

The Proportion of Physician Notes Addressing Elevated Blood Pressure Readings Varies Dramatically across Internal Medicine Specialties

Samuel David Zetumer¹, Philip M. Polgreen¹, Manish Suneja¹, Cole G. Chapman² and Linnea A. Polgreen^{2*}

¹Department of Internal Medicine, University of Iowa, Iowa City, IA, 52242, USA

²Department of Pharmacy Practice and Science, University of Iowa, Iowa City, IA 52242, USA

Abstract

Background: Both diagnostic and therapeutic inertia are important barriers to Blood Pressure (BP) control. BP readings are routinely measured and recorded at most healthcare visits. Thus, there are many opportunities to diagnose hypertension and improve BP control. The objective of this study was to determine the percentage of patients with elevated BP measurements where BP or hypertension is mentioned in the clinical notes.

Methods: We randomly selected outpatient visits for 10,000 patients in Internal Medicine clinics (1-1-2017 to 6-30-2021) and recorded if there was a BP value $\geq 140/90$ mm Hg. The Assessment and Plans (A/Ps) from these clinic visits were extracted using a rule-based pattern-matching algorithm. A/Ps with no matching text pattern indicating BP or hypertension was considered not to have addressed hypertension. The percentage of visits where BP was mentioned was calculated for each specialty.

Results: Among the 10,000 patients, we found 5,674 clinic visits where patients had elevated BP. A/Ps from nephrology, cardiology and general internal medicine visits mentioned elevated BP at least 50% of the time. In contrast, A/Ps from encounters with allergy/immunology, endocrinology (not diabetes clinic) and rheumatology specialists referenced the patient's BP less than 10% of the time.

Conclusions: We demonstrate widespread deficiencies in the discussion of hypertension and BP in clinical notes across medical specialties.

Keywords: Hypertension • Blood pressure • Inertia • Notes • Internal medicine

Abbreviations: BP: Blood Pressure; A/P: Assessment and Plan; HTN: Hypertension

Introduction

Hypertension is associated with the greatest attributable risk for mortality among all modifiable risk factors for cardiovascular disease [1], and in the United States, approximately 116 million adults (47%) have hypertension [2]. Numerous clinical trials have demonstrated that antihypertensive medications reduce the risk of cardiovascular events [3], and even modest improvements in Blood Pressure (BP) control can substantially reduce the risk of strokes and myocardial infarctions [4]. Yet, approximately 20% of U.S. adults are unaware of their hypertension [5] and as many as 75% of those diagnosed with hypertension may be uncontrolled [2]. Thus, there is a critical need to more effectively diagnose and treat patients with hypertension.

Both diagnostic and therapeutic inertia have been identified as important causes of delays in achieving BP control [6]. Healthcare professionals frequently delay the diagnosis and treatment of hypertension, even when presented with documented elevated BP readings [7]. For example, in one study, treatment changes were implemented in only 38% of cases despite documented uncontrolled hypertension for at least 6 months [8]. Many

reasons have been proposed to explain diagnostic and therapeutic inertia. For example, healthcare providers might perceive elevated office BP readings to be "white coat hypertension" [9]. Furthermore, a diagnosis of hypertension requires multiple elevated BP measurements [10], but patients are often seen infrequently by their healthcare providers, resulting in further delays in diagnosis and treatment. Moreover, even when patients present to the clinic, often for more pressing concerns, BP discussions may be neglected to focus on other health concerns.

BP readings are routinely measured and recorded at almost all healthcare visits, regardless of specialty. Thus, there are many opportunities to diagnose hypertension and improve BP control. Increasing the potential visibility of potential BP issues in clinical notes could ultimately help improve hypertension diagnosis and BP control. The objective of this pilot study is to determine the percentage of patients with elevated BP measurements where the clinical notes from clinic visits specifically mention BP or hypertension outside of the vitals section of the note.

Methods

In order to examine clinical notes, we used data from the electronic medical record. We collected outpatient visits for ten thousand randomly selected patients with at least one visit to an Internal Medicine clinic between Jan 1st 2017 and June 30th 2021. For these 10,000 patients, those clinic visits for which all of the recorded BPs were at or above 140/90 mm Hg were recorded. This threshold was chosen because, while current guidelines define elevated blood pressure at lower levels, 140/90 mm Hg is the lowest blood pressure recognized as hypertensive regardless of the patient's comorbidities or the version of the guidelines used [11].

The Assessment and Plans (A/Ps) section of notes from these clinic visits were then extracted using a rule-based pattern-matching algorithm.

***Address for Correspondence:** Linnea A. Polgreen, Department of Pharmacy Practice and Science, University of Iowa, Iowa City, IA 52242, USA, Tel: 319-384-3024, E-mail: linnea-polgreen@uiowa.edu

Copyright: © 2024 Zetumer SD, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Received: 03 February, 2024, Manuscript No. jhoa-24-126673; **Editor Assigned:** 05 February, 2024, PreQC No. P-126673; **Reviewed:** 17 February, 2024, QC No. Q-126673; **Revised:** 22 February, 2024, Manuscript No. R-126673; **Published:** 29 February, 2024, DOI: 10.37421/2167-1095.2024.13.437

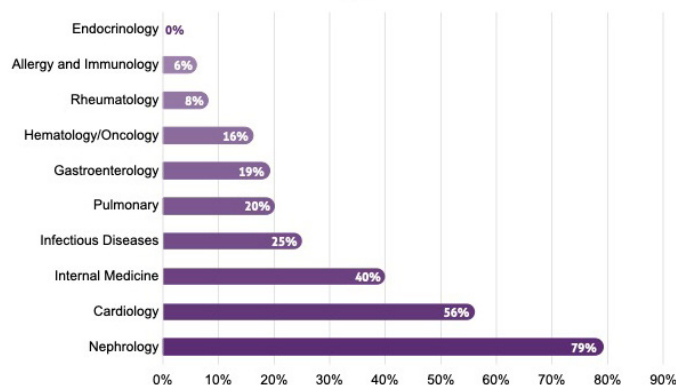


Figure 1. Percentages of assessment and plans that mention elevated blood pressure differ among specialties.

These A/P sections were then parsed by regular expressions to determine the presence or absence of words related to hypertension ('BP', 'HTN', 'blood pressure', etc.). Matches were excluded if the string also matched expressions for pulmonary hypertension or ocular hypertension. A/Ps with no matching text pattern indicating BP or hypertension was considered not to have addressed hypertension. Similar approaches have been shown to perform well for identifying hypertension diagnoses in inpatient clinical notes, having approximately 90% sensitivity and 90% positive predictive value vs. manual review [12].

We also captured the specialty associated with the clinic of the visit where the patient arrived hypertensive. The analyses of clinical notes were then grouped by the following internal medicine specialties: cardiology, endocrinology, gastroenterology, general internal medicine, hematology/oncology, immunology, infectious disease, nephrology, pulmonology and rheumatology. The percentage of visits where BP was discussed was calculated for each specialty.

Results

Among the 10,000 visits randomly collected from the electronic medical record, we found 5,674 visits where patients had recorded BP measurements above 140/90 mmHg as part of their vital signs. Among the 5,674 patient visits with an elevated BP, only 1872 (33%) of the visits had a note that discussed hypertension or BP in the A/P portion of the note. The proportion of notes corresponding to visits with elevated measurements that mentioned hypertension or BP in the A/P varied widely according to specialty types. Figure 1 shows the proportion of notes from clinic visits with elevated BP levels across different specialties.

For two specialties, nephrology and cardiology, notes referred to hypertension or BP at least 50% of the time: 79% for nephrology (55 of 77 encounters) and 56% for cardiology (206 of 366). In contrast to cardiology and nephrology, the notes in the assessment and plan from visits in allergy/immunology, endocrinology (not diabetes clinic) and rheumatology specialists referenced the hypertension or blood pressure less than 10% of the time (in 3 of 52 (6%), 0 of 15 (0%) and 10 of 124 (8%) encounters, respectively). Finally, some disciplines had a proportion of notes closer to the overall average. For example, 40% (1287 of 3219) of general internal medicine visits and 25% (15 of 61) for infectious diseases visits had notes that mentioned BP or hypertension.

Discussion

Using data from the electronic medical record, we found that documentation of elevated BP readings in clinical notes is surprisingly uncommon. Specifically, we found that the text of clinical notes summarizing clinical visits frequently fail to mention the elevated BP measurements that were captured at the beginning of the clinical visit. Even in clinics that should be focused on the diagnosis and treatment of BP frequently fail to specifically mention hypertension or BP. For

example, 60% of the time general internal medicine clinic notes fail to refer to hypertension or BP when an elevated BP was recorded at the clinical visit. Furthermore, in clinics not typically associated with hypertension management (e.g., allergy, rheumatology), clinic notes fail to refer to hypertension or BP over 90 percent of the time despite an elevated BP reading. Collectively, our results highlight the need for improved documentation regarding elevated BP readings across medical specialties.

We think that there are three major reasons for physicians and other healthcare providers failing to adequately document elevated BP readings in the A/P of their notes. First, there are many competing demands on providers' time. For each visit, there is limited time with the patient and the most urgent, often acute, complaint takes precedence; attending to pressing problems or chief complaints may reduce time for addressing chronic health conditions, like hypertension. In fact, high patient volumes are associated with lower rates of hypertension treatment among patients diagnosed with hypertension [13] thus it follows that a lack of documentation of hypertension would also coincide with a provider's large workload and large patient volume.

A second reason we think that physicians and other healthcare providers fail to adequately document elevated BP readings is that they may believe that diagnosing and treating hypertension is not their primary or even secondary clinical responsibility and that it is instead the job of the patient's primary care provider. Supporting our hypothesis, we found that clinics that focus on problems related to hypertension (e.g., nephrology, cardiology) had higher rates of documentation than ones that do not. However, there is no point-of-care test for hypertension and multiple elevated readings are necessary for a diagnosis [10]. Accordingly, even if it is not the clinical responsibility for a healthcare provider to diagnose and manage hypertension, it is important for any provider to discuss elevated BP readings with patients and to encourage patients to obtain more readings and convey these results to their primary care providers, who are, in most cases, ultimately responsible for diagnosing and treating hypertension. Furthermore, it is important to highlight such conversations with patients in the electronic medical record for consideration at future appointments.

A third reason why physicians and other healthcare providers may fail to adequately document elevated BP is due to confusion regarding changing definitions and guidelines for hypertension treatment and management. Indeed, physicians report using different thresholds for diagnosis or treatment changes [14]. Also, some physicians overestimate their own adherence to existing guideline recommendations [15]. Alternatively, physicians may not make recommendations because they assume that patients will be non-adherent [13]. However, these reasons do not justify a lack of discussion of abnormal measurements for a treatable condition that is routinely measured across clinical visits. Indeed, for this study, we picked a level of BP (140/90 mm Hg) that is generally considered to warrant follow up or further attention [11].

Our work is consistent with prior reports that have also found that elevated BP is more likely to be addressed in clinics where hypertension is an important comorbidity [16], but prior research has primarily relied upon labour-intensive chart reviews. Here we propose an automated method that is relatively simple to implement, could be applied to other diseases and patient groups and could be widely implemented across healthcare institutions. Furthermore, given the widespread adoption of electronic medical record systems, our approach could be performed repeatedly to measure improvements or changes in documentation. Indeed, electronic medical records have, in some cases, led to improved hypertension outcomes by increasing access to patient data across visits and providers [17,18].

This pilot study has multiple limitations. First, this sample was taken from a single university-based health system and its generalizability to other settings may be limited. Second, we only used a sample of notes and did not examine all notes in our electronic-medical-record system. Third, the reason for each visit was not captured in the study data and it is possible that some visits were specifically for hypertension, which likely varies across specialties. Finally, we used a simple "key word" approach to identify discussions of hypertension or BP in clinical notes. Natural Language Processing (NLP) applied to clinical text documents has experienced rapid growth in recent years [19,20], and

future work can increase the sensitivity and flexibility of our relatively simple approach [21,22].

Despite our limitations, our exploratory work clearly demonstrates common deficiencies in the documentation of hypertension and BP in clinical notes. Even in internal medicine specialties, less than 50% of visits referred to hypertension in a clinic note that coincided with an elevated BP reading. Future work should focus on determining if the discussion of elevated BP observed during clinic visits is associated with improved BP control. However, given that clinical notes are the primary method of communication among physicians, it seems difficult to improve BP control if it is not discussed in clinical notes.

Conclusion

We demonstrate widespread deficiencies in the discussion of hypertension and BP in clinical notes across medical specialties.

Acknowledgment

This work was supported in part by grant #HL144880 from the National Heart Lung and Blood Institute (to LAP) and grant #UL1TR002537 from the Center for Advancing Clinical and Translational Science (to PMP).

Conflict of Interest

PMP is a consultant for Eli Lilly and has received grant funding from Pfizer. All other authors report no conflicts of interest.

References

1. Yang, Quanhe, Mary E. Cogswell, W. Dana Flanders and Yuling Hong, et al. "Trends in cardiovascular health metrics and associations with all-cause and CVD mortality among US adults." *JAMA* 307 (2012): 1273-1283.
2. <https://millionhearts.hhs.gov/data-reports/hypertension-prevalence.html>
3. Law, Malcom R., Joan K. Morris and NJ2684577 Wald. "Use of blood pressure lowering drugs in the prevention of cardiovascular disease: Meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies." *BMJ* 338 (2009).
4. Staessen, Jan A., Ji-Guang Wang and Lutgarde Thijs. "What can be expected from optimal blood pressure control?." *J Hypertens* 21 (2003): S3-S9.
5. Egan, Brent M., Yumin Zhao and R. Neal Axon. "US trends in prevalence, awareness, treatment and control of hypertension, 1988-2008." *JAMA* 303 (2010): 2043-2050.
6. Rose, Adam J., Dan R. Berlowitz, Michelle B. Orner and Nancy R. Kressin. "Understanding uncontrolled hypertension: Is it the patient or the provider?." *J Clin Hypertens* 9 (2007): 937-943.
7. Filippi, Alessandro, Diego Sangiorgi, Stefano Buda and Luca Degli Esposti, et al. "How many hypertensive patients can be controlled in "real life": An improvement strategy in primary care." *BMC Fam Pract* 14 (2013): 1-7.
8. Chomutare, Taridzo, Luis Fernandez-Luque, Eirik Årsand and Gunnar Hartvigsen. "Features of mobile diabetes applications: Review of the literature and analysis of current applications compared against evidence-based guidelines." *J Med Internet Res* 13 (2011): e1874.
9. Pickering, Thomas G., Gary D. James, Charlene Boddie and Gregory A. Harshfield, et al. "How common is white coat hypertension?." *JAMA* 259 (1988): 225-228.
10. Whelton, Paul K. and Robert M. Carey. "The 2017 American College of Cardiology/American Heart Association clinical practice guideline for high blood pressure in adults." *JAMA Cardiol* 3 (2018): 352-353.
11. Chrysant, Steven G. "The debate over the optimal blood pressure treatment target of less than 130/80 mmHg." *Postgrad Med* 135 (2023): 208-213.
12. Martin, Elliot A., Adam G. D'Souza, Seungwon Lee and Chelsea Doktorchik, et al. "Hypertension identification using inpatient clinical notes from electronic medical records: An explainable, data-driven algorithm study." *Can Med Assoc J* 11 (2023): E131-E139.
13. Harle, Christopher A., Jeffrey S. Harman and Shuo Yang. "Physician and patient characteristics associated with clinical inertia in blood pressure control." *J Clin Hypertens* 15 (2013): 820-824.
14. Basile, Jan and Joel Neutel. "Overcoming clinical inertia to achieve blood pressure goals: The role of fixed-dose combination therapy." *Ther Adv Cardiovasc Dis* 4 (2010): 119-127.
15. Leaf, David Alexander, William E. Neighbor, Douglas Schaad and Craig S. Scott. "A comparison of self-report and chart audit in studying resident physician assessment of cardiac risk factors." *J Gen Intern Med* 10 (1995): 194-198.
16. Viera, Anthony J., Dorothee Schmid, Susan Bostrom and Angie Yow, et al. "Level of blood pressure above goal and clinical inertia in a Medicaid population." *J Am Soc Hypertens* 4 (2010): 244-254.
17. Linder, Jeffrey A., Jeffrey L. Schnipper and Blackford Middleton. "Method of electronic health record documentation and quality of primary care." *J Am Med Inform Assoc* 19 (2012): 1019-1024.
18. Kinn, James W., Joseph C. Marek, Michael F. O'Toole and Stephen M. Rowley, et al. "Effectiveness of the electronic medical record in improving the management of hypertension." *J Clin Hypertens* 4 (2002): 415-419.
19. Fu, Sunyang, David Chen, Huan He and Sijia Liu, et al. "Clinical concept extraction: A methodology review." *J Biomed Inform* 109 (2020): 103526.
20. Sheikhalishahi, Seyedmostafa, Riccardo Miotto, Joel T. Dudley and Alberto Lavelli, et al. "Natural language processing of clinical notes on chronic diseases: Systematic review." *JMIR Med Inform* 7 (2019): e12239.
21. Lindberg, C. "The Unified Medical Language System (UMLS) of the National Library of Medicine." *J Am Med Dir Assoc* 61 (1990): 40-42.
22. <https://www.nlm.nih.gov/research/umls/index.html>

How to cite this article: Zetumer, Samuel David, Philip M. Polgreen, Manish Suneja and Cole G. Chapman, et al. "The Proportion of Physician Notes Addressing Elevated Blood Pressure Readings Varies Dramatically across Internal Medicine Specialties." *J Hypertens* 13 (2024): 437.