

Hypertensive Urgency: An Emergency Department Pipeline to Primary Care Pilot Study

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BACKGROUND

Optimal triage of patients with hypertensive urgency (HU) in the emergency department (ED) is not well established. 2017 ACC/AHA hypertension (HTN) guidelines recommend treatment initiation and follow-up within 1 week. Objectives of our pilot study were to evaluate feasibility and impact of directly connecting ED patients with HU to outpatient HTN management on blood pressure (BP) control and ED utilization.

METHODS

ED patients with HU and no primary care physician were scheduled by a referral coordinator for an initial appointment in a HTN clinic embedded within a primary care practice. BP control and ED utilization over the subsequent 90 days were tracked and compared with BP at time of the referral ED visit, and ED utilization in the 90 days preceding referral.

RESULTS

Data are reported for the first 40 referred patients. Average time to first visit was 7.8 days. Mean age was 51 years (range 28–76), 75%

were African-American, and mean pooled 10-year atherosclerotic cardiovascular disease (ASCVD) risk was 20.8%. Mean BP declined from 198/116 mm Hg at ED visit to 167/98 mm Hg at HTN clinic visit 1 to 136/83 by 6 weeks and was sustained at 90 days. Total ED visits for the group decreased from 61 in the 90 days prior to referral, to 18 in the 90 days after the first HTN clinic visit.

CONCLUSIONS

In this pilot study, coordinated referral between the ED and primary care provides safe, timely care for this high ASCVD risk population and leads to sustained reductions in BP and ED utilization.

Keywords: blood pressure; cardiovascular risk; emergency department; hypertension; hypertensive urgency

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The incidence of hypertension (HTN) related emergency department (ED) visits is high and increased from 85 per 1,000 adult population per year in 2006 to about 110 per 1,000 adult population per year in 2012. Patients treated in the ED with a primary diagnosis of HTN are more likely to be younger, uninsured/underinsured, minority and with incomes in the lowest bracket.¹

Triage of patients with severely elevated blood pressure (BP) in the ED hinges on whether there is evidence of hypertensive emergency with impending or progressive target organ dysfunction (e.g., encephalopathy, intracerebral hemorrhage, acute coronary syndrome, acute heart failure, unstable angina, dissecting aortic aneurysm, or eclampsia in pregnant patients). The clinical diagnosis of hypertensive urgency (HU), on the other hand, has been applied to severely elevated BP ($\geq 180/110$ mm Hg) without acute target organ dysfunction. The prevalence of HU in the ED is estimated at 3%–5% of total ED visits.² Patients can be asymptomatic

or have associated symptoms such as headache, dyspnea, epistaxis, chest pain, or anxiety. Contrary to hypertensive emergency, hospital admission and emergent BP reduction are rarely indicated.

The American College of Emergency Physicians guidelines emphasize outpatient follow-up for patients presenting to the ED with HU.³ Previous JNC recommendations advise that “patients should not leave the ED without a confirmed follow-up visit within several days.”⁴ The more recent ACC/AHA 2017 Hypertension guidelines recommend that for adults with a very high BP (e.g., systolic BP ≥ 180 mm Hg or diastolic BP ≥ 110 mm Hg), evaluation followed by prompt antihypertensive drug treatment should occur within 1 week.⁵ Despite these recommendations, in some studies less than 25% of ED patients with severely elevated BP are instructed to follow-up as an outpatient.^{6,7} Health disparity populations make up a rising proportion of HTN-related ED visits at safety net hospitals, and are more likely to use EDs

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for primary care.¹ However, those who use the ED for their primary care needs still underutilize outpatient primary care services, even with a referral.⁸

An effective intervention that improves BP control and decreases ED utilization must be multifaceted with a focus on improving access to primary care. A potentially essential component is the use of collaborators in the ED that can help patients navigate an increasingly complicated health-care system to ensure a referral leads to timely outpatient follow-up.⁹ Resident physician clinics represent an opportunity to help care for this at-risk population by providing both chronic disease management and access to primary care.

We sought to address these challenges by introducing a referral mechanism into the ED discharge process and utilizing a referral coordinator embedded in the ED to coordinate a timely appointment.

The objectives of this pilot study were to create a streamlined process for connecting patients found to have HU in the ED with outpatient HTN management in a primary care teaching clinic setting and to evaluate the feasibility and impact of this pipeline referral process on BP control and ED utilization.

METHODS

This prospective cohort pilot study was conducted at Yale New Haven Hospital, a 1,500 bed urban academic medical center with over 100,000 annual ED visits, serving a large uninsured and underinsured population. The Yale University IRB reviewed and exempted this study. Timeframe of this study was September 2017–September 2018. Patients presenting to the ED with any chief concern found to have HU (systolic BP ≥ 180 mm Hg and/or diastolic BP ≥ 110 mm Hg on any BP measurement without evidence of acute target organ dysfunction), who did not have a primary care physician (PCP) or who were patients of the resident physician primary care clinic were eligible. Patients were excluded if they had a PCP elsewhere, had an appointment already scheduled within 1 week, or were on dialysis. Referrals were limited to 2 patients per week.

At the start of the study, the authors sent an email detailing the objectives of the study to the ED physician directors, who then subsequently informed the other ED providers at a faculty meeting. ED providers were asked to treat patients as they saw appropriate, but were informed that a referral to a HTN clinic visit could be facilitated by the ED referral coordinator by utilizing a button added to the electronic medical record in the ED discharge workflow. The ED referral coordinator facilitated HTN clinic appointment scheduling at the point of care or by telephone with the patient the next day. The goal was a scheduled visit within 10 days.

The HTN clinic is embedded within the hospital sponsored resident physician primary care practice and is staffed by a HTN specialist and chief medical resident supervising internal medicine residents. At the start of their rotations, the residents are trained on how to take proper manual BPs using AHA guidelines.

Patients were seen, and typically had 3 HTN clinic visits within a 6-week span (i.e., HTN V1, HTN V2, and HTN V3). If a patient did not have a PCP, the resident physician leading

the first clinic visit became their PCP. After achieving BP control, patients were set up to see their newly established PCP for primary care. Other primary care issues, especially those chief concerns contributing to the ED visit, were also addressed.

BP measurement in the ED was performed using standardized automated BP machines per ED protocol. BP measurements in the HTN clinic were collected manually by the resident physician using proper AHA technique. If there were concerning discrepancies in BP measurements, the BP was measured again by the attending physician. A flow diagram of the process used in this pilot study can be found in [Figure 1](#).

Baseline lab data including lipid panel, electrolytes, blood urea nitrogen, creatinine, spot urine albumin/creatinine ratio, and an electrocardiogram were collected at HTN V1. Using input variables from HTN V1 and the American College of Cardiology (ACC) atherosclerotic cardiovascular disease (ASCVD) risk estimator, the mean 10-year ASCVD risk was calculated for patients aged 40–79 years.¹⁰ ED utilization in the 90 days before and after the intervention was measured. Not all patients attended all the scheduled clinic visits. A last observed carry forward approach was used in calculating mean BP at each visit. Subsequent ED visits were counted even if patients were lost to follow-up. A paired *T*-test was used to compare the mean number of ED visits per patient in the 90-day period before and after HTN V1.

RESULTS

Of the first 47 patients referred to the HTN clinic, 40 (85%) attended HTN V1. Data are reported for this group. Mean age of patients was 51 years ± 12 with a range from 28 to 76 years. Fifty percent of the patients were female, and the majority identified as African-American (75%). Most of the patients had no PCP (75%). 52.5% of patients had Medicaid insurance, 17.5% were uninsured/self-pay, 2.5% had Medicare, and the remaining 27.5% had a mix of other commercial insurance plans.

HTN was the most common ED presenting chief concern (10/40). This included patients referred to the ED by their outpatient provider, as well as those self-referred because of concern for uncontrolled HTN. However, there was also a wide range of presenting concerns where HTN was an incidental finding including: headache (6), musculoskeletal pain (4), gout (3), abdominal pain (3), dyspnea (3), lightheadedness (2), cough (2), anxiety (1), epistaxis (1), chest pain (1), eye pain (1), dental problem (1), insect bite (1), and hematuria (1).

Average and range systolic and diastolic BP at time of assessment in the ED, and HTN management in the ED are shown in [Table 1](#). Mean time to first HTN clinic visit (HTN V1) was 7.8 \pm 5.9 days. Cardiovascular comorbidities and target organ dysfunction status at time of first HTN clinic visit are also shown in [Table 1](#). Two patients were diagnosed with primary aldosteronism, and 1 patient with renal artery stenosis. The mean 10-year ASCVD risk was 20.8 \pm 9.3% for the patients aged 40–79 years.

[Figure 2](#) shows change in BP from initial ED visit to each of the subsequent HTN clinic visits to 90 days after HTN V1.

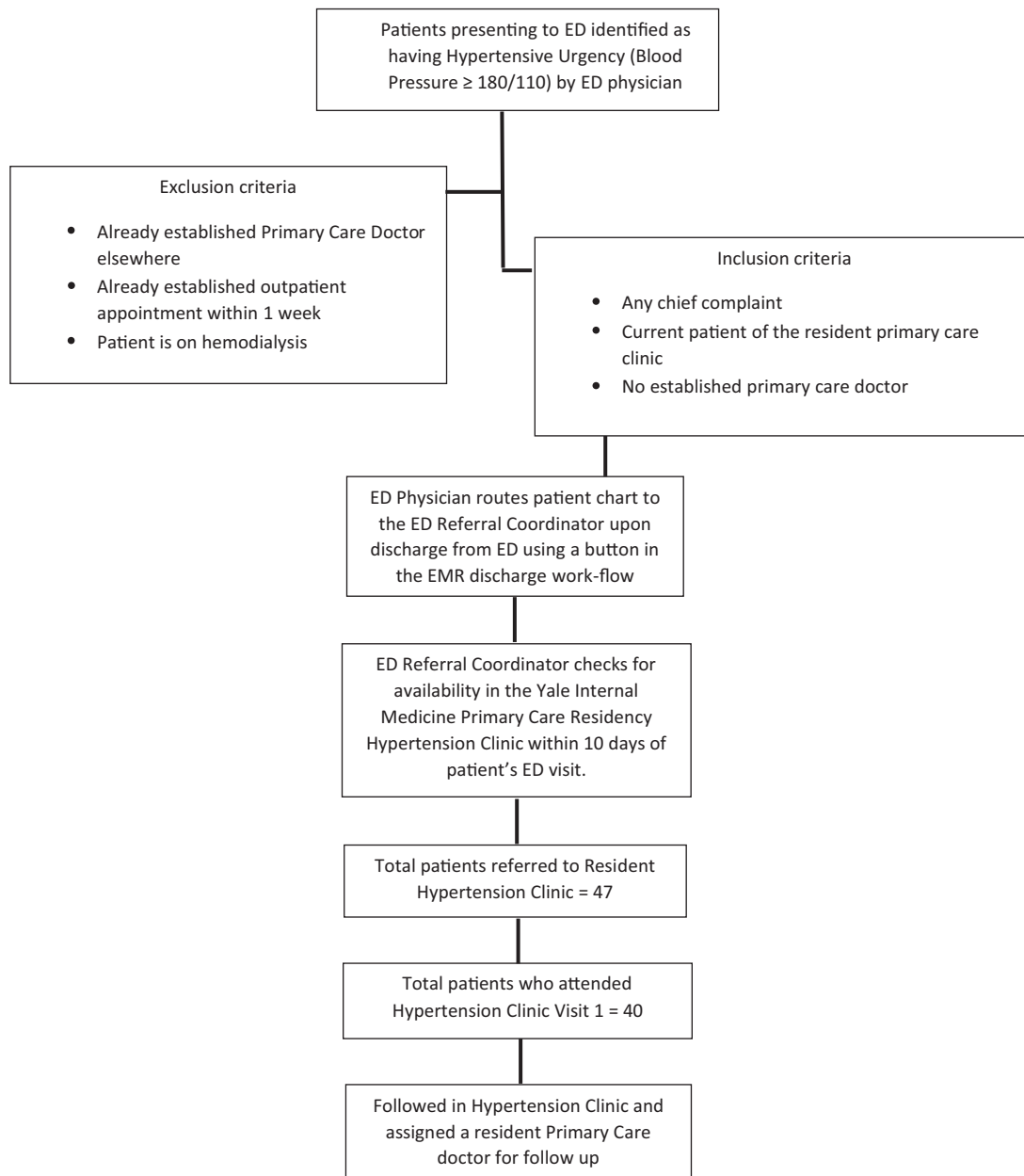


Figure 1. Flow diagram of emergency department pipeline to primary care pilot study process. Abbreviation: EMR, electronic medical record.

At 90 days, mean BP was $134/82 \pm 19/10$ mm Hg, statistically significantly lower than upon referral and as compared with HTN V1. Mean number of antihypertensive medications per patient at 90 days post HTN V1 was 2.5.

Figure 3 illustrates that ED utilization decreased in the 90 days after HTN V1. The estimation for paired difference was -1.08 (SD 1.41, 99% confidence interval $-1.56, -0.59$, P value <0.05).

DISCUSSION

The clinical utility of the diagnosis of HU has been questioned with a worthwhile argument being that asymptomatic patients are unlikely to be acutely ill.¹¹ Notably,

sending patients with asymptomatic HU to the ED is ineffective at reducing major adverse cardiovascular events or controlling BP.² There is a low incidence of poor short-term outcomes, so immediate BP reduction is rarely necessary and hospital admission comes at a high cost and low yield. However, there is a known association between HU and subsequent cardiovascular events¹² including an increased risk for hospitalization for congestive heart failure following an ED visit with elevated BP compared with normotension.¹³

Patients treated in the ED with HU represent a high ASCVD risk population and many lack access to primary care, are underinsured/uninsured, and are members of self-identified minority groups. We have demonstrated that a streamlined referral collaboration between the ED and a

Table 1. Patient referral data and comorbidities as assessed at first clinic visit ($n = 40$)

	Mean	SD	Range
Referral systolic blood pressure	198	24	145–257
Referral diastolic blood pressure	116	18	72–154
Discharged with a medication change	27.5%	—	—
Discharged with any antihypertensive	37.5%	—	—
Supply of antihypertensive prescribed	18 days	—	0–35
Number of days from ED to HTN V1	7.8	5.9	1–25
Known diagnosis of hypertension	82.5%	—	—
Previously prescribed an antihypertensive	77.5%	—	—
History of an ASCVD event	15.0%	—	—
Left ventricular hypertrophy by EKG	50.0%	—	—
Albuminuria (>30 mg/g)	20.0%	—	—
Chronic kidney disease (eGFR <60)	10.0%	—	—
Mean 10-year ASCVD pooled risk	20.8%	9.3	—

Abbreviations: ASCVD, atherosclerotic cardiovascular disease; ED, emergency department; eGFR, estimated glomerular filtration rate; EKG, electrocardiogram; HTN, hypertension.

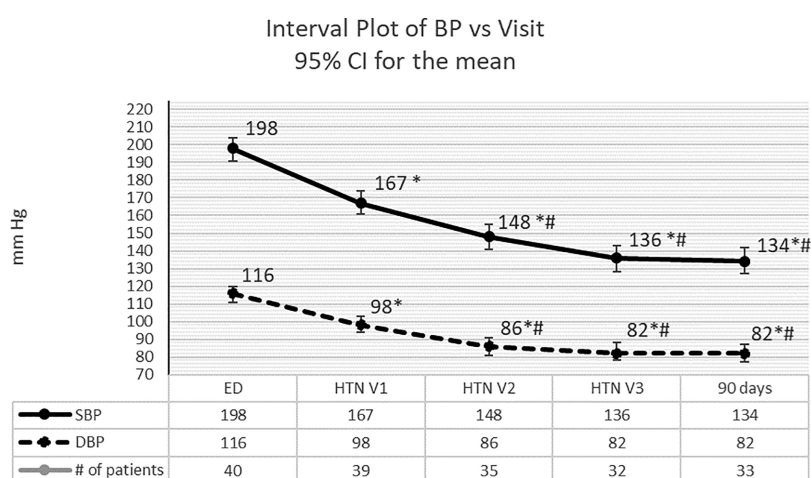


Figure 2. Interval plot of mean systolic and diastolic blood pressure in mm Hg by visit. A repeated measures analysis of variance was used to compare patients' blood pressures over time. * $P < 0.05$ compared with emergency department visit. # $P < 0.05$ compared with hypertension clinic visit number 1. Abbreviation: CI, confidence interval.

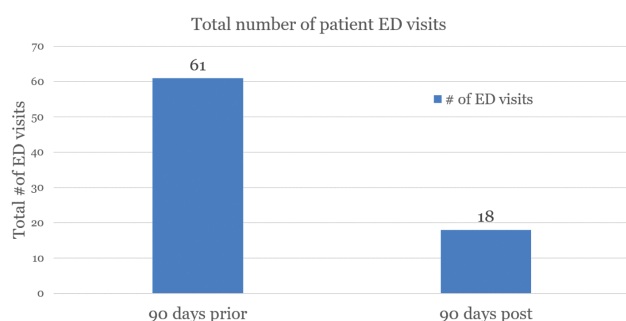


Figure 3. Total number of patient emergency department visits in the 90 days before hypertension clinic visit 1 and the 90 days after the intervention.

primary care teaching clinic can provide safe, timely care for these patients, and can lead to significant and sustained reductions in BP and ED utilization.

We believe that the role of the ED referral coordinator in engaging patients and directly scheduling a timely initial HTN clinic appointment (on average 7.8 days from ED visit) was a key success factor for this pilot study. Previous studies have found that close follow-up after ED discharge for HU is associated with increased adherence to medication. The odds of taking a medication to treat HTN were higher for patients who obtained follow-up within 1 week of presentation to the ED compared with those who did not receive care within 30 days. The odds for taking antihypertensives were still higher in those that followed up within 30 days

compared with those that did not.¹⁴ Additionally, access to our HTN clinic embedded within our resident physician primary care clinic provided opportunity to address important factors including focused attention on both HTN and the common primary care concerns that brought patients to the ED, as well as the ability to see patients every 1–2 weeks until BP was near target.

Our study has several limitations. We cannot confirm that ED BP measurements were accurate, and it is possible that some patients may have been excluded from our study or found to have controlled HTN if BP was measured in a less stressful environment. However, only 2 patients had BP at goal at HTN V1 (both of whom were taking antihypertensive medications), most had stage 2 HTN at HTN V1, and several still met criteria for HU. Our data indicate that though BPs were on average lower at follow-up outpatient visits, they remained significantly elevated above goal. The difference in BP between the ED visit and HTN V1 is likely due to a combination of improved adherence after gaining new prescriptions and less confounded BP measurements. Although the physicians obtaining manual BP in the clinic were trained to do so with technique consistent with guideline recommendations, there may still be intraindividual variability. Many patients in our study did not have access to home BP monitors so there may be a subset of patients with white coat hypertension or masked hypertension who were misclassified. Lastly, patients may have used an ED outside our health system that uses a different electronic medical record, resulting in undercounting the number of ED visits.

Ensuring referral and timely follow-up for patients with severely elevated BPs in the ED is a worthy endeavor. In the current system, and especially for the underserved, there are significant barriers to meeting guideline recommendations for follow-up and treatment initiation within 1 week. Meeting this challenge represents an opportunity to implement prevention strategies for a population at high cardiovascular risk. This pilot study concludes that introducing a referral mechanism into the ED electronic medical record discharge process, utilizing an ED referral coordinator to assist in the role of a patient navigator, and utilizing a HTN clinic embedded in a resident physician primary care clinic is both feasible and can result in timely follow-up appointments, improved BP control rates and reduced ED utilization.

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DISCLOSURE

The authors declared no conflict of interest.

REFERENCES

- 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; 116:1717–1723.
- Patel KK, Young L, Howell EH, Hu B, Rutecki G, Thomas G, Rothberg MB. Characteristics and outcomes of patients presenting with hypertensive urgency in the office setting. *JAMA Intern Med* 2016; 176:981–988.
- Wolf SJ, Lo B, Shih RD, Smith MD, Fesmire FM; American College of Emergency Physicians Clinical Policies Committee. Clinical policy: critical issues in the evaluation and management of adult patients in the emergency department with asymptomatic elevated blood pressure. *Ann Emerg Med* 2013; 62:59–68.
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report. *JAMA* 2003; 289:2560–2572.
- Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbigele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. 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: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension* 2018; 71:1269–1324.
- Baumann BM, Abate NL, Cowan RM, Chansky ME, Rosa K, Boudreaux ED. Characteristics and referral of emergency department patients with elevated blood pressure. *Acad Emerg Med* 2007; 14:779–784.
- 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. *Am J Hypertens* 2009; 22:604–610.
- Wexler R, Hefner JL, Sieck C, Taylor CA, Lehman J, Panchal AR, Aldrich A, McAlearney AS. Connecting emergency department patients to primary care. *J Am Board Fam Med* 2015; 28:722–732.
- Brody A, Janke A, Sharma V, Levy P. Public health, hypertension, and the emergency department. *Curr Hypertens Rep* 2016; 18:50.
- Lloyd-Jones DM, Braun LT, Ndumele CE, Smith SC Jr, Sperling LS, Virani SS, Blumenthal RS. Use of risk assessment tools to guide decision-making in the primary prevention of atherosclerotic cardiovascular disease: a special report from the American Heart Association and American College of Cardiology. *J Am Coll Cardiol* 2019; 73:3153–3167.
- Heath I. Hypertensive urgency—is this a useful diagnosis? *JAMA Intern Med* 2016; 176:988–989.
- Vlcek M, Bur A, Woisetschlager C, Herkner H, Laggner AN, Hirschl MM. Association between hypertensive urgencies and subsequent cardiovascular events in patients with hypertension. *J Hypertens* 2008; 26:657–662.
- Ayalon-Dangur I, Rudman Y, Shochat T, Shiber S, Grossman A. Elevated blood pressure during emergency departments visit is associated with increased rate of hospitalization for heart failure: a retrospective cohort study. *J Clin Hypertens (Greenwich)* 2018; 20:98–103.
- Cho DD, Austin PC, Atzema CL. Management of discharged emergency department patients with a primary diagnosis of hypertension: a multicentre study. *CJEM* 2015; 17:523–531.