



Hypertension Outcomes at a Student-Run Clinic for the Uninsured

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Published: June 4, 2015

Abstract

Background: Hypertension is a potent risk factor for cardiovascular disease in the uninsured. Medical student-run free clinics are increasingly managing chronic conditions like hypertension, but there are limited data addressing the quality of care such clinics provide. This study evaluates hypertension outcomes at the East Harlem Health Outreach Partnership (EHHOP), a student-run clinic affiliated with Mount Sinai School of Medicine, in comparison to publicly and privately insured populations.

Methods: A retrospective cohort analysis of EHHOP patients with hypertension (N=65) was performed. Results were compared to New York State Medicaid (N=10,117) and commercial insurance patients (N=7,669) with hypertension. The primary outcome measure was percent of patients controlled <140/90 mmHg. Secondary analyses in the EHHOP sample evaluated control below individual JNC 7 (Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure) goal, blood pressure trends, and factors associated with control.

Results: At their most recent visits, 57% of EHHOP, 58% of Medicaid, and 59% of commercial insurance patients were controlled <140/90 mmHg. In the EHHOP sample, 47.7% (31/65) of patients met their individual goal, including 35.7% (10/28) of diabetics. The mean change in blood pressure at EHHOP was -12.3 mmHg systolic (95% CI 5.7-18.9; $p<0.01$) and -6.8 mmHg diastolic (95% CI 2.9-10.5; $p<0.01$) over a mean follow-up of 16.2 months.

Conclusions: Though limited by small sample size, results suggest that hypertension control at EHHOP is equivalent to other care settings. Results also demonstrate that EHHOP patients with hypertension experience clinically meaningful reductions in blood pressure. The study supports student-run free clinics as a model for delivering quality healthcare to vulnerable populations.

Introduction

Hypertension affects one in three adults in the United States and represents a potent risk factor for stroke, coronary disease, and chronic kidney disease. Published hypertension control rates have improved over the last decade, approaching the Healthy People 2010 goal of 50% control nationwide.¹⁻⁶ Despite these apparent gains, the effects of uncontrolled hypertension remain devastating in communities with limited access to healthcare. Prior to the Affordable Care Act, 16% of the nation's 50 million hypertensive patients were

uninsured.⁷ Data show that uninsured patients with hypertension are less likely to receive adequate medical therapy and have control rates as low as 29%.^{4,7-13}

Healthcare reform promises to decrease numbers of uninsured across the country. However, uninsurance rates are likely to remain stagnant in communities where many residents are without legal status. East Harlem, a neighborhood of 108,000 in northeast Manhattan (New York, New York) is one such community. Heart disease is the leading cause of premature death in East Harlem, where heart disease hospitalizations are 80%

higher than in Manhattan overall and 45% higher than in New York City overall.¹⁴ Nearly one third of East Harlem residents carry a diagnosis of hypertension; the true prevalence may be higher given that one third of residents do not have a regular source of medical care.¹⁴

The East Harlem Health Outreach Partnership (EHHOP) is the medical student-run, physician-supervised free clinic of the Mount Sinai School of Medicine. EHHOP provides primary care to uninsured residents of East Harlem. Like many other safety-net practices, EHHOP is increasingly caring for chronic conditions, and hypertension is now the clinic's most common diagnosis.¹⁵⁻¹⁹

Student-run clinics such as EHHOP number over 200 and perform more than 37,000 collective patient visits per year.^{20,21} One barrier to continued growth and institutional support has been uncertainty about the quality of care that student-run clinics provide.^{22,23} Only recently have outcomes data from student-run clinics begun to emerge, and data on hypertension management in the student-run clinic setting remain limited.^{22,24-29}

In one of the only published analyses of hypertension outcomes at a student-run clinic, Zucker investigated blood pressure control among patients at the Student Family Health Care Center, the student-run clinic at Rutgers New Jersey Medical School (formerly the University of Medicine and Dentistry of New Jersey). Authors found that 50% of patients with hypertension were controlled ≤ 140 mmHg. Among hypertensive patients with diabetes, 26% were controlled ≤ 130 mmHg.²⁶ Smith and colleagues also investigated health outcomes among diabetics at three University of California, San Diego student-run free clinic sites. They found that 45% of diabetic patients were controlled $< 130/80$ mmHg.²⁷

The purpose of our study was to evaluate the quality of hypertension care at EHHOP by comparing EHHOP patient outcomes to published outcomes from New York State Medicaid and commercial insurance patients. Medicaid and privately insured patients were selected as control groups because EHHOP aims to provide excellent care that meets or exceeds standards in higher-resource settings. To our knowledge, this is the first study at a student-run clinic utilizing $< 140/90$ mmHg as the primary endpoint. At the time of data collection, this was the recommended treatment goal for uncomplicated primary hypertension as per the Seventh Report of the Joint Na-

tional Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7).³

Methods

Site

EHHOP has provided comprehensive primary care to uninsured, adult residents of East Harlem since 2004. The clinic operates on Saturdays, performing > 500 encounters with 150 unique patients per year. Primary care medical visits; diagnostic testing; social work services; ophthalmologic, reproductive, and mental health services; and medications are provided at no cost to patients. Pairs of clinical and preclinical students see patients under the supervision of attending physicians, who see all patients, approve all plans of care, and write their own visit note. Clinic operations are carried out by a steering committee comprised of 15 students and two faculty mentors. The endeavor relies heavily upon grant funds, philanthropy, and volunteer faculty and medical students.¹⁹

Design

A retrospective cohort analysis was performed of all EHHOP patients seen for a medical visit between 01/01/2004 and 05/20/2009 (N=487). Paper and electronic medical records were manually reviewed by the first author. Inclusion criteria were: 1) hypertension (defined as a diagnosis of hypertension, use of anti-hypertensive medication in the absence of other indications, or blood pressure $\geq 140/90$ mmHg on ≥ 2 occasions) and 2) ≥ 2 medical visits. Seated blood pressure measurements, demographics, and comorbidities were abstracted.

A literature review identified 2006 Medicaid and commercial insurance patient outcomes in New York State.³⁰ The New York State Department of Health provided the raw data used to generate outcome statistics and limited demographic data for Medicaid patients.³¹ Medicare was not included as a control group because $< 10\%$ of EHHOP patients are over the age of 65 years.

The Institutional Review Board of the Mount Sinai School of Medicine approved this study.

Statistical Analyses

Data were entered into EpiInfo (Version 3.5.1, U.S. Centers for Disease Control and Prevention,

Atlanta, GA), then cleaned and analyzed using Statistical Package for the Social Sciences (Version 18.0, SPSS Inc, Chicago, IL). Data from EHHOP, Medicaid, and commercial insurance patients were compared using chi-square tests with continuity correction for categorical variables and two-tailed t-tests for continuous variables. A post-hoc power calculation was performed to contextualize study results.³²

Secondary analyses in the EHHOP sample employed a two-tailed t-test to evaluate the mean blood pressure change between patients' first and most recent clinic visit. Univariate followed by multivariate binomial logistic regressions were used to identify factors associated with hypertension control. The dependent variables were blood pressure <140/90 mmHg and blood pressure below individual JNC 7 treatment goal. Univariate analyses employed the following independent variables: age, sex, race, foreign birth, years in the United States, non-English primary language, marital status, body mass index (BMI), diabetes mellitus, hyperlipidemia, depression, alcohol use, current smoker, ACE-inhibitor use, diuretic use, β -blocker use, number of antihypertensive medications, months of follow-up, and number of clinic visits. Multivariate analyses were performed for variables demonstrating significant univariate associations.

Results

Demographic and Clinical Characteristics

Sixty-five patients with hypertension were identified in the EHHOP sample. Patients' mean age was 52.9 years, and the majority were female, Hispanic, and born outside the United States (Table 1). The New York State Medicaid group contained a random sample of 10,117 patients with hypertension.³¹ Medicaid patients were less likely than EHHOP patients to be over the age of 65 years, less likely to be Hispanic, and more likely to be white or Asian (Table 1). The New York State commercial insurance sample contained a random sample of 7,669 patients with hypertension.³¹ Demographic data were unavailable for commercial insurance patients.

Chronic conditions such as hyperlipidemia and type II diabetes mellitus were common in the EHHOP sample. Among hypertensive patients with diabetes, 75% were on an ACE-inhibitor. Alcohol use was significantly higher in African-American patients than Hispanic patients. Additional clinical characteristics are presented in Table 2. Information regarding medical comorbidities, blood pressure treatment, and clinic usage were unavailable for Medicaid and commercial insurance patients.

Table 1. Hypertension Patient Demographics

	EHHOP (N=65)	NYS Medicaid (N=10,117)
Mean Age, yr. (SD)	52.9 (11)	—
Age 18-44 yr., no. (%)	14 (22)	2,508 (25)
Age 45-64 yr., no. (%)	43 (66)	7,273 (72)
Age >65 yr., no. (%)	8 (12)	331 (3)*
Female, no. (%)	39 (60)	6,438 (64)
Hispanic, no. (%)	36 (55)	1,094 (29)*†
African-American, no. (%)	19 (29)	671 (18)†
White, no. (%)	2 (3)	745 (20)*†
Asian, no. (%)	3 (5)	776 (21)*†
Foreign-born, no. (%)	39 (60)	—
Primary language Spanish, no. (%)	29 (45)	—
Primary language English, no. (%)	31 (48)	—
Married, no. (%)	26 (40)	—
Mean Annual Income, US\$ (SD)	14,300 (11,100)	—

* $p < 0.05$; †NYS Medicaid race information available only for $N=3,771$; —not available

Table 2. Clinical Characteristics of EHHOP Hypertension Patients

	EHHOP Patients (N=65)
Comorbidities	
Hyperlipidemia, no. (%)	38 (58)
Diabetes Mellitus, no. (%)	28 (43)
Depression, no. (%)	13 (20)
Mean BMI (SD)	33.3 (9)
Hispanic	33.4 (9)
African-American	35.7 (10)
Current Smoker, no. (%)	15 (23)
Alcohol Use, no. (%)	24 (37)
Hispanic (N=36)	10 (29)
African-American (N=19)	12 (67)*
Initial Visit	
On Antihypertensive Medication, no. (%)	32 (49)
Most Recent Visit	
Mean No. Antihypertensive Agents (SD)	1.3 (1.0)
≥2 Antihypertensive Agents, no. (%)	25 (38)
ACE-inhibitor, no. (%)	35 (54)
Diuretic, no. (%)	19 (29)
Calcium Channel Blocker, no. (%)	15 (23)
β-blocker, no. (%)	16 (25)
Hypertensive Patients with Diabetes (N=28)	
ACE-Inhibitor, no. (%)	21 (75)
Clinic Utilization	
Mean No. Medical Visits (SD)	8.0 (6.6)
≥1 Nutritionist Visit, no. (%)	8 (12)
Mean No. Months Under Care (SD)	16.2 (12.4)

*p<0.01 as compared to reference group of Hispanic patients

Hypertension Outcomes: Control <140/90 mmHg

At the most recent visit, 57% of EHHOP patients were controlled with blood pressure <140/90 mmHg. By comparison, 58% of Medicaid patients (p>0.99) and 59% of commercial insurance patients (p=0.85) met this goal (Figure 1). Though p-values suggested no statistical difference between the groups, post-hoc power calculations revealed that the EHHOP sample (N=65) was only adequate to detect an 18% difference in control rate with 80% power. In order to detect the 2% difference in control rate observed between EHHOP and commercial insurance with 80% power, the EHHOP sample would have needed to contain >9,000 patients.

EHHOP Patients at Individual Blood Pressure Goal

JNC 7 recommends a lower blood pressure goal of <130/80 mmHg for patients with certain comorbidities, such as diabetes and chronic kidney disease. In the overall EHHOP sample, 47.7% (31/65) of patients met their individual blood pressure goal. Among the 28 EHHOP patients with hypertension and diabetes, 35.7% (10/28) were controlled at <130/80 mmHg. Data on Medicaid and commercial insurance patients with hypertension and diabetes or chronic kidney disease were unavailable.

Figure 1. Hypertension Patients Controlled <140/90 mmHg

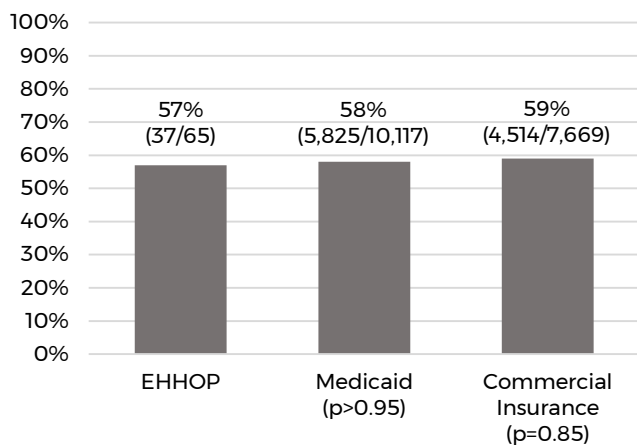
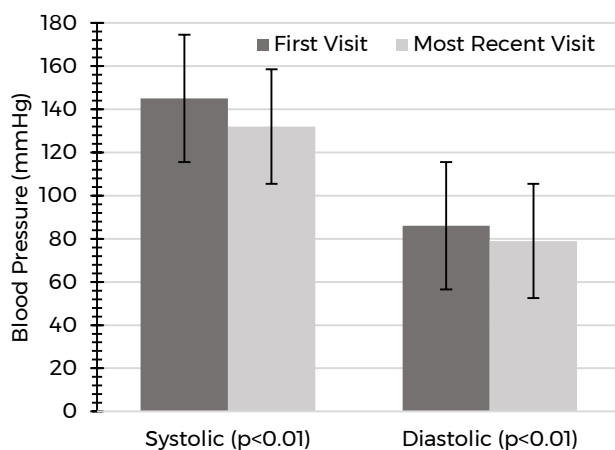


Figure 2. Mean Change in Blood Pressure Under EHHOP's Care



EHHOP Blood Pressure Trends

EHHOP patients' mean blood pressure was 145/86 mmHg at their initial visit and 132/79 mmHg at their most recent visit. Over a mean follow-up of 16.2 months and 8.0 clinic visits, the reduction in blood pressure while under EHHOP's care was 12.3 mmHg systolic (95% CI 5.7-18.9; p<0.01) and 6.8 mmHg diastolic (95% CI 2.9-10.5; p<0.01) (Figure 2).

EHHOP Factors Associated with Blood Pressure Control

Univariate analyses revealed that alcohol, BMI, and race were significantly associated with blood pressure control. Patients who drank alcohol were 67% less likely than patients who did not drink to have their blood pressure controlled <140/90 mmHg (OR 0.33; 95% CI 0.11-0.95; p<0.05; Table 3). Elevated BMI was associated with decreased blood pressure control (OR 0.92; 95% CI 0.85-0.99; p<0.05). The mean BMI was 36.5 kg/m² in uncontrolled patients, compared to 30.5 kg/m² in controlled patients (p=0.02). Finally, African-American patients in the EHHOP sample were 71% less likely than the reference group of Hispanic patients to have their blood pressure controlled <140/90 mmHg (OR 0.29; 95% CI 0.09-0.95; p<0.05).

In multivariate analyses, the relationship between race and blood pressure control <140/90 mmHg remained significant when controlling for age and sex. When race and alcohol use were entered as the model's only covariates, the relation-

ship between African-American race and blood pressure became non-significant (OR 0.32; 95% CI 0.085-1.16; p=0.08). The relationship also became non-significant when BMI and race were entered as the model's only covariates (OR 0.22; 95% CI 0.05-1.03; p=0.054).

Discussion

The purpose of our study was to evaluate hypertension outcomes at EHHOP, a student-run free clinic for the uninsured. Our results demonstrate that 57% of hypertension patients at EHHOP were controlled <140/90 mmHg, the standard of care treatment goal at the time of this study. Results compare favorably with New York State Medicaid patients (58%), New York State commercial insurance patients (59%), and published control rates from other care settings.^{1,4,5,33}

EHHOP patients experienced a mean reduction in blood pressure of 12.3/6.8 mmHg. Given that reductions of 10/5 mmHg are associated with a 41% reduction in stroke and a 22% reduction in coronary heart disease, the blood pressure reductions observed in the EHHOP sample appear clinically meaningful.³⁴ Data have also shown that one death is prevented for every 11 patients who sustain a 12 mmHg reduction in systolic blood pressure over 10 years.³⁵ If EHHOP's hypertension control rates can be sustained, they may help combat the disproportionate burden of premature cardiac death in the East Harlem community.

Table 3. Univariate Associations with Hypertension Control at EHHOP

Independent Variable	Control < 140/90 mmHg	Control < Individual Goal
Demographic, OR (95% CI)		
Age	1.00 (0.96-1.05)	1.02 (0.98-1.07)
Sex		
Female	1.00	1.00
Male	1.79 (0.64-4.99)	1.36 (0.50-3.68)
Race		
Hispanic	1.00	1.00
African-American	0.29 (0.09-0.95)*	0.57 (0.18-1.86)
White or Asian	4.46 (0.49-40.20)	8.8 (0.97-78.65)
Foreign Born	2.08 (0.76-5.73)	1.23 (0.45-3.32)
Years in the U.S†		
>10	1.00	1.00
5-10	4.5 (0.47-42.97)	1.53 (0.29-7.94)
<5	0.64 (0.11-3.91)	0.46 (0.07-3.02)
Non-English Primary Language	1.96 (0.72-5.29)	1.07 (0.40-2.82)
Married	1.37 (0.50-3.77)	1.36 (0.50-3.68)
Clinical, OR (95% CI)		
BMI	0.92 (0.85-0.99) *	0.93 (0.86-1.00)
Diabetes Mellitus	1.02 (0.38-2.74)	0.49 (0.18-1.34)
Hyperlipidemia	1.85 (0.68-5.03)	1.08 (0.40-2.89)
Depression	1.93 (0.53-7.06)	2.84 (0.77-10.40)
Alcohol Use	0.33 (0.11-0.95) *	0.42 (0.14-1.24)
Current Smoker	1.18 (0.36-3.81)	1.24 (0.39-3.93)
ACE-Inhibitor Use	1.69 (0.63-4.56)	1.2 (0.46-3.21)
Diuretic Use	0.43 (0.14-1.27)	0.67 (0.23-1.96)
β-Blocker Use	0.35 (0.11-1.12)	0.53 (0.17-1.69)
No. Antihypertensive Medications	0.80 (0.49-1.32)	0.95 (0.58-1.55)
Months Under Care	1.02 (0.98-1.05)	1.02 (0.99-1.06)
No. Clinic Visits	1.09 (0.99-1.19)	1.06 (0.98-1.15)

* $p < 0.05$; †Among foreign-born patients only

The study's secondary analyses highlight opportunities to improve culturally competent patient care and the education of student clinicians. In our sample, foreign-born patients and those with a non-English primary language were no more likely to have uncontrolled hypertension. However, African-American patients were less likely to have their blood pressure controlled <140/90 mmHg. This relationship was explained by alcohol use and BMI, highlighting the need to improve our comprehensive lifestyle counseling in African Americans with hypertension.³⁶ Study results also suggest the need for increased clinician training on blood pressure management in special populations. For example, only 75% of EHHOP

patients with hypertension and diabetes were on an ACE-inhibitor and just 36% of these patients were controlled <130/80 mmHg, which were standard of care guidelines during the study period.

These results have been used to guide improvements in hypertension management at the EHHOP clinic. Since the time of data collection, EHHOP has expanded its chronic care program, increasing continuity of care for patients with uncontrolled hypertension. Such patients are now paired with the same students for two years at a time. EHHOP has also developed a formal curriculum for students involved in the chronic care program.

Several limitations of our study should be considered. Our data were only powered to detect differences of 18% or more between groups. It is possible that a larger sample size would have revealed significant differences between EHHOP, Medicaid, and commercial insurance patients. Given the nature of student-run free clinics as small, safety net practices, sample size is a perpetual challenge. Future studies should consider collaborative efforts that pool data from multiple student-run free clinic sites.

We limited our sample to EHHOP patients seen for two or more clinic visits in order to assess our clinic's performance in blood pressure management. In doing so, we may have excluded patients with higher barriers to continuity and adherence. We were also unable to assess for demographic differences between EHHOP, Medicaid, and privately insured patients, which may have been substantial.

Our study compared hypertension outcomes at EHHOP to contemporary guidelines. More recent JNC 8 recommendations have loosened goals for blood pressure control in certain populations.³⁷ If our data were compared to current JNC 8 standards, it is likely that a higher percentage of EHHOP patients would have achieved blood pressure control.

Overall, study results demonstrate that EHHOP patients experience clinically meaningful reductions in blood pressure. While limited by sample size, results also suggest that outcomes at EHHOP are similar to New York State Medicaid and commercial insurance populations. Results support student-run clinics as a model for delivering high quality healthcare to vulnerable populations.

Acknowledgements

The authors thank the New York State Department of Health for their assistance in obtaining Medicaid and commercial insurance patient data.

Disclosures

This project was supported by the Mount Sinai Alumni Association and by EHHOP clinic funds. The authors have no conflicts of interest to disclose.

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