

Rates and Predictors of Uncontrolled Hypertension Among Hypertensive Homeless Adults Using New York City Shelter-Based Clinics

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ABSTRACT

PURPOSE We undertook a study to determine the rates, predictors, and barriers to blood pressure control among homeless and nonhomeless hypertensive adult patients from 10 New York City shelter-based clinics.

METHODS The study was a retrospective chart review of blood pressure measurements, sociodemographic characteristics, and factors associated with homelessness and hypertension extracted from the medical records of a random sample of hypertensive patients (N = 210) in 2014.

RESULTS Most patients were African American or Hispanic; 24.8% were female, and 84.3% were homeless for a mean duration of 3.07 years (SD = 5.04 years). Homeless adult patients were younger, had less insurance, and were more likely to be a current smoker and alcohol abuser. Of the 210 hypertensive patients, 40.1% of homeless and 33.3% of nonhomeless patients had uncontrolled blood pressure ($P = .29$) when compared with US rates for hypertensive adults, which range between 19.6% and 24.8%, respectively; 15.8% of homeless patients had stage 2 hypertension ($P = .27$). Homeless hypertensive patients with diabetes or multiple chronic diseases had better blood pressure control ($P < .01$). In logistic regression, lack of insurance was associated with inadequate blood pressure control ($P < .05$).

CONCLUSIONS The high rate of uncontrolled hypertension among hypertensive homeless adults is alarming. We propose comprehensive approaches to improve social support, access to medical insurance, and medication adherence, the lack of which complicate blood pressure control, targeted health education, and life style modifications using mobile health strategies for this mobile population.

Ann Fam Med 2016;14:41-46. doi: 10.1370/afm.1882.

INTRODUCTION

Annually millions of Americans experience homelessness, and approximately 630,000 spend each night in the shelter system.^{1,2} Most homeless adults were born during the latter part of the baby boom era and are now entering their 50s, placing them at a higher risk of developing hypertension.^{3,4} Hypertension is one of the most common conditions among homeless adults⁵⁻¹⁰; however, data on blood pressure control in the homeless is very limited.^{6,11} The homeless are also more likely to be smokers and have a history of cocaine abuse.^{6,8,11,12} They lack access to primary care and suffer from mental illness or substance abuse,^{4,13} experience discrimination in the health system, and face barriers to therapeutic lifestyle changes,⁷ factors that likely complicate their chronic disease management.

There are effective and proven strategies to control blood pressure in the general population, including self-management behaviors and counseling to support lifestyle changes.¹⁴⁻¹⁸ These strategies are rarely evaluated among the homeless or disseminated to health facilities where the homeless seek care, partly because data regarding the rates and predictors of poor blood pressure control among the homeless are lacking. This study aims to assess the rates and predictors of uncontrolled blood pressure

Conflicts of interest: authors report none.

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among hypertensive homeless adults and a nonhomeless, low-socioeconomic adult population who use New York City's shelter-based clinics. The results will guide interventions aimed at improving control among this vulnerable population.

METHODS

Study Design and Setting

The Community Medicine Program (CMP) of the NYU Lutheran Family Health Centers provides medical services to the homeless population of New York City at various shelters and shelter-based clinics. We conducted a retrospective chart review to determine and compare the rates of uncontrolled hypertension among homeless and nonhomeless hypertensive adults who used 10 shelter-based clinics in New York City and to determine factors associated with uncontrolled hypertension. The Institutional Review Board at NYU Lutheran Family Health Centers approved this study.

We collected a computer-generated random sample of patients with a diagnosis of hypertension from 10 shelter-based clinics in 2013 and early 2014 in 3-month intervals to account for potential seasonal effects. Electronic medical records were then reviewed to document systolic and diastolic blood pressure readings in the latest recorded visit. Blood pressure was evaluated based on the JNC-7 recommendations.¹⁹ Inclusion criteria included hypertensive homeless and nonhomeless patients receiving care at CMP shelter-based clinics during 2013 to 2014.¹⁹ We collected the following sociodemographic characteristics and clinical and nonclinical data: age, race, and sex; housing status and years of homelessness; body mass index; health insurance status; personal history of chronic diseases, including diabetes, renal insufficiency, hypercholesterolemia, asthma or chronic obstructive pulmonary disease, and coronary artery disease; tobacco, alcohol and substance abuse; and history of mental illness, including mood disorders, psychosis, and neurosis or anxiety disorders. One trained research team member reviewed all medical records and extracted data. A second research team member double-checked the accuracy of the data collection. We defined homeless status when a patient indicated that he/she lives in a shelter or on the street. Years of homelessness were recorded when indicated in the medical records. Current history of chronic illness, mental illness, alcohol abuse, and smoking and substance abuse were defined as reported by patients and indicated by the physician in the records.

Study Outcomes and Statistical Analyses

The primary outcome was the rate of uncontrolled hypertension measured as a dichotomous/categori-

cal variable (levels of blood pressure as either stage 1, uncontrolled, 140/90 to 160/100 mm Hg; or stage 2, very uncontrolled, 160/100 mm Hg or higher). Secondary outcomes included factors associated with homelessness and hypertension, including alcohol, smoking, substance abuse, and history of mental illness and chronic disease. The main independent variable was housing status, which was dichotomous; the duration of homelessness was evaluated as a continuous variable. All other independent variables were dichotomous/categorical except age, number of mental illnesses and chronic diseases, and number of cigarettes smoked daily.

We calculated and reported the numbers of events and proportions and compared the rates of primary and secondary outcomes. Descriptive statistics, univariate and bivariate analysis using χ^2 and the Student *t* test, as well as multivariable logistic regression with adjusted odds ratios and 95% confidence intervals, were performed where indicated. We determined statistical significance for differences in rates between groups using the two-sided χ^2 or *t* test. We used logistic regression analysis to assess the presence and degree of association between independent variables with the rate of uncontrolled hypertension and to control for potential confounders. Variables were included in the models when bivariate analysis showed significance and when clinically sensible and plausible. We looked at the correlation of predictors of blood pressure control between the nonhomeless and homeless and within the homeless population. SPSS 21.0 (International Business Machines Corp) was used for data analysis. In the absence of prior studies, and considering our arbitrary threshold to consider a targeted program, we hypothesized that the prevalence of uncontrolled hypertension among our patient population needed to be at least 15%. We set α at .05 with a power of 0.8 and calculated the sample size of 196.²⁰

RESULTS

The total number of participants that met our inclusion-exclusion criteria was 210. Their average age was 55.74 years; 84.3% were homeless. Most were African American and Hispanic; 24.8% were female. Of the homeless and nonhomeless patients, 40.1% and 33.3% had uncontrolled blood pressure levels, respectively ($P = .29$; odds ratio [OR] = 1.34; 95% CI, 0.61-2.93). The rates of stage 2 hypertension ($\geq 160/100$ mm Hg) was 15.8% in the homeless and 0.03% in the nonhomeless patients ($P = .27$). The homeless were younger (55.10 vs 59.15 years; $P = .04$), more likely to be uninsured (OR = 1.22; 95% CI, 1.14-1.31; $P = .01$), less likely to have hypercholesterolemia (OR = 0.32; 95% CI, 0.17-0.6; $P = .001$) or coronary artery disease (OR = 0.50; 95% CI, 0.26-

0.95; $P = .03$), and more likely to be a current smoker (OR = 2.36; 95% CI, 1.15-4.85; $P = 0.01$) and abuse alcohol (OR = 5.39; 95% CI, 1.39-8.0; $P = .04$). There was no significant difference between the homeless and nonhomeless patients in regard to prevalence of mental illness (OR = 0.7; 95% CI, 0.31-1.58; $P = .43$). Table 1 displays the demographic characteristics and clinical indicators among all study patients.

The average duration of homelessness was 3.07 years (range = 0.03-23). Among the homeless, lack of insurance was associated with uncontrolled blood pressure, whereas having diabetes, a mental illness, or multiple chronic diseases was associated with better blood pres-

sure control. Table 2 displays the findings for study variables among the homeless patients with hypertension.

In the logistic regression analysis that included only homeless patients, when age, health insurance, mental health, diabetes, high cholesterol, alcohol abuse and mental illness were in the model, only mental illness, diabetes, and health insurance continued to be independently associated with better blood pressure control (Table 3).

We also performed a logistic regression analysis that included all patients (nonhomeless and homeless). When mental illness, health insurance, and housing status were in the model, mental illness (adjusted OR = 0.45; 95%

Table 1. Study Variables Among Homeless and Nonhomeless Hypertensive Patients, New York City, 2014

Variable	Total Patients N = 210	Homeless (n = 177)	Nonhomeless (n = 33)
Sociodemographic characteristic			
Age, mean (SD) [range], y ^a	55.74 (10.99) [28-92]	55.10 (11.07)	59.15 (10.01)
Systolic blood pressure, mean (SD) [range], mm Hg	131.04 (19.47) [86-210]	131.76 (20.05)	127.18 (15.70)
Diastolic blood pressure, mean (SD) [range], mm Hg	79.76 (12.34) [30-111]	80.06 (12.91)	78.18 (8.71)
Blood pressure level (n = 210)			
Normal (<135/85 mm Hg), No. (%)	46 (21.9)	38 (21.4)	8 (24.2)
At risk (≥135/85 to <140/90 mm Hg), No. (%) ^c	82 (39)	68 (38.4)	14 (42.4)
Stage 1, uncontrolled (≥140/90 to <160/100 mm Hg), No. (%)	53 (25.2)	43 (24.2)	10 (30.3)
Stage 2, very uncontrolled (≥160/100), No. (%)	29 (13.8)	28 (15.8)	1 (0.03)
Hypertension, uncontrolled (n = 210), No. (%)	82 (39)	71	11
Sex (n = 210), male, No. (%)	158 (75.2)	136	22
Race (n = 206)			
White, No. (%)	32 (15.5)	26	6
African American, No. (%)	114 (55.3)	101	13
Hispanic, No. (%)	40 (19.4)	31	9
Asian, Native American, others, No. (%)	20 (9.7)	17	3
Health insurance (n = 209), No. (%) ^b	180 (86.1)	147	33
Insurance type (n = 176)			
Medicaid, No. (%)	118 (67)	100	18
Medicare, No. (%)	56 (31.8)	41	15
Other, No. (%)	2 (1.1)	2	0
Clinical indicator			
Diabetes (n = 204), No. (%)	75 (36.8)	60	15
Coronary artery diseases (n = 204), No. (%) ^a	41 (20.1)	30	11
Kidney disease (n = 204), No. (%)	8 (3.9)	5	3
Hypercholesterolemia (n = 204), No. (%) ^b	63 (30.9)	44	19
Number of chronic diseases (n = 176), mean (SD) [range] ^b	1.91 (0.97) [0-5]	1.82 (0.93)	2.39 (1.02)
Mental illness (n = 201), No. (%)	127 (63.2)	104	23
Number of mental illness (n = 100), mean (SD) [range]	1.18 (0.44) [0-3]	1.16 (0.44)	1.26 (0.45)
Body mass index (n = 205), mean (SD) [range]	30.55 (6.97) [18.36-51.24]	30.36 (6.42)	31.58 (9.36)
Obesity (n = 176), No. (%)	95 (46.6)	79	16
Substance abuse (n = 160), No. (%)	30 (18.8)	25	5
Alcohol abuse (n = 164), No. (%) ^a	25 (15.2)	24	1
Smoking cigarettes (n = 181), No. (%) ^a	89 (49.2)	80	9
Number of current daily cigarettes (n = 84), mean (SD) [range]	9.08 (5.71) [2-31]	8.98 (5.47)	9.89 (7.84)

^a $P < .05$.

^b $P < .01$.

^c Participants with blood pressure readings of ≥135/85 mm Hg to <140/90 mm Hg are at higher risk of developing hypertension compared with the general population.

CI, 0.25-0.82) and health insurance (adjusted OR = 1.22; 95% CI, 1.14-1.31) were independently associated with better blood pressure control, and housing status was not (adjusted OR = 1.07; CI, 0.47-2.43).

DISCUSSION

The 40.1% rate of uncontrolled blood pressure among the homeless, with 15.8% having stage 2 hypertension, is alarming. The rates of uncontrolled blood pressure among US hypertensive persons aged 40 to 59 years and 60 to 79 years who are under treatment are 19.6% and 24.8%, respectively.²¹ Considering the remarkably higher prevalence of other important risk factors for cardiovascular events among homeless,^{6,8,11,12} effective treatment and better blood pressure control among

hypertensive homeless patients becomes even more important. Lack of health insurance was a strong predictor of uncontrolled blood pressure among both homeless and nonhomeless hypertensive adults. We hypothesize that the lack of consistent medical insurance limits access to a steady supply of medications and likely contributes to missing follow-up visits with clinicians. Although we did not directly collect data on treatment adherence, we hypothesize that uncontrolled blood pressure is likely due to lower adherence to a medical regimen or a lack of access to healthy food choices and exercise during homelessness or in the shelters.

Contrary to our original hypothesis, having one or more mental illnesses was not associated with the increased risk of uncontrolled blood pressure. Mental illness can have a profound impact on access to

Table 2. Bivariate Analysis of Hypertension Among Homeless Hypertensive Patients, New York City, 2014

Variable	Total Patients n = 177	Controlled Hypertension n = 106 (59.9%)	Uncontrolled Hypertension n = 71 (40.1%)
Age (n = 177), mean (SD) [range], y	55.10 (11.07) [28-92]	55.27 (10.65)	54.85 (11.76)
Duration of homelessness (n = 39), mean (SD) [range], y	3.07 (5.04) [0.03-23]	3.08 (4.24)	3.07 (5.97)
Systolic blood pressure (n = 177), mean (SD) [range] ^b	131.76 (20.05) [86-210]	118.85 (10.99)	151.03 (14.17)
Diastolic blood pressure (n = 177), mean (SD) [range] ^b	80.06 (12.91) [30-111]	73.71 (8.73)	89.54 (12.34)
Blood pressure level (n = 177)			
Normal (<135/85 mm Hg), No. (%)	38 (21.5)	...	...
At risk (≥135/85 to <140/90 mm Hg)	68 (38.4)	...	...
Stage 1, uncontrolled (≥140/0 to <160/100 mm Hg)	43 (24.3)	...	...
Stage 2, very uncontrolled (≥160/100 mm Hg)	28 (15.8)	...	...
Sex, male (n = 177)	136 (76.8)	79	57
Race (n = 175)			
White, No. (%)	26 (14.9)	15	11
African American, No. (%)	101 (57.7)	58	43
Hispanic, No. (%)	31 (17.7)	19	12
Asian, Native American, others, No. (%)	17 (9.7)	13	4
Health insurance (n = 176), No. (%) ^a	147 (83.5)	93	54
Insurance type (n = 143)			
Medicaid, No. (%)	100 (69.9)	62	38
Medicare, No. (%)	41 (28.7)	29	12
Other, No. (%)	2 (1.4)	0	2
Diabetes (n = 171), No. (%) ^b	60 (35.1)	45	15
Coronary artery disease (n = 171), No. (%)	30 (17.5)	19	11
Kidney disease (n = 171), No. (%)	5 (2.9)	3	2
Hypercholesterolemia (n = 171), No. (%)	44 (25.7)	31	13
Mental illness (n = 168), No. (%) ^a	104 (61.9)	70	34
Number of mental illness (n = 100), mean (SD) [range]	1.16 (0.44) [0-3]	1.17 (0.45)	1.15 (0.43)
Body mass index (n = 172), mean (SD) [range]	30.36 (6.42) [18-49]	30.68 (6.07)	29.87 (6.93)
Obesity (n = 171), No. (%)	79 (46.2)	51	28
Substance abuse (n = 131), No. (%)	25 (19.1)	15	10
Alcohol abuse (n = 133), No. (%)	24 (18)	12	12
Smoking cigarettes (n = 150), No. (%)	80 (53.3)	50	30
Number of current daily cigarettes (n = 76), mean (SD) [range]	8.98 (5.47) [2-31]	8.99 (5.92)	8.96 (4.67)

^a P < .05.

^b P < .01.

Table 3. Logistic Regression Analysis of Independent Variables on Uncontrolled Hypertension Among Homeless Adults, New York City, 2014

Variable	Uncontrolled Hypertension			
	Unadjusted OR	95% CI	Adjusted OR ^a	95% CI
Age	...	...	1.007	0.97-1.03
Health insurance ^b	0.41	0.18-0.92	0.39	0.16-0.97
Diabetes	0.35	0.17-0.70	0.38	0.18-0.81
Hypercholesterolemia ^b	0.53	0.25-1.11	0.52	0.23-1.19
Mental illness ^b	0.45	0.24-0.86	0.42	0.21-0.84

OR = odds ratio.

^a Adjusted for age, health insurance, mental health, diabetes, high cholesterol, alcohol abuse, and obesity.^b $P < .05$.

health care and needs to be addressed systematically using team efforts that engage mental health and primary care clinicians, shelter staff and case workers, and social workers. We noted that most of our homeless patients with mental illness often resided in shelters that have nursing support and staff to provide reminders and help with adherence to mental health medications, which may have also helped to improve adherence to hypertension medications. Additionally, it is likely that having another chronic illness increased the number of clinical encounters and therefore improved detection and treatment of uncontrolled blood pressure among the homeless with mental illness.

An overwhelming majority of the homeless lose their housing secondary to eviction and inability to pay rent or domestic and family disputes,¹ and mental illness is often a byproduct of homelessness rather than its primary cause.^{1,12} Addressing fundamental causes of homelessness may help address mental health issues. Considering inadequate access to proper mental health care for the general population in the United States, targeted programs aimed at highly vulnerable populations of the homeless who lack other social supports and social capital should be considered.

Homeless patients who are eligible for Medicaid state-supported health insurance may not necessarily have access to it because of the complicated process to obtain and maintain it. The Patient Protection and Affordable Care Act may result in more opportunities for the homeless to be insured.²² Prejudice against the homeless and minorities' health care needs and the health system's focus on addressing their acute care have been well documented.²³⁻²⁶ These issues need to be addressed, and communication with health care providers, improved. Considering the mobile nature of the homeless populations and their lack of consistent housing, mobile health strategies (the delivery of health

care services via mobile communication devices), which have been used in the general population to improve the management of chronic diseases with reminders and health education for diet and exercise, may be effective and should be explored.²⁷⁻³³

Providing opportunities at shelters or shelter-based clinics where the homeless often seek care and where they have access to other social and system supports could address the multilevel barriers to hypertension control. These opportunities would adopt the elements of the chronic care model, which include targeted outreach to support health behavior change, collaborative goal setting, and reminders and feedback that empower patients.

We could not find any association between years of homelessness and uncontrolled blood pressure, which we hypothesize is due to a limited number of reported years of homelessness. That neither obesity nor body mass index was associated with uncontrolled blood pressure is likely because the level of obesity in our total population is high. Substance or alcohol abuse were also not independently associated with uncontrolled hypertension; the average alcohol abuse among the homeless is high, and the relationship with blood pressure is probably masked or confounded by the significant association of mental illness with substance or alcohol abuse. We did not find any racial differences between controlled and uncontrolled hypertensive homeless patients, largely because of the overwhelming minority population of the homeless. Having diabetes was associated with better blood pressure control among homeless patients, possibly because they had more frequent clinic visits or they received more rigorous blood pressure control for their diabetes by their clinicians.

There are limitations to our study. Medical records review poses limitations to objective assessments of important components of predictors that may have not been documented, such as duration and severity of mental illness, substance or alcohol abuse, or other chronic diseases, as well as data on current length, episodes, or duration of lifetime homelessness. We were unable to collect specific data on hypertension awareness or medications adherence, and we used only a single blood pressure reading measured during the most recent visit. Blood pressures are, however, measured in a consistent way and according to national recommendations in all of our shelter-based clinics, which have regular quality assurance assessment of measurement reliability and consistency.

A more comprehensive examination of the behavioral and psychosocial factors associated with poor

blood pressure control in future research may provide a better understanding of the pathway to uncontrolled hypertension in this high-risk population. Nevertheless, structural strategies to prevent and address homelessness are paramount and need to be implemented.

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Key words: hypertension; homeless persons; healthcare disparities; blood pressure

Submitted May 31, 2015; submitted, revised, September 14, 2015; accepted November 3, 2015.

Acknowledgment: The leadership and staff at the NYU Lutheran's Community Medicine Program provided invaluable support to this project.

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