Published in final edited form as:

J Am Soc Hypertens. 2018 December ; 12(12): 858–866. doi:10.1016/j.jash.2018.09.010.

National Trends in the Emergency Department Management of Adult Patients with Elevated Blood Pressure from 2005–2015

Sarah Marks, MS and

Department of Emergency Medicine, Brown University

Roland C. Merchant, MD, ScD

Department of Emergency Medicine & Department of Epidemiology, Brown University

Abstract

Background: Emergency department (ED)-based screening and referral of patients with elevated blood pressure (BP) is recommended by 2006 and 2013 American College of Emergency Physicians (ACEP) guidelines, however, it is unknown if these recommendations or disparities in care impact clinical practice.

Objectives: (1) Assess temporal trends in antihypertensive prescriptions, outpatient follow-up referrals, and diagnosis of hypertension (HTN)/elevated BP and (2) identify potential disparities by patient characteristics.

Methods: Using the 2005–2015 National Hospital Ambulatory Medical Care Survey, we examined the frequency and trends overtime of antihypertensive prescriptions, outpatient follow-up referrals, and BP diagnoses for US ED visits by adult patients with an elevated triage BP and identified potential disparities in management by patient demography and socioeconomic status.

Results: Of the 594 million eligible ED visits by patients from 2005–2015, 1.2% (1.0–1.4%) received antihypertensive prescriptions at discharge, 82.3% (80.0–83.6%) outpatient follow-up referrals, and 2.1% (1.9–2.4%) a HTN/elevated BP diagnosis. There were small annual increases over time in the odds of antihypertensive prescriptions at discharge (aOR 1.05 (1.00, 1.10)), follow-up referrals (aOR 1.04 (1.01, 1.07)), and HTN/elevated BP diagnosis (aOR 1.05 (1.02, 1.08)). For BPs $\geq 160/100$ mm Hg, prescriptions were more common for Blacks (aOR 2.36 (1.93, 2.88)) and uninsured patients (aOR 1.81 (1.38, 2.38)), and diagnoses were more common for Blacks (aOR 1.95 (1.70, 2.24)) and uninsured patients (aOR 1.30 (1.09, 1.55)).

Discussion: These data suggest little change in and the need for improvement in the management of ED patients with elevated BP, despite ACEP guidelines, and raise concern about patient care disparities.

Corresponding author: Elizabeth M. Goldberg, MD, ScM, Department of Emergency Medicine & Center of Gerontology and Healthcare Research, Brown University, Address: 55 Claverick Street, Providence, RI 02903, Telephone: 401-444-7975, Elizabeth_goldberg@brown.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Conflict of interest: The authors declare that they have no conflict of interest.

Keywords

hypertension; blood pressure; diagnosis; epidemiology; emergency medical services; emergency department

1. Introduction

An estimated 34% of the adult United States (US) population (approximately 8.7 million people) have hypertension (HTN), which is the leading modifiable risk factor for heart disease and stroke.[1] Emergency medicine specialty organizations and other national organizations recommend emergency department (ED)-based screening and outpatient follow-up referral of patients with elevated blood pressure (BP), but previous research indicates that there is great variation in the adoption of these recommendations in clinical practice.[2–4] The American College of Emergency Physicians (ACEP) first published guidelines on the care of patients with asymptomatic elevated BP in 2006,[5] which recommended outpatient follow-up referral for a BP recheck for patients with an ED BP 140/90 mm Hg. In 2013, an updated ACEP clinical policy on asymptomatic elevated BP reemphasized outpatient referral of patients with elevated BP and advised that antihypertensives could be initiated in the ED, particularly for patients who might have difficulty securing follow-up.[6]

Despite Medicaid expansion and other Affordable Care Act provisions increasing the accessibility to primary care, many patients continue to rely on EDs as their primary site of health care.[7] One-fifth of annual US ED visits by adults are for a HTN-related complaint.[8] As the health care safety net, EDs are in a unique position to help decrease the rates of undiagnosed and untreated HTN in the US. Studies that address compliance with BP guidelines among ED physicians are lacking, but are crucial to improving HTN awareness and control. It is also important to evaluate whether disparities in ED HTN care exist by patient age, racial, ethnic, and socioeconomic characteristics. In regards to ethnic/racial disparities, prior research has indicated that although overall mortality from causes related to HTN is highest among Blacks, some Black patients may not be getting the care they need.[9] Additionally, commensurate with the publication of the SPRINT and HVERT trial results, there has been increasing recognition that older adults benefit more than younger patients from even modest reductions in BP and that previous treatment thresholds for this population were too high.[10, 11] However, there has not been an evaluation of whether older adults receive appropriate management of elevated BP by ED physicians.

Prior investigations of US elevated BP trends have been based on a diagnosis of HTN rendered at the ED visit.[8, 12] However, these prior analyses missed an important subgroup of ED patients, those with undiagnosed or unrecognized HTN. Elevated BP often goes unrecognized and ED providers may be hesitant to provide a diagnosis of HTN in patients with elevated BP who have no prior documented history of HTN. In addition, for the majority of ED visits (80.5%) only one BP is taken, the triage BP.[13] Triage BP might be the only value upon which ED clinicians base their elevated BP management decisions. Prior studies also have shown that systolic and diastolic BP readings decrease only an average of

10 mm Hg between triage and subsequent measurements during an ED stay, which indicates the importance of recognizing and responding to an elevated triage BP.[14–17]

For US ED visits involving adult patients discharged from the ED, the goals of this study were on a national level to: (1) assess the temporal trends in antihypertensive prescriptions, outpatient follow-up recommendations after the ED visit, and diagnosis of HTN/elevated BP, particularly in response to the release of ACEP elevated BP guidelines in 2006 and 2013; and (2) identify potential disparities in care provided in US EDs to patients with elevated triage BP by patient demography and socioeconomic status. We hypothesized that despite ACEP recommendations, there would be no change in ED management of these patients overtime, as suggested by previous research involving medical record reviews on this topic area.[18, 19] We also hypothesized that older [20] and racial/ethnic[21] minority patients and those lacking health insurance would be less likely to receive treatment, referrals and diagnoses, given concerns for disparities in care based on demography and socioeconomic status.

2. Materials and methods

2.1 Study design and data source description

We examined the management of elevated triage BP for adult patients discharged from US EDs from 2005 to 2015 using the Centers for Disease Control and Prevention's NHAMCS public use files. NHAMCS is an annual, multistage, stratified, nationally representative assessment of ED visits to non-federal, general and short-stay hospitals. Further methodological details as well as quality control procedures are available at the Centers for Disease Control and Prevention website.[22]

NHAMCS offers a unique opportunity to study temporal trends in elevated BP management in US EDs. NHAMCS is the only national database that captures ED patient vital signs as well as variables for prescriptions, recommendations for follow-up, and final diagnosis coding. All of these variables are critical to determining how ED providers care for patients with elevated BP. Unlike other datasets, NHAMCS also includes data on each patient's triage BP. Although having the totality of BPs obtained during ED visits would be preferable, no such national database containing this information exists. However, the NHAMCS database does not contain information on patients' prior diagnoses and treatment, whether for HTN or any other condition.

2.2 Selection of participants

We included ED visits by patients who were 18 years-old, evaluated by a licensed medical provider (attending physician, resident, nurse practitioner, or physician assistant) and discharged from the ED. Only visits for which both a triage systolic and diastolic BP were reported and in a physiologically possible range were included. Less than 1% of visits were excluded due to missing triage BP. We excluded visits for which patients did not complete care (i.e., left against medical advice or eloped prior to completing their care), were dead on arrival or died in the ED, transferred to another facility, or were admitted.

2.2 Measurements

Triage BP was categorized as normal (below 120 mm Hg systolic and 80 mm Hg diastolic), elevated (120–159 mm Hg systolic and/or 80–99 mm Hg diastolic), and severely elevated 160/100 mm Hg. These three strata were used because normal BP is widely accepted as below 120/80 mm Hg, BPs 120/80 mm Hg are considered to be elevated,[23] and prior ED research indicates that an ED BP of 160/100 mm Hg has a high predictive value for HTN diagnosed in follow-up and would be most likely to prompt ED management compared to lower thresholds.[24, 16, 25]

2.3 Outcomes

Outcomes measured were: (1) prescription of antihypertensive medications (given in the ED, at discharge, or both), (2) outpatient follow-up referrals, and (3) diagnosis of HTN or elevated BP rendered for the ED visit. Medications prescribed were categorized as antihypertensive agents per the therapeutic classification used in Multum's Lexicon Drug Database.[26] An outpatient follow-up recommendation was noted when patients were referred for any follow-up care (NHAMCS data do not state the reasons for referral, locations or types of providers the patient is referred to). A diagnosis of HTN/elevated BP was defined by the presence of an ICD-9-CM code between 401 and 405 (inclusive)[8] or 796.2. The codes 401 and 405 (inclusive)[8] and 796.2 include essential HTN, secondary HTN and hypertensive heart and chronic kidney disease and elevated BP reading without a diagnosis of HTN.

2.4 Data analysis

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC) using appropriate survey procedures with weights and survey design variables unless otherwise noted. Sample weighting adjusted for nonresponse by time of year, geographic region, urban/rural status and ownership designation. We obtained weighted proportions of visits with corresponding 95% confidence intervals (CIs) that met the aforementioned outcomes: antihypertensive medication prescription, outpatient follow-up referral, and the provision of a diagnostic code for HTN/elevated BP. The unit of analysis used for the NHAMCS dataset is the ED visit not the patient. Therefore, results are expressed as a proportion of visits. We examined trends overtime for all outcomes using adjusted models with linear tests of trend. We used multivariable logistic regression including all demographic and socioeconomic characteristics of interest to examine the association of patient factors with our outcome variables of interest to identify disparities in treatment and management of elevated BP. Odds ratios (ORs) with 95% CIs were estimated.

3. Results

3.1 Characteristics of participant ED visits

There were 741 million ED visits from 2005 to 2015 that met study inclusion criteria (see Figure 1). Of these, 20% had a normal, 64% an elevated, and 16% a severely elevated BP. Among all ED visits with elevated or severely elevated BP, 59.8% were between 18–44

years in age, 55.7% were female, 63.0% were non-Hispanic white, and 35.7% were privately insured (Table 1).

3.2 Primary outcomes: antihypertensive medication prescriptions, outpatient follow-up referrals, and HTN/elevated BP diagnosis

Among patients with severely elevated BP, 4.84% were prescribed antihypertensive medications at discharge, 84.1% were referred for outpatient follow-up, and 13.1% were diagnosed with HTN/elevated BP (Table 2). Antihypertensive medication prescriptions at discharge increased in frequency with increasing triage BP category (normal, elevated, severely elevated). The most commonly prescribed antihypertensive medications prescribed at ED discharge (in decreasing frequency) were lisinopril, hydrochlorothiazide, metoprolol, clonidine, amlodipine, atenolol, enalapril, carvedilol, diltiazem and losartan.

Most visits regardless of triage BP category resulted in outpatient follow-up referrals; there were no differences across triage BP categories (Table 2). HTN/elevated BP diagnosis increased in frequency with increasing triage BP category. Between 2005 and 2015, antihypertensive medication prescribing on discharge, outpatient follow-up referrals, and provision of a HTN/elevated BP diagnosis (Supplementary Table A) increased at low levels: antihypertensive medication in the ED and at discharge, aOR 1.08 (95% CI: 1.03, 1.14); antihypertensive prescription at discharge only, aOR 1.05 (95% CI: 1.00, 1.10); outpatient follow-up referrals, aOR 1.04 (95% CI: 1.01, 1.07); HTN/elevated BP diagnoses, aOR 1.05 (95% CI: 1.02, 1.08). Antihypertensive medication administered in the ED only did not increase, aOR 1.02 (95% CI: 0.99, 1.04).

3.3 Potential disparities by patient demography and socioeconomic status in clinical practice

As shown in Table 3, there were differences in antihypertensive medication prescription, outpatient follow-up referrals and HTN/elevated BP diagnosis by patient demographic and socioeconomic characteristics across all triage BP categories. When focusing only on visits by patients with severely elevated triage BP, adults 65 years-old and older were more likely to receive antihypertensive medication prescriptions and a HTN/elevated BP diagnosis, but not more likely to receive an outpatient follow-up referral. Non-Hispanic Blacks were more likely to receive an antihypertensive medication both in the ED and at discharge and a HTN/elevated BP diagnosis. Uninsured patients also were more likely to receive an antihypertensive medication at discharge and a HTN/elevated BP diagnosis.

For visits with elevated triage BPs (120 mm Hg systolic or 80 mm Hg diastolic), older adults were four times more likely to receive antihypertensive medication and almost six times more likely to receive an elevated BP/HTN diagnosis (Supplementary Table B). Non-Hispanic Blacks were more likely to receive antihypertensive medication on discharge, but not in the ED, and were twice as likely to receive an elevated BP/HTN diagnosis. Uninsured patients were no more likely than those with private insurance to receive prescriptions, outpatient follow-up referral, or an elevated BP/HTN diagnosis.

4. Discussion

Since the 2006 and 2013 release of ACEP clinical policies on asymptomatic elevated BP, these NHAMCS data suggest at most a modest increase in overall clinical management of patients presenting to the ED with an elevated triage BP from 2005 to 2015. Treatment and diagnosis remained at low levels overtime, although referral to follow-up rates stayed high. Clinical management in response to elevated triage BP was more pronounced for patients with higher triage BPs. This finding indicates that ED providers either do not recognize that the BP of a patient is abnormal unless it is very elevated, doubt the validity of an elevated BP in the ED setting, or may believe that no action is necessary for lower BP elevations.

Prior studies show that an ED BP of 160/100 mm Hg or above is associated with a definitive diagnosis of HTN in follow-up,[24, 16, 25, 27] two thirds of patients with severely elevated BPs meet criteria for HTN in follow-up. Despite this association, only 4.8% of patients with severely elevated BP were discharged with an antihypertensive medication and 13.1% were diagnosed with HTN/elevated BP from US EDs in the NHAMCS sample. Although it cannot be assessed by the data available from the NHAMCS database, an unknown number of these patients may already have carried a diagnosis of HTN and perhaps also were noncompliant with their medications. In accordance with good medical practice, the ED clinician might have counseled such patients to take his/her medication, adjusted the dosing, contacted the patient's primary care provider, and arranged follow-up in the near future. Regardless of this limitation of the NHAMCS database and this investigation, the findings provide at least an approximation of the lowest, base rates that antihypertensive medications are prescribed, outpatient follow-up referrals are rendered, and HTN/elevated BP diagnoses are made among ED patients with an elevated triage BP. Although this cannot be assessed using this dataset, higher rates might be possible among patients newly diagnosed with HTN/elevated BP in the ED or referred for an outpatient evaluation of their elevated BP.

Other ED-based studies found similar low rates of prescriptions, outpatient follow-up referrals and elevated BP/HTN diagnosis for ED patients with asymptomatic elevated BP. In a prospective cross-sectional single-ED study of adult patients with elevated BP and no prior diagnosis of HTN, 2.1% received an antihypertensive prescription, 5% received outpatient follow-up referrals, and 6.4% received a HTN diagnosis.[28] In a single-ED medical record review 9,805 adult ED patients with elevated BP and no history of HTN, only 7% received any in-ED management applicable to this condition, including medication prescription, referral for outpatient follow-up and/or a HTN diagnosis.[29]

One potential explanation for the low rates of in-ED HTN-related clinical management could be that elevated triage BPs went unnoticed or were discounted and no action was taken. Clinicians could have been more focused on other patient complaints, might have obtained subsequent BP readings that were lower or in the normal range, or believed the elevated BP was a spurious finding related to the patient's acute condition. Studies have shown that systolic and diastolic BP decrease only an average of 10 mm Hg between triage and subsequent measurements during an ED visit.[14–17] Most patients with an elevated initial BP will continue to have abnormal BPs after discharge, despite the acuity of the presenting condition, pain or anxiety.[15, 30, 31, 27]

Regardless of well-meaning ED provider intentions or beliefs, not recognizing or even dismissing elevated BP readings unfortunately might contribute to HTN-related morbidity and mortality.[32] In a retrospective cohort study of over 58,000 patients by Patel et al, 82% of patients had poor BP control one month after an ED visit for markedly elevated BP and 1% had a major adverse cardiovascular event.[33] Given the high likelihood of morbidity and mortality from untreated HTN and that ED patients with elevated triage or other ED-obtained BPs indicate a strong probability of HTN, ED providers should recognize, assess and act on elevated BP values in accordance with established guidelines. In a retrospective cohort study of approximately 263,000 ED visits in Korea, ED patients diagnosed with elevated BP or receiving antihypertensives in the ED or on discharge had a 5% cumulative incidence of a major adverse cardiovascular event (MACE) and a cardiovascular mortality of 0.8% in the median follow-up period of 5.8 years.[32] Follow-up visits within three months of ED discharge modified the risk of MACE in follow-up, underscoring the importance of recognizing and referring patients who present with elevated BP.

Another concern raised by these data are potential disparities in ED management across demographic and socioeconomic characteristics. Perhaps due to recognition of greater prevalence in this population, ED providers were more likely to diagnose non-Hispanic Black patients with HTN/elevated BP and prescribe antihypertensive medications, even after adjusting for other demographic characteristics and health insurance status. However, this predilection might indicate a failure to recognize, diagnose and treat other patients with elevated BP. Perhaps in accordance with guidelines that encourage a focus on patients for whom follow-up access to care difficult,[6] ED patients without healthcare insurance are receiving more antihypertensive medication prescriptions than those with insurance. However, this behavior also might reflect an assumption that those with healthcare insurance will receive follow-up for elevated BP and as needed treatment for HTN, which might not be correct. Despite our hypothesis regarding age, older adults are appropriately receiving more prescriptions, outpatient follow-up referrals, and elevated BP/HTN diagnoses.

Of all potential strategies for managing ED patients with elevated BP without clear target organ damage, referring patients for outpatient follow-up may have the greatest consensus. [30, 5] The Centers for Medicare & Medicaid Services instituted a physician quality reporting system (PQRS) measure in 2012 recommending that all patients evaluated in the ED without known HTN and a BP $\geq 120/80$ mm Hg be referred for further HTN screening. There is evidence that this cut-off has validity in the ED setting and ED providers should consider using this threshold for screening and referral.[34] Regardless of the general consensus for the need for referral, prior studies have shown that directed referral for HTN occurs infrequently.[30, 35, 36, 29] Although in this study, most (80%) of patients were referred to follow-up with another provider following discharge, we cannot know using NHAMCS data if the outpatient follow-up referral specifically instructed the patient to have their elevated BP assessed.

A more controversial ED management strategy for asymptomatic elevated BP is the initiation of an antihypertensive at ED discharge.[3] Although primary care providers are best suited to prescribe long-term antihypertensive medications to their patients, given the long wait times most patients can expect to see an outpatient prescriber and the relative

safety, affordability and efficacy of these medications,[37, 33] prescribing antihypertensives in the ED setting with the intent of gradual lowering of BP is an acceptable management strategy.[37, 33] A recent American Heart Association advisory can help providers decide on the best medication for their patients depending on their other comorbidities.[38] After lifestyle modifications, thiazides, calcium channel blockers and angiotensin converting enzyme inhibitors or angiotensin II receptor blockers are considered first-line therapy. Unfortunately, many of the medications that were most commonly prescribed to ED patients in this study are not considered first or second line medication for HTN. Some of these, such as clonidine, should almost never be prescribed for ED patients, due to the risk of rebound HTN and the particularly high risk of central nervous system adverse effects in older adults. [39, 40]

4.1 Limitations

This study has several important limitations. Diagnosis coding can change over time and may not represent actual trends overtime. These changes might affect the diagnosis outcome. We based our analysis on triage BP alone, which was the only BP value available in the NHAMCS dataset until 2014. For most of the data available, we were unable to ascertain if more than one BP measurement per visit was obtained during a visit and whether the BP remained elevated, declined, or increased during the visit. It is unlikely that patients included in our analysis, particularly in the highest two BP categories, will have normal BPs on recheck in the ED, given that prior studies show that systolic and diastolic BP readings decrease only an average of 10 mm Hg between triage and subsequent measurements during an ED stay.[14–17] Starting in 2014, multiple BP measurements were recorded in NHAMCS. In these years among ED visits where the patient did not receive BP-lowering medication while in the ED, the mean decrease in systolic BP from triage to discharge was 7.65 mm Hg (95% CI: 6.97–8.33) and the mean decrease in diastolic BP was 5.35 mm Hg (95% CI: 4.97–5.73). For participants with elevated triage BP, 75.5% also had elevated or severely elevated BP at discharge. Among participants with severely elevated triage BP, 95.5% had elevated or severely elevated BP at discharge (58.6% elevated, 36.9% severely elevated).

Given the large sample sizes in the study, some statistical differences observed between or among groups found may not be clinically relevant. Medical and prescription histories were also not available in the dataset, so we could not determine which patients were known to have HTN and were taking antihypertensive medications. It is also possible that antihypertensive medication initiation was discussed as an option with the patient or his/her primary care provider and not accepted by patients. We also could not ascertain from the data if outpatient follow-up referrals were for HTN/elevated BP or another reason. Four of the five trend tests were significant indicating an increase in outcomes over time. This finding warrants further confirmation given the large sample sizes and a change in data collection procedures for the NHAMCS dataset over time. Despite the limitations of the NHAMCS data, prior research evaluating asymptomatic elevated BP management has been mostly limited to retrospective single-center studies[29, 41–43] or prospective studies with modest sample sizes,[44, 35] thus our findings likely better represent national trends.

5. Conclusions

Despite published guidelines recommending screening and referral for all patients and despite the proven safety and efficacy of antihypertensive medications, treatment and diagnosis in the ED for elevated triage BPs remain low and there has been at best a modest increase in the clinical management of US ED patients with elevated BP overtime. ED providers were appropriately more likely to intervene in the uninsured, non-Hispanic Blacks, older adults, and those with a higher initial BP, yet other patients were less likely to be treated. ED clinicians should review current guidance on BP management and help to initiate treatment, and appropriate referrals to reduce the adverse sequelae of this common condition and guard against potential demographic- and socioeconomic-based disparities in treatment.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments:

The authors would like to acknowledge Dr. Andrew Zullo, PharmD, ScM, PhD for his early contribution to the study including the provision of expertise on complex survey design and coding.

Funding: This work was supported by the Agency for Healthcare Research and Quality [T32 HS000011].

References:

1. Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R et al. Heart Disease and Stroke Statistics-2017 Update: A Report From the American Heart Association. *Circulation*. 2017;135(10):e146–e603. doi:10.1161/cir.0000000000000485. [PubMed: 28122885]
2. Kinsella K, Baraff LJ. Initiation of Therapy for Asymptomatic Hypertension in the Emergency Department. *Annals of emergency medicine*. 2009;54(6):791–2. doi:10.1016/j.annemergmed.2009.05.001. [PubMed: 19942065]
3. Shayne P Against Routine Initiation of Antihypertensive Therapy in the Emergency Department. *Annals of emergency medicine*. 2009;54(6):792–3. doi:10.1016/j.annemergmed.2009.08.018. [PubMed: 19942066]
4. Brody A, Twiner M, Kumar A, Goldberg E, McNaughton C, Souffront K et al. Survey of Emergency Physician Approaches to Management of Asymptomatic Hypertension. *Journal of clinical hypertension (Greenwich, Conn)*. 2017;19(3):265–9. doi:10.1111/jch.12921.
5. Decker WW, Godwin SA, Hess EP, Lenamond CC, Jagoda AS, Amer Coll Emergency Phys C. Clinical policy: Critical issues in the evaluation and management of adult patients with asymptomatic hypertension in the emergency department. *Annals of emergency medicine*. 2006;47(3):237–49. doi:10.1016/j.annemergmed.2005.10.003. [PubMed: 16492490]
6. Wolf SJ, Lo B, Shih RD, Smith MD, Fesmire FM. Clinical policy: critical issues in the evaluation and management of adult patients in the emergency department with asymptomatic elevated blood pressure. *Annals of emergency medicine*. 2013;62(1):59–68. doi:10.1016/j.annemergmed.2013.05.012. [PubMed: 23842053]
7. Gonzalez Morganti K, Bauhoff Sebastian, Blanchard Janice C., Abir Mahshid, Iyer Neema, Smith Alexandria, Vesely Joseph V., Okeke Edward N. and Kellermann Arthur L.. *The Evolving Role of Emergency Departments in the United States*. Santa Monica, CA2013.
8. McNaughton CD, Self WH, Zhu Y, Janke AT, Storrow AB, Levy P. Incidence of Hypertension-Related Emergency Department Visits in the United States, 2006 to 2012. *Am J Cardiol*. 2015;116(11):1717–23. doi:10.1016/j.amjcard.2015.09.007. [PubMed: 26454813]

9. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaha MJ et al. Executive summary: heart disease and stroke statistics—2014 update: a report from the American Heart Association. *Circulation*. 2014;129(3):399–410. doi:10.1161/01.cir.0000442015.53336.12. [PubMed: 24446411]
10. Wright JT, Jr., Williamson JD, Whelton PK, Snyder JK, Sink KM, Rocco MV et al. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. *The New England journal of medicine*. 2015;373(22):2103–16. doi:10.1056/NEJMoa1511939. [PubMed: 26551272]
11. Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D et al. Treatment of hypertension in patients 80 years of age or older. *The New England journal of medicine*. 2008;358(18):1887–98. doi:10.1056/NEJMoa0801369. [PubMed: 18378519]
12. Quam L, Ellis LB, Venus P, Clouse J, Taylor CG, Leatherman S. Using claims data for epidemiologic research. The concordance of claims-based criteria with the medical record and patient survey for identifying a hypertensive population. *Medical care*. 1993;31(6):498–507. [PubMed: 8501997]
13. Miltner RS, Johnson KD, Deierhoi R. Exploring the frequency of blood pressure documentation in emergency departments. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing / Sigma Theta Tau*. 2014;46(2):98–105. doi:10.1111/jnu.12060.
14. Pitts SR, Adams RP. Emergency department hypertension and regression to the mean. *Annals of emergency medicine*. 1998;31(2):214–8. doi:10.1016/s0196-0644(98)70309-9. [PubMed: 9472183]
15. Leiby T, Paloucek F, Dela Cruz F, Leikin JB. Blood pressure decrease prior to initiating pharmacological therapy in nonemergent hypertension. *The American journal of emergency medicine*. 1990;8(1):27–9. [PubMed: 2293829]
16. Fleming J, Meredith C, Henry J. Detection of hypertension in the emergency department. *Emergency medicine journal : EMJ*. 2005;22(9):636–40. doi:10.1136/emj.2004.015040. [PubMed: 16113183]
17. Chiang WK, Jamshahi B. Asymptomatic hypertension in the ED. *The American journal of emergency medicine*. 1998;16(7):701–4. [PubMed: 9827753]
18. Baumann BM, Cline DM, Cienki JJ, Egging D, Lehrmann JF, Tanabe P. Provider Self-Report and Practice: Reassessment and Referral of Emergency Department Patients With Elevated Blood Pressure. *American Journal of Hypertension*. 2009;22(6):604–10. doi:10.1038/ajh.2009.44. [PubMed: 19265789]
19. Lehrmann JF, Tanabe P, Baumann BM, Jones MK, Martinovich Z, Adams JG. Knowledge translation of the American College of Emergency Physicians clinical policy on hypertension. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*. 2007;14(11):1090–6. doi:10.1197/j.aem.2007.05.016. [PubMed: 17898244]
20. Abramov D, Cheng H. Controversy in treating the oldest old with hypertension: is the hypertension in the very elderly trial the final answer? *Journal of the American Geriatrics Society*. 2009;57(3):570–1. doi:10.1111/j.1532-5415.2009.02148.x. [PubMed: 19278408]
21. Whelton PK, Einhorn PT, Muntner P, Appel LJ, Cushman WC, Diez Roux AV et al. Research Needs to Improve Hypertension Treatment and Control in African Americans. *Hypertension*. 2016;68(5):1066–72. doi:10.1161/hypertensionaha.116.07905. [PubMed: 27620388]
22. CDC/National Center for Health Statistics. NHAMCS Data Collection and Processing. 2015 https://www.cdc.gov/nchs/ahcd/ahcd_data_collection.htm. Accessed March 13, 2017 2017.
23. Whelton PK, Carey RM, Aronow WS, Casey DE, Jr., Collins KJ, Dennison Himmelfarb C et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Journal of the American College of Cardiology*. 2017. doi:10.1016/j.jacc.2017.11.006.
24. Dieterle T, Schuurmans MM, Strobel W, Battegay EJ, Martina B. Moderate-to-severe blood pressure elevation at ED entry: hypertension or normotension? *The American journal of emergency medicine*. 2005;23(4):474–9. [PubMed: 16032614]

25. Chernow SM, Iserson KV, Criss E. Use of the emergency department for hypertension screening: a prospective study. *Annals of emergency medicine*. 1987;16(2):180–2. [PubMed: 3800093]
26. CDC/National Center for Health Statistics. The New Ambulatory Care Drug Database System. 2012 <https://www2.cdc.gov/drugs/applicationnav1.asp>. Accessed June 6, 2017.
27. Backer HD, Decker L, Ackerson L. Reproducibility of increased blood pressure during an emergency department or urgent care visit. *Annals of emergency medicine*. 2003;41(4):507–12. doi:10.1067/mem.2003.151. [PubMed: 12658251]
28. Bohan J, Fullerton L, Oakland B, Oldewage J. Hypertension in the ED: a multifaceted intervention to change provider practice. *The American journal of emergency medicine*. 2011;29(7):796–801. doi:10.1016/j.ajem.2010.05.003. [PubMed: 20685061]
29. Tilman K, DeLashaw M, Lowe S, Springer S, Hundley S, Counselman FL. Recognizing asymptomatic elevated blood pressure in ED patients: how good (bad) are we? *The American journal of emergency medicine*. 2007;25(3):313–7. doi:10.1016/j.ajem.2006.09.007. [PubMed: 17349906]
30. Karras DJ, Kruus LK, Cienki JJ, Wald MM, Chiang WK, Shayne P et al. Evaluation and treatment of patients with severely elevated blood pressure in academic emergency departments: a multicenter study. *Annals of emergency medicine*. 2006;47(3):230–6. doi:10.1016/j.annemergmed.2005.11.001. [PubMed: 16492489]
31. Karras DJ, Ufberg JW, Heilpern KL, Cienki JJ, Chiang WK, Wald MM et al. Elevated blood pressure in urban emergency department patients. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*. 2005;12(9):835–43. doi:10.1197/j.aem.2005.04.015. [PubMed: 16141017]
32. Lee S, You CY, Kim J, Jo YH, Ro YS, Kang SH et al. Long-term cardiovascular risk of hypertensive events in emergency department: A population-based 10-year follow-up study. *PloS one*. 2018;13(2):e0191738. doi:10.1371/journal.pone.0191738. [PubMed: 29447174]
33. Patel KK, Young L, Howell EH, Hu B, Rutecki G, Thomas G et al. Characteristics and Outcomes of Patients Presenting With Hypertensive Urgency in the Office Setting. *JAMA Intern Med*. 2016;176(7):981–8. doi:10.1001/jamainternmed.2016.1509. [PubMed: 27294333]
34. Goldberg EM, Wilson T, Saucier C, Brody AM, Levy PD, Eaton CB et al. Achieving the BpTRUth: emergency department hypertension screening and the Centers for Medicare & Medicaid Services quality measure. *Journal of the American Society of Hypertension : JASH*. 2017;11(5):290–4. doi:10.1016/j.jash.2017.03.003. [PubMed: 28412275]
35. Baumann BM, Abate NL, Cowan RM, Chansky ME, Rosa K, Boudreaux ED. Characteristics and referral of emergency department patients with elevated blood pressure. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*. 2007;14(9):779–84. doi:10.1197/j.aem.2007.05.008. [PubMed: 17652640]
36. Baumann BM, Cienki JJ, Cline DM, Egging D, Lehrmann JF, Tanabe P. Evaluation, management, and referral of elderly emergency department patients with elevated blood pressure. *Blood Press Monit*. 2009;14(6):251–6. doi:10.1097/MBP.0b013e328332fd40. [PubMed: 19910790]
37. Brody A, Rahman T, Reed B, Millis S, Ference B, Flack JM et al. Safety and efficacy of antihypertensive prescription at emergency department discharge. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*. 2015;22(5):632–5. doi:10.1111/acem.12660. [PubMed: 25904073]
38. Go AS, Bauman MA, Coleman King SM, Fonarow GC, Lawrence W, Williams KA et al. An effective approach to high blood pressure control: a science advisory from the American Heart Association, the American College of Cardiology, and the Centers for Disease Control and Prevention. *Journal of the American College of Cardiology*. 2014;63(12):1230–8. doi:10.1016/j.jacc.2013.11.007. [PubMed: 24246165]
39. American Geriatrics Society Beers Criteria Update Expert Panel. American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. *Journal of the American Geriatrics Society*. 2015;63(11):2227–46. doi:10.1111/jgs.13702. [PubMed: 26446832]
40. Goldberg EM, Shah K, Shayne P. An Evidence-Based Approach To Managing Asymptomatic Elevated Blood Pressure In The Emergency Department. *Emergency medicine practice*. 2015;17(2):1–20; quiz 1.

41. Shea S, Misra D, Ehrlich MH, Field L, Francis CK. Predisposing factors for severe, uncontrolled hypertension in an inner-city minority population. *The New England journal of medicine*. 1992;327(11):776–81. doi:10.1056/nejm199209103271107. [PubMed: 1501654]
42. Svenson JE, Repplinger M. Hypertension in the ED: still an unrecognized problem. *The American journal of emergency medicine*. 2008;26(8):913–7. doi:10.1016/j.ajem.2007.11.024. [PubMed: 18926352]
43. Cienki JJ, Guerrero AD, Rose Steed N, Kubo EN, Baumann BM. Impact of an electronic medical record system on emergency department discharge instructions for patients with hypertension. *Postgraduate medicine*. 2013;125(5):59–66. doi:10.3810/pgm.2013.09.2702.
44. Tanabe P, Persell SD, Adams JG, McCormick JC, Martinovich Z, Baker DW. Increased blood pressure in the emergency department: pain, anxiety, or undiagnosed hypertension? *Annals of emergency medicine*. 2008;51(3):221–9. doi:10.1016/j.annemergmed.2007.10.017. [PubMed: 18207606]

Highlights

- From 2005–2015, 1.2% of ED visits resulted in an antihypertensive prescription
- From 2005–2015, 2.1% of ED visits resulted in a hypertension diagnosis
- From 2005–2015, 82.3% of ED visits resulted in an outpatient follow-up referral
- ED antihypertensive prescriptions, referrals, and diagnoses increased modestly

Figure 1.

Flowchart of study All visits in the above figure are weighted visits. The corresponding sampled visit numbers can be seen in Table 1.

Table 1.

Participant characteristics by blood pressure category for 2005–2015

	<120 mm Hg SBP & < 80 mm Hg DBP		120–159 mm Hg &/ or 80–99 mm Hg		160 mm Hg SBP or 100 mm Hg DBP	
	Sampled visits: 36,065 Weighted visits: 147,374,000		Sampled visits: 110,625 Weighted visits: 471,883,000		Sampled visits: 27,404 Weighted visits: 121,619,000	
Age ¹ (in years)	%	95% CI	%	95% CI	%	95% CI
18–44	70.2	(69.3, 71.0)	59.8	(59.1, 60.5)	34.3	(33.3, 35.2)
45–64	20.0	(19.3, 20.6)	26.7	(26.3, 27.1)	37.3	(36.5, 38.1)
65–84	7.9	(7.4, 8.3)	11.1	(10.7, 11.5)	22.8	(22.0, 23.6)
>84	2.0	(1.8, 2.2)	2.4	(2.3, 2.6)	5.6	(5.1, 6.0)
Sex						
Female	69.8	(69.1, 70.6)	55.7	(55.1, 56.3)	55.9	(55.0, 56.8)
Male	30.2	(29.4, 30.9)	44.3	(43.7, 44.9)	44.1	(43.2, 45.0)
Race/Ethnicity						
Non-Hispanic White	59.9	(57.7, 62.0)	63.0	(60.7, 65.2)	63.1	(60.7, 65.5)
Non-Hispanic Black	21.9	(19.9, 23.9)	21.7	(19.4, 23.9)	24.6	(21.9, 27.2)
Hispanic	14.7	(13.3, 16.1)	12.4	(11.1, 13.6)	9.7	(8.4, 11.0)
Non-Hispanic Other	3.6	(3.0, 4.1)	3.0	(2.4, 3.6)	2.7	(2.0, 3.3)
Healthcare Insurance²						
Private	32.8	(31.7, 33.8)	35.7	(34.8, 36.6)	32.6	(31.5, 33.6)
Medicare	14.2	(13.5, 14.8)	17.1	(16.5, 17.6)	30.3	(29.1, 31.5)
Medicaid	27.9	(26.7, 29.1)	21.5	(20.6, 22.5)	16.0	(15.1, 16.9)
Other	4.4	(3.9, 4.9)	5.0	(4.6, 5.5)	4.1	(3.6, 4.5)
No Insurance	20.8	(19.7, 21.9)	20.7	(19.7, 21.6)	17.1	(16.0, 18.2)

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure; CI: Confidence Interval

¹The imputed version of age, race/ethnicity and sex provided by NHAMCS were used for all analyses.²The other healthcare insurance category includes worker's compensation; no insurance includes both charity and self-pay patients.

Percentage of ED visits resulting in antihypertensive medication, outpatient follow-up referrals, or hypertension/elevated blood pressure diagnosis

Table 2.

	<120 mm Hg SBP & < 80 mm Hg DBP % (95% CI)	120–159 mm Hg &/ or 80–99 mm Hg % (95% CI)	160 mm Hg SBP or 100 mm Hg DBP % (95% CI)
Antihypertensive medication in the ED only	0.40 (0.30, 0.49)	0.65 (0.57, 0.73)	5.22 (4.82, 5.62)
Antihypertensive medication at discharge only	0.80 (0.64, 0.97)	1.16 (0.97, 1.35)	4.84 (4.25, 5.43)
Antihypertensive medication at discharge and ED	0.11 (0.05, 0.17)	0.24 (0.18, 0.31)	1.61 (1.39, 1.84)
Referral/follow-up recommendation	82.0 (80.7, 83.4)	82.3 (80.9, 83.6)	84.1 (82.9, 95.3)
Hypertension/elevated BP diagnosis	1.01 (0.83, 1.19)	2.11 (1.86, 2.37)	13.1 (12.33, 13.81)

SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure; CI: Confidence Interval

Table 3.

Adjusted odds of antihypertensive medication prescription, outpatient follow-up referrals, or hypertension/elevated blood pressure diagnosis for patients with severely elevated triage blood pressure (> 160 mm Hg SBP or > 100 mm Hg DBP)

	Antihypertensive Medication in the ED Only		Antihypertensive Medication at Discharge Only		Antihypertensive Medication at Discharge and ED		Outpatient Follow-up Referrals		Hypertension or Elevated BP Diagnosis	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Age¹ (in years)										
18-44	1	-----	1	-----	1	-----	1	-----	1	-----
45-64	1.84	(1.54, 2.19)	1.66	(1.39, 1.99)	1.58	(1.18, 2.11)	1.05	(0.94, 1.17)	1.63	(1.45, 1.84)
65-84	1.76	(1.34, 2.31)	1.86	(1.48, 2.34)	1.66	(1.13, 2.45)	0.95	(0.81, 1.11)	2.07	(1.73, 2.48)
>84	2.04	(1.43, 2.92)	1.74	(1.22, 2.48)	1.38	(0.68, 2.79)	0.94	(0.72, 1.21)	1.91	(1.50, 2.42)
Sex										
Male	1	-----	1	-----	1	-----	1	-----	1	-----
Female	1.31	(1.11, 1.55)	0.92	(0.78, 1.09)	1.08	(0.85, 1.37)	1.01	(0.92, 1.12)	1.04	(0.95, 1.14)
Race/Ethnicity										
Non-Hispanic White	1	-----	1	-----	1	-----	1	-----	1	-----
Non-Hispanic Black	1.98	(1.63, 2.40)	2.36	(1.93, 2.88)	2.38	(1.79, 3.16)	1.08	(0.90, 1.31)	1.95	(1.70, 2.24)
Hispanic	1.28	(0.97, 1.69)	0.96	(0.73, 1.25)	1.24	(0.73, 2.13)	1.14	(0.93, 1.40)	1.24	(1.01, 1.52)
Non-Hispanic Other	1.71	(1.11, 2.61)	0.96	(0.54, 1.71)	1.34	(0.69, 2.59)	1.27	(0.90, 1.78)	1.44	(1.12, 1.87)
Healthcare Insurance²										
Private	1	-----	1	-----	1	-----	1	-----	1	-----
Medicare	0.94	(0.72, 1.22)	0.98	(0.77, 1.26)	0.72	(0.48, 1.06)	1.11	(0.94, 1.31)	0.86	(0.73, 1.02)
Medicaid	1.00	(0.79, 1.27)	1.09	(0.84, 1.42)	0.56	(0.37, 0.86)	0.92	(0.78, 1.09)	0.91	(0.77, 1.06)
Other	0.50	(0.30, 0.86)	1.17	(0.80, 1.74)	1.46	(0.81, 2.61)	0.72	(0.55, 0.93)	0.77	(0.59, 1.00)
No Insurance	0.96	(0.75, 1.24)	1.81	(1.38, 2.38)	1.40	(0.97, 2.01)	0.97	(0.82, 1.14)	1.30	(1.09, 1.55)

SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; CI: Confidence Interval

¹The imputed version of age, race/ethnicity and sex provided by NHAMCS were used for all analyses.

²The other healthcare insurance category includes worker's compensation; no insurance includes both charity and self-pay patients.