This reduction was concurrent with similar changes in trend in the rate of asthma-related and all-cause consultations, suggesting that the new downward trend was driven in part by wider system or population level changes. However, changes in hypertension-related workload were relatively greater than changes in overall all-cause consultation rates and occurred primarily around the time of diagnosis, indicating that these
changes may be plausibly associated with the guideline change in 2011. Similar patterns were observed for average consulting time.

**Strengths and limitations**

This was a large scale analysis of data known to be representative of the UK population. Hence we have been able to estimate rates with the precision required to detect meaningful differences in outcomes. Our use of standardized rates further increases the likelihood that our results are applicable to the wider population.

A consultation in CPRD represents a distinct opening of a patient’s electronic healthcare record. This may occur to document a consultation or for administrative purposes. We grouped consultations by type to consider patient-facing clinical workload with a GP or nurse only, but some consultations may have been misclassified. However, the rate of consultation observed for normotensives is consistent with Quality and Outcomes Framework guidelines for BP to be measured every 5 years, indicating that our results have face validity.

Our definition of hypertension-related activity did not include codes specifically related to cardiovascular disease risk or prevention since, in England, guidelines for cardiovascular disease prevention (largely related to statin prescription in relation to CVD risk) are separate to those for hypertension. Nevertheless our inclusion of codes for any BP measurement is likely to have captured many consultations considering cardiovascular risk more generally. Due to our inclusive definition, some consultations may have been misclassified (e.g. the use of calcium channel blockers in Raynaud’s phenomenon), but these would not have been expected to change with changes in hypertension guidance. Our estimates of change are therefore likely to be conservative. Results were similar when we excluded consultations containing a BP reading alone, where the majority of any misclassification would have occurred.

We observed different trends in analyses stratified by hypertensive status compared to our main analysis including all patients combined. Some patients developed incident hypertension during the study period, and as a result, our main, combined analysis includes a greater proportion of patients with hypertension in later, compared to earlier, years. Since patients with hypertension also consult more often, this is likely to explain some of the differences seen. Furthermore, this means that the observed, overall downward trend in hypertension-related consultation in this study is likely to be a conservative (under-) estimate of true downward trends.

We have not considered the clinical content of consultations in finer detail as this would overlap considerably with our previous work. Finally, interrupted time series analysis cannot establish causality and our results should be interpreted with caution.

**Comparisons with existing literature**

Our analyses of hypertension and asthma related consultations, as well as all consultations, showed similar patterns, suggesting that system-wide changes were influencing all consultation rates during our study period. In this context, the impact of guideline changes will be limited and more difficult to discern in routine data. Our finding that the rate of consultation has fallen over recent years may be surprising given that GPs reported increased workload up to 2017 and media portrayals of a service in crisis. We have considered consultation rates using patient person-years as the denominator, and not the number of general practice staff. The number of full-time equivalent GPs fell from 36,069 in 2012 to 33,804 in 2016, despite increases in the population. Although the number of full-time equivalent nurses increased during this time (from 14,695 to 15,827), the
The majority of consultations in this study were conducted by GPs. This may indicate problems with access rather than decreased demand per se. Further work would be required to examine consultation rates using staff numbers as the denominator.

The rate of hypertension-related consultation in patients with hypertension was higher than may be expected given guidance to provide an annual review. However, approximately two-thirds of patients with hypertension have at least one other condition, and our definition is likely to have captured consultations in which an opportunistic BP reading was taken despite hypertension not being the primary reason for consultation. Many GPs may manage hypertension as an “add-on” problem in this way and this may explain the high proportion of consultations conducted by a GP in this study. When we excluded consultations containing only a BP reading, the rate of hypertension-related consultation was consistent with an annual review.

Changes in hypertension-related workload primarily occurred around the time of diagnosis, suggesting diagnoses are confirmed more quickly and with fewer visits than previously. This is consistent with GP survey data indicating that the majority of practices now offer out-of-office monitoring for diagnosis. We have not provided cost estimates as part of this study, but recent formal economic analyses have shown that out-of-office monitoring is cost saving compared to clinic BP measurement, with savings of up to £186 per person.

Implications for research and/or practice

The introduction of the NICE hypertension guideline in 2011 was predicted to reduce workload by reducing the number of false diagnoses in people with white coat hypertension and workload related to subsequent management. We have shown that workload related to making a diagnosis more generally has reduced, rather than in the specific context predicted. Indeed, we have previously shown that the rate of incident hypertension actually increased after the guideline change, compared to what would have been expected based on previous trends. Further research would be required to understand why this is the case.

Whilst we cannot establish causality, our findings indicate that the implementation of out-of-office monitoring for diagnosis does not increase general practice workload and may deliver time savings. Although the vast majority of practices report having access to home or ambulatory BP measurement devices for diagnosis, provision has been shown to vary regionally, and individual GPs report variable use of self-monitoring for diagnosis. We have previously shown that the use of out-of-office monitoring increased substantially after the change in guidelines, although levels of use remained low compared to clinic BP. Practices should seek to address equipment shortages where possible and increase awareness of the potential for time savings amongst individual practitioners.

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**Ethical Approval**

The protocol was approved by the Independent Scientific Advisory Committee (ISAC) of the MHRA (ISAC protocol number 17_239R; available from the authors on request). Ethics approval for observational research using the CPRD with approval from ISAC was granted by a National Research Ethics Service committee (Trent MultiResearch Ethics Committee, REC reference number 05/MRE04/87).

**Competing Interests**

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: SLF reports grants from National Institute for Health Research, School for Primary Care Research, during the conduct of the study; RJM reports grants from National Institute for Health Research, during the conduct of the study and grants from Omron, outside the submitted work; and being a member of the 2019 NICE Hypertension Guideline Committee; CM reports grants from National Institute for Health Research, Medical Research Council, Versus Arthritis and Wellcome for unrelated research; JPS reports grants from National Institute for Health Research and Wellcome Trust, during the conduct of the study; CH reports grants from National Institute for Health Research and other expenses from World Health Organization, outside the submitted work, and is Editor in chief of the BMJ EBM and an NHS Urgent Care GP; all other authors report no support from any organisation for the submitted work, no financial relationships with any organisations that might have an interest in the submitted work in the previous three years and no other relationships or activities that could appear to have influenced the submitted work.
References


Table 1: Baseline study characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N= 3,937,191</th>
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<tbody>
<tr>
<td>Age (years, median [interquartile range])</td>
<td>36 [26,50]</td>
</tr>
<tr>
<td>Male (%)</td>
<td>49.0%</td>
</tr>
<tr>
<td>Follow-up (years, median)</td>
<td>4.2</td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>47.6%</td>
</tr>
<tr>
<td>Non-white</td>
<td>9.0%</td>
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<tr>
<td>Unknown</td>
<td>43.4%</td>
</tr>
<tr>
<td>Prior MI or stroke (%)</td>
<td>1.6%</td>
</tr>
<tr>
<td>Prior CVD (MI, stroke or other, %)</td>
<td>4.9%</td>
</tr>
<tr>
<td>Index of multiple deprivation quintile</td>
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</tr>
<tr>
<td>1 (least deprived, %)</td>
<td>22.1%</td>
</tr>
<tr>
<td>2</td>
<td>22.1%</td>
</tr>
<tr>
<td>3</td>
<td>19.9%</td>
</tr>
<tr>
<td>4</td>
<td>20.6%</td>
</tr>
<tr>
<td>5 (most deprived)</td>
<td>15.2%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.1%</td>
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Table 2: Results from interrupted time series analysis of age and sex standardized rates of hypertension related consultation (face-to-face, telephone or visit consultations with a GP or nurse per 100 person-years) between April 2006 and March 2017, with interruption between April 2011 and March 2012

<table>
<thead>
<tr>
<th></th>
<th>Estimate (per 100 person-years)</th>
<th>95% confidence interval</th>
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<tbody>
<tr>
<td>Initial rate (April 2006)</td>
<td>71.00</td>
<td>67.78 - 74.23</td>
</tr>
<tr>
<td>Initial trend per year (April 2006 - March 2011)</td>
<td>0.71</td>
<td>-0.43 - 1.84</td>
</tr>
<tr>
<td>Predicted rate (April 2012)</td>
<td>75.32</td>
<td>70.94 - 79.70</td>
</tr>
<tr>
<td>Post-intervention rate (April 2012)</td>
<td>73.42</td>
<td>70.45 - 76.38</td>
</tr>
<tr>
<td>Post-intervention trend per year (April 2012 - March 2017)</td>
<td>-2.89</td>
<td>-3.89 - -1.90</td>
</tr>
<tr>
<td>Change in rate</td>
<td>-1.90</td>
<td>-7.20 - 3.39</td>
</tr>
<tr>
<td>Change in trend</td>
<td>-3.60</td>
<td>-5.12 - -2.09</td>
</tr>
</tbody>
</table>
Figure 1: Age and sex standardized rate of hypertension related consultation (face-to-face, telephone or visit consultations with a GP or nurse per 100 person-years) between April 2006 and March 2017, with interruption between April 2011 and March 2012.

Note: Fitted lines produced using interrupted time-series analysis on monthly adjusted rates.
Figure 2: Age and sex standardized rate of consultations related to hypertension, as a proportion of all consultations, between April 2006 and March 2017, with interruption between April 2011 and March 2012.
Figure 3: Age and sex standardized rates of hypertension related consultations in normotensive and hypertensive patients between April 2007 and March 2017, with interruption between April 2011 and March 2012.
Figure 4: Age and sex standardized rate of hypertension related consultation time (minutes per person-year in face-to-face, telephone or visit consultations with a GP or nurse per person-year) between April 2006 and March 2017, with interruption between April 2011 and March 2012.