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ORIGINAL RESEARCH

Cardiology

Antihypertensive prescription is associated with improved 30-day outcomes for discharged hypertensive emergency department patients

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Abstract

Background: Hypertension (HTN) is common in discharged emergency department (ED) patients, yet the short-term outcomes of treating HTN at ED discharge are unclear. This study aimed to investigate whether emergency physician (EP) prescription of oral antihypertensive therapy at ED discharge for hypertensive patients is associated with a decreased 30-day risk of the severe adverse events (AEs), death, and revisits to the ED.

Methods: We conducted an observational cohort study assessing the 30-day outcomes of discharged ED patients with HTN, comparing outcomes based on whether antihypertensive therapy was prescribed. All discharged adult ED patients from an eight-hospital system with a diagnosis of HTN from January 2016 to February 2020 were screened, and consisted of a mix of suburban and urban patients with broad ethnic and socioeconomic backgrounds. Patients were categorized into the treatment group if they received a prescription for antihypertensive medication at ED discharge. The primary outcome was severe composite AEs from HTN (aortic catastrophe, heart failure, myocardial infarction, hemorrhagic and ischemic stroke, or hypertensive encephalopathy) within 30 days of ED discharge. The secondary outcomes were death or ED revisit over the same period.

Results: The study sample consisted of 93,512 ED visits; 57.5% were female, and mean age was 59.3 years. 4.7% of patients were prescribed antihypertensive treatment at ED discharge. Within 30 days, 0.7% of patients experienced an AE, 0.1% died, and 15.2% had an ED revisit. The treatment group had significantly lower odds of AE (adjusted odds ratio [aOR]: 0.224, 95%CI 0.106–0.416, $p < 0.001$), and ED revisits (aOR: 0.610, 95%CI 0.547–0.678, $p < 0.001$), adjusting for age, race, degree of HTN, ED treatment for elevated HTN, Elixhauser comorbidity index, and heart failure history. There was no difference in odds of death 30 days after discharge.

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Conclusion and relevance: Prescription antihypertensive therapy for discharged ED patients is associated with a 30-day decrease in severe adverse events and ED revisit rate.

1 | INTRODUCTION

1.1 | Background

Hypertension (HTN) is one of the most common findings observed in emergency department (ED) patients, with an enormous burden of over 900,000 annual ED visits[1] in the United States presenting for elevated blood pressure (BP), and visits are increasing by as much as 5.2% per year.[2] Additionally, up to one third of ED patients with elevated BP have no prior history of HTN.[3] It is important that emergency physicians (EPs) optimally manage and ensure outpatient follow up for this patient population due to an increased risk of poor outcomes including myocardial infarction, stroke, heart failure, renal failure, and death.[4,5] In addition to an increased risk of adverse events (AEs), hypertensive patients have a high rate of short-term revisit to the ED.[5] The risk of these AEs can be reduced with adequate long-term BP control, making the ED an environment with the potential to improve outcomes for hypertensive patients.[6]

1.2 | Importance

There are limited data or guidance regarding the optimal management of discharged ED patients with elevated BP. Current guidelines leave the decision to initiate discharge antihypertensive treatment to the discretion of the EP.[7] However, EPs frequently do not initiate antihypertensive therapy for this population,[8] despite evidence that initiation of oral antihypertensive therapy from the ED is safe and efficacious for short-term BP control in populations at high risk for HTN complications.[9] Thus, an improved understanding of short-term outcomes of hypertensive patients could provide guidance to EPs when deciding whether to prescribe oral antihypertensive therapy upon discharge.

1.3 | Goals of this investigation

This study aimed to investigate whether EP prescription of oral antihypertensive therapy on ED discharge for untreated hypertensive patients is associated with a decreased 30-day risk of the severe AEs, death, and revisits to ED.

2 | METHODS

2.1 | Study design, setting, and participants

We conducted a multicentered observational cohort study of discharged ED patients with elevated BP, not currently being treated for HTN, to determine if severe AEs are reduced within 30 days of ED discharge by the initiation of antihypertensive therapy. We also aimed to assess the effect of discharge initiation of antihypertensive therapy on 30-day risk of death and revisit to the ED.

The study was conducted at a large hospital system in the metro-Detroit region of Michigan. The hospital system is composed of eight hospitals and EDs, seven of which are community EDs, and one of which is a tertiary care, academic level 1 trauma center, with a combined 574,591 ED visits in 2019. The population is a mix of suburban and urban patients, with broad ethnic and socioeconomic backgrounds. The study was approved by the Institutional Review Board. Written informed consent requirement was waived due to the retrospective nature of the investigation.

We included all adult (≥18 years old) patients seen and discharged from an ED within the hospital system with a primary or secondary ED discharge diagnosis of Essential (primary) Hypertension and Hypertensive Urgency (ICD 10 codes I10 and I16.–0 respectively), without prior treatment for HTN during the previous 18 months. We categorized maximum ED BP into the ranges of between 140/90 mm Hg and 180/120 and ≥180/120 mm Hg, based on the American College of Cardiology/American Heart Association (ACA/AHA) 2017 guidelines.[10] We excluded patients admitted to the hospital, admitted to an ED observation area, those who died in the ED, patients without a documented elevation of BP in the ED (BP < 140/90), pregnancy, an ED stay greater than 48 h, patients prescribed an antihypertensive medication within 18 months preceding the ED visit, if an AE was present at ED discharge, and if there was missing gender or race data. The decision to exclude patients prescribed antihypertensive treatment 18 months prior to the ED visits was made to ensure that we investigated a cohort that was untreated for elevated BP, and this was accomplished through review of the electronic medical record (EMR). We followed patients for 30 days after ED discharge, and if they received an antihypertensive prescription during that post-ED visit period, we stopped the follow up to avoid the confounding effect of antihypertensive prescription on AE after discharge.

2.2 | Data source

Data were obtained from the integrated EMR (Epic Systems, Verona, Wisconsin). The database was queried from the dates of January 1, 2016 to February 29, 2020, to identify the study cohort of discharged hypertensive patients. The starting date reflects when records were first available in the EMR from the hospital system, and the end date was chosen to avoid confounding by COVID-19 patient volume changes experienced by the hospital system.

We extracted data on the following variables from the EMR for the ED visit: age, sex, race, maximum systolic and maximum diastolic BP during ED visit, BP treatment while in the ED, discharge ED antihypertensive prescriptions, and prescription of antihypertensive in the 18-months before ED visit, and within 30 days after ED discharge. Antihypertensive medications were defined in all situations as beta blockers, calcium channel blockers, angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, direct acting vasodilators, alpha-2 receptor agonists, and diuretics. EMR comorbidity data were utilized to calculate a Elixhauser Comorbidity Index for each patient. Finally, the cohort was analyzed to identify ED revisits, AEs, and deaths within 30 days. AEs were identified using ICD-10 corresponding to acute aortic catastrophes, acute heart failure, myocardial infarction, stroke (both ischemic and hemorrhagic), and hypertensive encephalopathy.

2.3 | Outcome measures

Primary outcome measures were AEs within 30 days of ED discharge, and secondary outcomes were death and ED revisit within 30 days of ED discharge. AEs were defined as acute aortic catastrophes (aortic dissection and aortic aneurysm rupture), acute heart failure, hemorrhagic stroke, ischemic stroke, hypertensive encephalopathy, myocardial infarction, and death. Thirty days was chosen as a reasonable time frame for most US patients to follow up with a primary care physician for continued management of their HTN and is consistent with previously reported follow-up times.[4]

2.4 | Statistical analysis

Descriptive analysis was used to summarize patient characteristics by medication groups. Continuous variables were reported as means with standard deviations and compared using the Kruskal–Wallis test. Categorical variables were expressed as frequencies and percentages and compared between medication groups using the Fisher's exact test.

Logistic regression was used to assess the effects of discharge antihypertensive medication in reducing AEs and ED revisits after adjusting for age, sex, race, HTN stage, ED treatment of HTN before discharge, Elixhauser comorbidity index, and history of heart failure 18 months before ED visit. Additionally, inverse probability weighted (IPW) logistic regression method was used to estimate the average treatment effects. Logistic regression was used to generate a propensity score for each patient, which was then applied in the IPW regression to balance covariates of age, sex, race, HTN stage, ED treatment of HTN before discharge, Elixhauser comorbidity index, and history of heart failure 18 months before ED visit. The balances were examined through the standardized mean difference (Figure S1).

Odds ratio (OR) was reported with 95% confidence interval (CI) and *p*-value for all logistic regressions. All tests of statistical significance were two-sided with $p < 0.05$. Analysis was performed using R-4.2.1 (R Foundation for Statistical Computing).

The Bottom Line

This observational cohort study aimed to compare the short-term rates of severe adverse events (aortic catastrophe, heart failure, myocardial infarction, hemorrhagic and ischemic stroke, or hypertensive encephalopathy) and emergency department revisits in hypertensive ED patients discharged with an antihypertensive prescription, and those not receiving a prescription.

3 | RESULTS

3.1 | Baseline characteristics of the study population

A total of 267,062 discharged ED patients with a discharge diagnosis of HTN were identified across the hospital system from January 1, 2016 to February 29, 2020. After exclusion criteria were applied, 93,512 patients remained in the study cohort. The mean age of the cohort was 59.3 years and 39,938 (42.7%) were male (Table 1). The racial composition of the cohort was 55,040 (58.9%) white, 34,279 (36.7%) Black, and 4193 (4.5%) of another race. Of this population, 77,812 (83.2%) had BPs in the range between 140/90 and 180/120 mm Hg, and the remaining 15,700 (16.8%) had severely elevated BPs (≥180/120 mm Hg). Prior to discharge, 9442 (10.1%) of patients received antihypertensive treatment, while in the ED, a further 4435 (4.7%) of patients received antihypertensive prescription upon ED discharge, and 4458 (4.8%) patients were prescribed antihypertensive therapy from another medical professional within 30 days after ED discharge. The distribution of patients receiving antihypertensive treatment in the ED, at ED discharge, and within 30 days of ED discharge is illustrated in Figure S2.

Patients receiving antihypertensive prescriptions at ED discharge were significantly more likely to be younger, male, Black, have higher systolic and diastolic BPs, have a lower burden of comorbidity (lower Elixhauser comorbidity indices), and have received antihypertensive treatment in the ED before discharge. This group was also less likely to have a recent diagnosis of heart failure. Finally, they were more likely to receive antihypertensive prescription from another medical professional within 30 days of ED discharge.

3.2 | Comparison of outcomes between groups

In our study cohort of 93,512 patients, 660 (0.7%) patients experienced one or more AEs within 30 days of ED discharge (Table 2). These AEs were comprised of 13 (<0.1%) aortic catastrophes, 422 (0.5%), acute heart failure cases, 19 (<0.1% hypertensive encephalopathy cases, 42 hemorrhagic strokes (<0.1%), 111 ischemic strokes (0.1%), and 107 (0.1%) myocardial infarctions.

TABLE 1 Population characteristics.

	All	Discharge antihypertensive prescription		*p* Value
		No	Yes	
N	93,512	89,077 (96.3%)	4435 (4.7%)	
Age, years				<0.001[a]
Mean (SD)	59.3 (16.6)	59.6 (16.6)	52.2 (14.7)	
Sex				<0.001[b]
Female	53,574 (57.3%)	51,251 (57.5%)	2323 (52.4%)	
Male	39,938 (42.7%)	37,826 (42.5%)	2112 (47.6%)	
Race				<0.001[b]
White or Caucasian	55,040 (58.9%)	53,116 (59.6%)	1924 (43.4%)	
Black or African American	34,279 (36.7%)	31,977 (35.9%)	2302 (51.9%)	
Other	4193 (4.5%)	3984 (4.5%)	209 (4.7%)	
SBP[c], mmHg				<0.001[a]
Mean (SD)	161.6 (20.2)	160.7 (19·4)	181.0 (25.4)	
DBP[c], mmHg				<0.001[a]
Mean (SD)	89.4 (13.6)	88.7 (13.1)	103.8 (16.0)	
Hypertension range (mm Hg)				<0.001[b]
140/90–180/120	77,812 (83.2%)	75,534 (84.8%)	2278 (51.4%)	
≥ 180/120	15,700 (16.8%)	13,543 (15.2%)	2157 (48.6%)	
Elixhauser comorbidity index				<0.001[a]
Mean (SD)	0.2 (3.4)	0.2 (3.5)	-0.3 (2.3)	
Heart failure history 18 months prior to ED visit				0.003[b]
No	93,148 (99.6%)	88,719 (99.6%)	4429 (99.9%)	
Yes	364 (0.4%)	358 (0.4%)	6 (0.1%)	
Antihypertensive treatment in ED prior to discharge				<0.001[b]
No	84,070 (89.9%)	82,529 (92.6%)	1541 (34.7%)	
Yes	9442 (10.1%)	6548 (7.4%)	2894 (65.3%)	
Antihypertensive treatment 30 days after ED discharge				<0.001[b]
No	89,054 (95.2%)	85,301 (95.8%)	3753 (84.6%)	
Yes	4458 (4.8%)	3776 (4.2%)	682 (15.4%)	
Acute aortic catastrophe				1.000[b]
No	93,499 (100.0%)	89,064 (100.0%)	4435 (100.0%)	
Yes	13 (<0.1%)	13 (<0.1%)	0 (0.0%)	
Acute heart failure				<0.001[b]
No	93,090 (99.5%)	88,659 (99.5%)	4431 (99.9%)	
Yes	422 (0.5%)	418 (0.5%)	4 (0.1%)	
Myocardial infarction				0.066[b]
No	93,405 (99.9%)	88,971 (99.9%)	4434 (100.0%)	
Yes	107 (0.1%)	106 (0.1%)	1 (<0.1%)	
Hemorrhagic stroke				0.723[b]
No	93,470 (100.0%)	89,036 (100.0%)	4434 (100.0%)	
Yes	42 (<0.1%)	41 (<0.1%)	1 (<0.1%)	
Ischemic stroke				0.822[b]
No	93,401 (99.9%)	88,970 (99.9%)	4431 (99.9%)	
Yes	111 (0.1%)	107 (0.1%)	4 (0.1%)	

(Continues)

TABLE 1 (Continued)

	All	Discharge antihypertensive prescription		*p* Value
		No	Yes	
Hypertensive encephalopathy				1.000[b]
No	93,493 (100.0%)	89,058 (100.0%)	4435 (100.0%)	
Yes	19 (< 0.1%)	19 (< 0.1%)	0 (0.0%)	

Abbreviations: DBP, diastolic blood pressure; ED, emergency department; SD, standard deviation; SBP, systolic blood pressure.
[a]Kruskal–Wallis rank sum test.
[b]Fisher's exact test.
[c]SBP and DBP were the documented highest measures at index ED visit.

TABLE 2 30-Day patient outcomes.

30-Day outcomes[a]	All	Discharge antihypertensive prescription[b]			Adjusted OR[c] (prescribed vs. not)			
		No	Yes	*p* Value	OR	Lower bound	Upper bound	*p* Value
N	93,512	89,077	4435					
Severe adverse events	660 (0.7%)	651 (0.7%)	9 (0.2%)	<0.01	0.22	0.11	0.42	<0.01
All-cause death	110 (0.1%)	105 (0.1%)	5 (0.1%)	1.00	1.45	0.48	3.58	0.47
ED revisit	14,208 (15.2%)	13,765 (15.5%)	443 (10.0%)	<0.01	0.61	0.55	0.68	<0.01

Abbreviations: ED, emergency department; OR, odds ratio.
[a]Observed frequencies (percentages) were presented.
[b]Comparison done using Fisher's exact test.
[c]Adjusted odds ratios along with 95% confidence intervals for comparing prescription versus no-prescription (reference) were estimated by multivariable logistic regression, adjusting for age, sex, race, hypertension stage, antihypertensive treatment at ED before discharge, Elixhauser comorbidity index, heart failure history 18 months before ED visit.

Of the 660 patients experiencing AEs, nine AEs were observed in the cohort prescribed antihypertensive therapy compared with 651 AEs in the nontreatment group. After multivariable logistic regression, adjusting for age, sex, race, HTN stage, ED treatment of HTN before discharge, Elixhauser comorbidity index, and history of heart failure 18 months before ED visit, the odds of AE in the population receiving antihypertensive prescriptions on ED discharge (0.2%) was significantly lower than in the untreated population (0.7%) (adjusted OR, 0.224 [95% CI, 0.106–0.416], $p < 0.001$) (Table 2). Results remained the same using IPW analysis (adjusted OR, 0.066 [95% CI, 0.030–0.146], $p < 0.001$). The number needed to treat (NNT) to prevent one AE was 183 (95% CI 161–247) (Table S1). Covariates were well balanced between the two groups (Figure S2). The lower odds of AE in the treatment group were observed in both the lower range group (BP 140/90–180/120 mm Hg) (adjusted OR, 0.15 [95% CI, 0.02–0.47], $p < 0.01$) and severely elevated (≥180/120 mm Hg) (adjusted OR, 0.25 [95% CI, 0.10–0.50], $p < 0.001$) cohorts (Table 3). Antihypertensive medication classes for medications given in the ED and prescribed on ED discharge are listed in Table S2.

Upon evaluation of specific AEs, antihypertensive therapy was associated with a decreased odds of acute heart failure (adjusted OR, 0.183, [95% CI, 0.056–0.441], $p < 0.001$). There were nonsignificant decreases in the odds of acute aortic catastrophe, hemorrhagic stroke, ischemic stroke, hypertensive encephalopathy, and myocardial infarction (Table 2).

There were 110 (0.1%) patients who died in the cohort within 30 days of ED discharge, with no observed difference in treatment ($n = 5$, 0.1%) group and control group ($n = 105$, 0.1%) (adjusted OR, 1.445 [95% CI, 0.476–3.583], $p = 0.467$). Additionally, there was no difference in all cause death between the treatment and control groups based on degree of BP elevation (Table 3).

Overall, 14,208 (15.2%) discharged HTN patients revisited the ED within 30 days of discharge (Table 3), with 13,765 (15.5%) in the nontreatment group, and 443 (10.0%) in the treatment group (adjusted OR 0.610 [95%CI, 0.547–0.678], $p < 0.001$]. Results remained the same using the IPW method (adjusted OR 0.653 [95%CI, 0.551–0.773], $p < 0.001$). The NNT was 18 (95% CI 16–23) to prevent one return visit (Table S1). Lower odds of revisit were observed in both the 140/90–180/120 mm Hg (adjusted OR, 0.633 [95% CI, 0.546–0.731], $p < 0.001$) and ≥180/120 mm Hg (adjusted OR, 0.589 [95% CI, 0.501–0.691], $p < 0.001$) subgroups (Table 3).

4 | LIMITATIONS

This analysis has several limitations. It is limited by its retrospective nature and patient selection through the review of the EMR and data query, which could introduce selection bias and limit our ability to assess causality. For example, if a patient received the antihypertensive medication outside the health system, we would consider that patient

TABLE 3 30-Day patient outcomes by blood pressure range.

	Adjusted OR[a] (prescribed vs. not)			
30-Day outcomes	OR	Lower bound	Upper bound	*p* Value
BP 140/90–180/120 mm Hg				
Severe adverse events	0.15	0.02	0.47	<0.01
All-cause death	1.33	0.21	4.74	0.71
ED revisit	0.63	0.55	0.73	<0.01
BP ≥180/120 mm Hg				
Severe adverse events	0.25	0.10	0.50	<0.01
All-cause death	1.44	0.31	5.18	0.60
ED revisit	0.59	0.50	0.69	<0.01

Abbreviations: ED, emergency department; OR, odds ratio.

[a]Adjusted odds ratios along with 95% confidence intervals for comparing prescription versus no-prescription (reference) were estimated by multivariable logistic regression, adjusting for age, sex, race, antihypertensive treatment at ED before discharge, Elixhauser comorbidity index, heart failure history 18 months before ED visit.

as not taking the antihypertensive medication. Future prospective, randomized trials should aim to establish the benefit of treating HTN in ED discharged ED patients. The patient population we investigated was from a single healthcare system and regionally located in the SE Michigan area. However, our patient population is socioeconomically diverse and should approximate other large urban or suburban EDs. Generalizability may also be limited by the exclusion from our cohort, of patients already prescribed antihypertensive treatment or who may not be taking outpatient antihypertensive therapy as prescribed. There is also the possibility of patients representing to a different hospital system and were not captured in our data query. Deaths were obtained from regional databases and could have underestimated the number of deaths in our sample. We also did not evaluate which antihypertensive medications were prescribed, and it remains to be seen if certain classes of antihypertensive treatment are more or less effective in this population. Additionally, we did not obtain data on filling of the discharge prescriptions or patient compliance with the discharge prescriptions, and noncompliance with the prescriptions may affect our results. Patient characteristics such as ability to PCP access may have affect ED prescriptions rates and revisit rates to the ED. Finally, we are unable to discern the clinical thought process of treating EP or the socioeconomic factors that may influence these treatment decisions, and further prospective work is needed to better delineate those issues.

5 | DISCUSSION

In our large study cohort of patients discharged with a diagnosis of HTN, our results indicate that while EPs rarely prescribe antihypertensive therapy on discharge, patients who are discharged with antihypertensive therapy are at a decreased risk of severe AEs as well as a decreased risk of 30-day ED revisits. While the safety of prescribing antihypertensives to ED patients has been demonstrated, to our knowledge, no prior study has demonstrated improved short-term outcomes in this population.[2,4,6,9]

The low rate (4.7%) of patients prescribed antihypertensive therapy in our study is less than the rate observed in prior studies, which range from 6 to 35%.[8,9] Antihypertensive medication was more likely to be prescribed to patients in a younger cohort, to black patients, and to males. It may be reasonably concluded that these populations are deemed by EPs to be less likely to have secure short-term primary care follow up in which to initiate antihypertensive therapy, prompting the prescription on ED discharge. Additionally, the younger cohort and cohort with a lower comorbidity burden may also be assessed as lower risk of complication from antihypertensive treatment (e.g., syncope or stroke), thus easing the comfort of EPs initiating treatment. Patients with higher BPs were also more likely to receive prescription antihypertensive therapy, which may reflect a clinical suspicion that these patients are at higher risk of a poor outcome. The benefits of antihypertensive therapy observed in our data indicate that, in fact, initiation of antihypertensive therapy should be considered for adult ED patients with elevated BP regardless of ethnicity, age, or comorbidity burden.

Notably, recipients of antihypertensive prescriptions had 78% lower odds of severe complications from HTN with benefit noted in the subgroups of patients with milder BP elevations (between 140/90 and 180/120 mm Hg) and severely elevated BP (≥180/120 mm Hg). This indicates that EPs should consider initiating antihypertensive therapy at ED discharge to all patients with elevated BP, regardless of degree of BP elevation as the treatment effect of lowering AEs within 30 days was observed in all BP ranges. Our observed rate of 0.7% 30-day rate of severe AEs is consistent with prior studies demonstrating a relatively low rate of short-term severe AEs.[5,8,11] Nonetheless, while the absolute reduction of AEs from a rate of 0.7% in the untreated group to 0.2% in the treatment group is modest, treatment of HTN upon discharge from the ED appears to have the potential to improve public health outcomes if broadly applied, given the large number of patients seen in ED with elevated BP.

Mortality in our study population at 30 days was very low (0.10%), consistent with the low observed short-term mortality on other studies,[5,11] and treatment did not have a statistical benefit on mortality. This low mortality in both the treatment and no-treatment cohorts emphasizes the safety of initiation of antihypertensive treatment observed in other investigations.[2,4,6,9]

On review of specific AEs within 30 days, there was a significant decrease in heart failure, and although not statistically significant, there appeared to be reductions in myocardial infarction and ischemic stroke. Additionally, all cases of aortic catastrophe and hypertensive encephalopathy were observed in the no-treatment group, with none occurring in the group receiving antihypertensive treatment on ED discharge. This indicates that most of the AE reduction observed was due to decrease acute heart failure events. A larger study may have the power to conclusively detect any benefit of the short-term effects of hypertensive therapy on myocardial infarction, stroke, aortic catastrophe, and hypertensive encephalopathy.

Finally, we observed an overall 30-day ED revisit rate in our patient population was 15.2%, which is consistent with short-term ED return rates seen in other studies.[5,12–14] Patients that were discharged from the ED with antihypertensive therapy had 39% lower odds of revisiting the ED within 30 days of discharge. Our findings differ from a study done in Thailand, which did not demonstrate a decreased ED revisit rate for patients receiving antihypertensive treatment on ED discharge.[12] That study, however, was done in a different and much smaller patient population with a shorter time frame (1 day and 7 days) compared with our 30-day return. Our results indicate the potential to decrease unneeded revisits to the ED for a condition which is best managed over extended time periods in the outpatient setting. When considering the enormous number of ED visits for elevated BP, more liberal antihypertensive EP prescription could make a notable difference on ED volumes.

To our knowledge, our study is the first to demonstrate an association between prescription treatment for HTN in discharged ED patients and improved short-term patient outcomes.

We observed both lower odds of a severe AE (NNT of 183 to prevent one AE) as well ED revisits (NNT of 18 to prevent one revisit) in this large population of ED patients with elevated BP within a period after discharge. There has been a previously defined role for the EP in the screening, detection, and referral for continued management of patients with HTN[7]; however, the short-term benefits of treating this population have not been previously established. Our results indicate that there is an opportunity for EPs to improve patient outcomes for ED patients with elevated BP through the low-cost, and low-risk intervention of initiating antihypertensive therapy at ED discharge. Further research is needed to identify any patient subpopulations that might benefit from this intervention. Additionally, as HTN is a chronic disease, investigations of long-term outcomes of ED patients receiving HTN treatment would help to further clarify ED HTN management decisions.

In conclusion, in this large retrospective observational study, ED discharge prescription of antihypertensive therapy was associated with lower odds of an AE or ED revisit within 30 days of ED discharge.

AUTHOR CONTRIBUTIONS

B. T., A. N., A. B., L. Z., and S. W. conceived and designed the study. B. T., A. N., and L. E. performed the literature search. B. T. and L. Z. supervised the data collection. Y. X. and L. Z. provided statistical advice on study design and analyzed the data. All authors contributed to data interpretation. B. T. drafted the manuscript and all authors contributed substantially to its revision. B. T. takes responsibility for the paper as a whole.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to report.

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DATA AVAILABILITY STATEMENT

Not available.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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