

## Hypertension in a Low-income and Homeless Community Sample

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### Abstract

**Background:** Uncontrolled hypertension is a problem among many sub-populations of U.S. adults.

**Objective:** To investigate hypertension in a low-income community sample of adults with a high proportion reporting homelessness.

**Methods:** Respondents (N = 478) completed a cardiovascular risk assessment (CVRA) with five subscales (social support, nutrition, physical activity, control and negative emotions) and the Risk Behavior Assessment (RBA) which collects demographic information as well as drug use and sexual risk behaviors.

**Results:** Findings showed that homeless individuals, and those who are married, divorced, or separated as opposed to being single, African-Americans, and women are at high risk for hypertension. A mediational model was developed using hypertension as the main outcome and the nutrition subscale of the CVRA as the mediator for homeless individuals. Results indicate that good nutrition (higher scores on the nutrition subscale) act as a protective mediator against hypertension for those who are homeless. The total mediated effect of nutrition on hypertension for the homeless was significant.

**Conclusions:** Improved nutrition may help prevent/reduce risk of hypertension among low income adults, especially those who are homeless.

**Keywords:** Homeless; Hypertension; Nutrition; Mediation model

### Introduction

The prevalence of systemic hypertension in the U.S adult population is estimated to be between 20-30%, and about 20% of the people with this condition are unaware they have hypertension [1-3]. The associated morbidities and mortalities with untreated or uncontrolled hypertension are cardiovascular diseases (CVD) such as stroke, myocardial infarction, peripheral arterial diseases and heart failure [2,4], chronic kidney diseases [5], diabetes, arthritis, mobility problems, and depression [6]. There are enormous healthcare costs associated with the care and treatment of patients with hypertension [2].

The prevalence of hypertension and associated chronic diseases are even more severe in medically underserved, low-income community populations [7-9]. Certain populations are at a higher risk for hypertension, including African-Americans and those living in poor socio-economic and environmental conditions [10-15]. Furthermore, the incidence of death and disability from cardiovascular diseases is disproportionately higher in minority, low-income and homeless populations [16]. The relationship between the consumption of food with a high concentration of fat, carbohydrates and hypertension is well documented [17,18]. Low-income populations, including

homeless individuals, are subject to obesity and undernourishment due to limited access to healthy foods. Low-income women, especially African Americans and Latinas experience greater food insecurity and related illnesses such as diabetes, hypertension, and cancer [19]. A lack of social support and depression and negative emotions can act as strong barriers to behavioral hypertension control [12,20].

Among the preventable causes of morbidity and mortality associated with hypertension are the behavioral risk factors of poor diet and lack of information regarding affordable nutritious food. [15,21-23]. Much is known about healthy eating habits [15] and the Dietary Approaches to Stop Hypertension (DASH) diet, [24,25] however, many of the recommendations are very difficult to implement by the homeless population due to lack of availability of a kitchen to prepare and store the food [17,26]. Few studies have examined barriers to a low-salt diet and the dietary habits of medically underserved populations with hypertension. No previous studies have examined the mediating factor of nutrition on hypertension in homeless and low-income populations.

The aim of this study is to determine the correlates and the mediating effect of nutrition on hypertension in a low-income and homeless community sample.

## Hypotheses

We hypothesized that hypertension would be positively correlated with homelessness and that an inverse relationship would exist between homelessness and nutrition.

## Background

In the United States, it is estimated that 65 million Americans are hypertensive [2,27,28]. According to the Bazzano et al. [25] and Calton et al. [29], dietary modifications including fruits and vegetables, non-fat dairy food and a low sodium diet, with moderate consumption of alcohol, provides a protective benefit and a significant reduction of hypertension at a cost that is often much less than pharmacotherapy [30,31].

Nutrition can be a serious challenge for homeless individuals [32]. Many experience food insufficiency and struggle to meet their daily basic needs. Food from shelters or fast food vendors is nutritionally inadequate, high in fats, cholesterol and lack necessary fruits, vegetables, and essential vitamins and minerals. Obesity is the new malnutrition in homeless population and those living under extreme poverty, which may have adverse effect on their health, for example, diabetes, hypertension and other chronic health conditions [26].

The environment of homeless shelters and food stores in inner cities seems to play an important role in determining the availability of affordable nutritious foods [33,34]. On an individual and behavioral level, some of the barriers to consuming affordable healthy foods are: (1) lack of knowledge on the part of homeless or very-low income individuals about how to select quality food items; (2) how to prepare foods individuals do have access to cooking facilities; and (3) mental disorders that hinder good decision making and self-care.

Cocaine and amphetamines have been associated with hypertension [35]. Akkina et al. [5] found mean systolic and diastolic blood pressures were significantly higher for illicit drug users (cocaine amphetamine and heroin). The highest prevalence was associated with cocaine use (OR. 1.24, CI, 1.00-1.54) especially with a life time use of 6 to 49 times (OR, 1.42, CI 1.06-1.91).

## Methods

Respondents were recruited from the low-income community in the Long Beach, California area, who attended the Center for Behavioral Research for Human Immunodeficiency Virus (HIV) and sexually transmitted disease testing as well as free hepatitis A and B vaccination. All participants signed an informed consent approved by the California State University, Long Beach (CSULB) Institutional Review Board (IRB). Each of the 478 adults was administered the Cardiovascular Risk Assessment (CVRA) [36], and Risk Behavior Assessment (RBA) [37,38].

The CVRA elicits information on whether a medical provider has told the respondent that they have heart disease, stroke, arrhythmias, hypertension, diabetes and/or high cholesterol. The CVRA includes five subscales: social support, negative emotions, control, a brief nutrition assessment and physical activity assessment [36]. The subscales of the CVRA had good internal consistency: social support ( $\alpha = 0.92$ ), negative emotions ( $\alpha = 0.91$ ), physical activity ( $\alpha = 0.74$ ), nutrition ( $\alpha = 0.62$ ), except for control subscale ( $\alpha = 0.20$ ). The question on the CVRA that was used in this analysis as the classification (dependent) variable was, "Have you ever been told that

you have high blood pressure?" with high blood pressure defined as 140/90 mm Hg.

The Risk Behavior Assessment (RBA) is a structured interview that captures the risky drug and sexual behaviors in a participants' lifetime, as well as their recent (in the last 30 days) risk behaviors [37]. The first section of the interview contains demographic questions, such as gender (women/men), age (in years), and education level (in years) and homelessness. The other sections relevant to the current study include drug use and sexual activities during the last 30 days, and economic information such as income. Participants are asked what types of drugs they used, how many times they used each drug in the last 30 days and whether they injected them. They were also asked how many sexual partners they had in the last 30 days, whether their partner was likely to be a drug injector, the different types of sex they engaged in (e.g., vaginal, oral, or anal), and how many times they used a condom. Many previous studies have shown high test-retest reliability of RBA items regarding drug use and sexual behavior [37-40].

## Data analysis

Bivariate statistical tests were used to determine whether significant differences existed between respondents and non-respondents on the outcome variable.

Mediation analysis was used to investigate factors that mediated the relationship between homelessness and hypertension. Use of mediation analysis explains the mechanism through which the independent variable affects the dependent variable [41]. A single mediator model determines whether the relationship of the independent variable to the dependent variable was mediated by another third variable. Logistic regression was used because the response (outcome variable) of hypertension was a binary variable coded at 1 = hypertension or 0 = no hypertension. Mediation models are developed through a series of regression models where the direct effect of the independent variable are assessed by regression coefficients and standard errors; the effect of the mediator variable is also assessed by regression coefficients and standard errors, and the indirect or mediated effect is of the independent variable on the outcome variable via the mediator variable is then calculated. The mediator variable that was tested in the current study included the nutrition subscale from the CVRA. We hypothesized that respondents who had lower scores on the nutrition subscale would be more likely to report hypertension. We employed the notation used by MacKinnon [41] (Figure 1) where  $c$  is the direct effect of the independent variable on the outcome;  $b$  is the effect of the mediator variable on the outcome;  $a$  is the effect of the independent variable on the mediator, and  $c'$  is the mediated effect of the independent on the outcome via the mediator variable. A  $z$  score is then calculated to determine the statistical significance of the mediated or indirect effect. All analyses were conducted in SAS 9.3.

## Results

The majority of the respondents had a monthly income of less than or equal to \$500 (52%); 134 (28%) had at least a high school education; 191 (40%) were Black, and the mean age was 40 years ( $SD = 11.93$ ). The significant factors associated with hypertension included being divorced compared to single, being married compared to single, being separated compared to single and ever having used crack cocaine. Scoring higher (each point) on the nutrition subscale was a protective

factor for hypertension. The number of male respondents told that they were hypertensive was higher compared to women ( $n = 76, 23\%$ ), but the proportion of the female respondents was greater ( $n = 49, 32\%$ ; Table 1). This significant finding indicates that in this underserved area of Long Beach, California, women are more likely to suffer from hypertension.

Findings on ethnicity presented in Table 1 also show that a significantly higher number of Black respondents were hypertensive compared to Whites and Hispanics. Individuals with a history of crack cocaine use were significantly more likely to report hypertension (Table 1).

Variable	Hypertension		$\chi^2$
	Yes n%	No n%	
<b>Gender</b>			
Male	76 (60)	248 (70)	3.77*
Female	49 (39)	105 (30)	
<b>Ethnicity</b>			
Black	59 (48)	132 (37)	12.60**
White	45 (37)	111 (31)	
Hispanic	13 (11)	70 (20)	
Other	5 (4)	39 (11)	
<b>Marital status</b>			
Single	52 (42)		42.41***
Married	17 (14)		
Partnered	11 (9)		
Separated	10 (8)		
Divorced	19 (16)		
Other	9 (2)		
<b>Current work situation</b>			
Unemployed, looking	45(37)	124 (35)	19.08**
Unemployed, not looking	26 (31)	49 (14)	
Full time job	12 (10)	42 (12)	
Part time job	4 (3)	40 (11)	
Disabled	32 (26)	63 (18)	
Something else	3 (2)	34 (9)	
<b>Homeless</b>			
Yes	61 (50)	117 (66)	10.16***
No	61 (50)	230 (34)	
<b>Ever used in lifetime</b>			
<b>Marijuana</b>			
Yes	105 (86)	264 (75)	6.43**
No	17 (14)	88 (25)	
<b>Crack</b>			
Yes	69 (57)	146 (41)	8.31**

No	53 (41)	206 (59)	
Note: *p<0.05, **p<0.01, ***p<0.001.			

**Table 1:** Bivariate associations for individuals with and without hypertension, categorical variables.

Concerning the CVRA domains, five areas were assessed—physical activity, social support, negative emotions, nutrition and control over one’s life events. Findings presented in Table 2 showed two out of five areas to be of significance—negative emotions and nutrition. Those

previously told that they were hypertensive expressed significantly higher negative emotions than the normotensives; individuals with hypertension had significantly lower scores on the nutrition subscale.

Variable	Hypertension		t-test
	Yes Mean (SD)	No Mean (SD)	
Age	45.9 (11.61)	39.15 (11.57)	4.92***
<b>CVRA subscales</b>			
Physical activity	14.11 (6.40)	15.04 (5.28)	1.50
Social support	15.41 (7.39)	16.58 (6.65)	1.94
Negative emotions	14.41 (9.70)	11.12 (8.57)	4.12***
Nutrition	9.69 (2.87)	10.85 (3.08)	4.34***
Control	7.95 (3.15)	7.93 (2.51)	.07
Note: ***p<0.001.			

**Table 2:** Bivariate associations for individuals with and without hypertension, continuous variables.

Table 3 shows the bivariate associations between the nutrition subscale score, which was considered as a mediator variable in the

mediation analysis. This table indicates that the nutrition subscale is significantly associated with both hypertension and homelessness.

Variable	Nutrition Subscale Median Split		χ <sup>2</sup>
	Above n%	Below n%	
<b>Homeless</b>			
Yes	42 (24)	136 (76)	8.00**
No	105 (36)	186 (64)	
<b>Hypertension</b>			
Yes	39 (21)	147 (79)	14.37***
No	164 (36)	287 (64)	
<b>Taking medication for hypertension</b>			
Yes	23 (20)	91 (79)	8.95**
No	180 (35)	340 (65)	
<b>Ever used in lifetime</b>			
<b>Marijuana</b>			
Yes	103 (28)	266 (72)	7.47**
No	44 (42)	61 (58)	

Crack			
Yes	56 (26)	159 (74)	4.53*
No	91 (35)	168 (65)	
Other opiates			
Yes	19 (22)	68 (78)	4.19*
No	128 (33)	259 (67)	

**Table 3:** Bivariate associations with nutrition subscale (mediator).

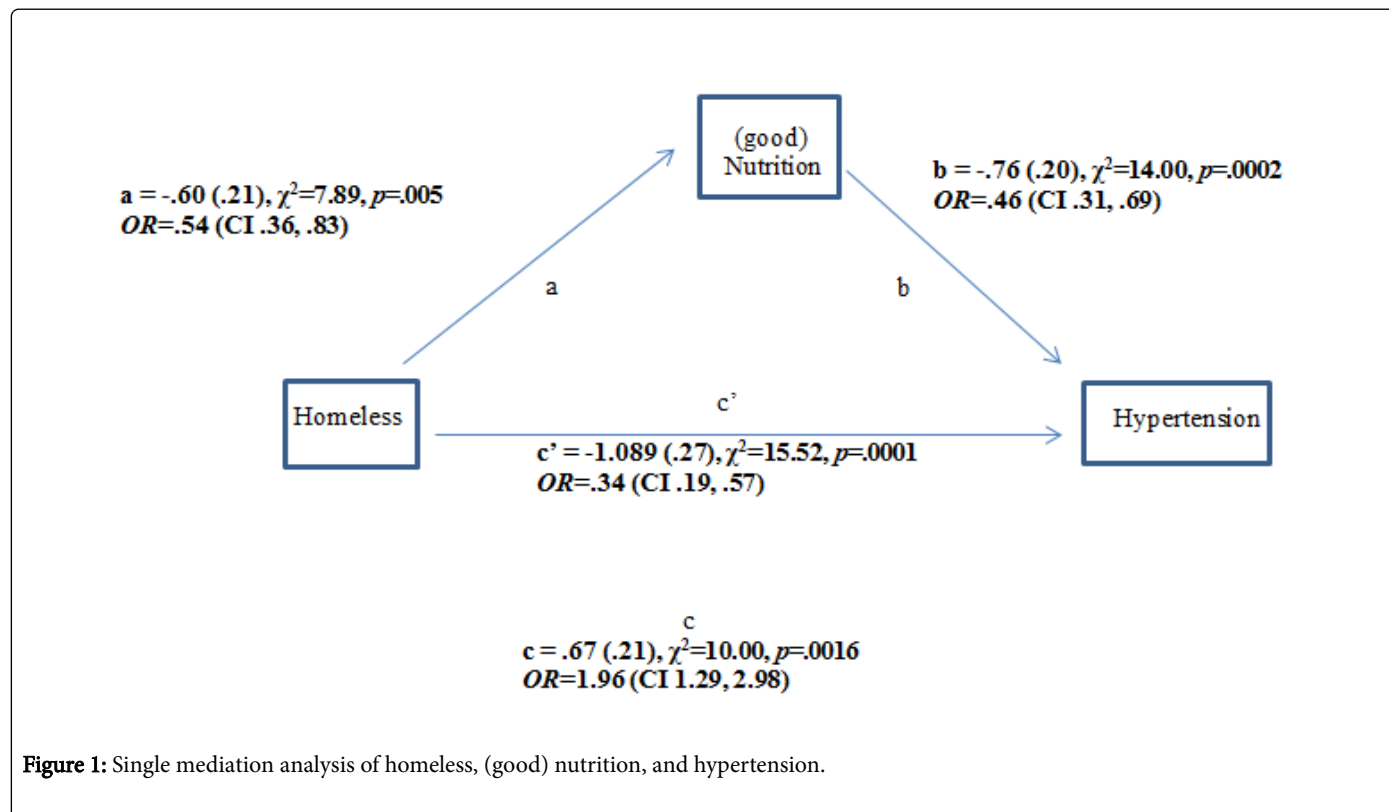
### Mediation analysis

Figure 1 presents the model of how the effect of homelessness on hypertension is mediated by scores on the nutrition subscale. The hypothesis was that those who reported that they were homeless were more likely to have low scores on the nutrition subscale, indicating poor nutrition which then led to hypertension.

Individuals who reported that they were homeless were significantly more likely to also report having hypertension ( $\hat{c} = 0.67$ ,  $s\hat{c} = 0.21$ ,  $\chi^2 = 10.00$ , OR = 1.96). When the effects of the nutrition mediator were

taken into account ( $c' = -1.087$ ,  $sc' = 0.27$ ,  $\chi^2 = 15.52$ , OR = 0.34), the negative parameter estimate (as well as the OR less than 1.0) indicate that good nutrition (higher scores on the nutrition subscale) act as a protective mediator against hypertension for those who are homeless.

This means that nutrition mediated the effect of homelessness on hypertension. The total mediated effect (indirect effect) of nutrition score on hypertension for the homeless was significant ( $\hat{ab}$  (std. err.) = 0.456 (0.106),  $z = 4.24$  (Figure 1).



### Discussion

Results of this study demonstrated that homeless individuals are more likely to report that they have been told they have hypertension. However, when looking at good nutrition as a mediator, the relationship of homelessness and hypertension changes such that good nutrition is associated with an inverse association between homelessness and hypertension.

### Relationship of demographic data to hypertension

One of the significant risk factors for hypertension in the bivariate analysis was being married, divorced or separated in comparison to being single. Not being able to afford to take care of his/her family due to being financially incapable is a major cause of stress [42]. Stress causes adverse physiological changes in the cardiovascular system with the high probability of hypertension, depending on the coping

mechanism of the individual [8]. Similarly, breakup of a marriage for any reason ranks very high in the stressful events in one's life [42].

The fact that the negative emotions subscale was associated with hypertension provides additional support for the relationship between stressful events in one's life, such as being married, divorced, or separated, and not being able to care for their families or for themselves. Stress increases blood pressure. Continuous stress without an adaptive coping mechanism produces hypertension [43].

Being a person of color, especially African American, and being a woman, were significantly associated with hypertension. Many in the sample were homeless which adds to stress levels and increases risk for hypertension. These findings are consistent with existing research studies [9-17].

The other risk factor that was associated with hypertension was the use of crack cocaine. Of the total sample of 474 subjects, 217 (45.7%) had used crack cocaine. Cocaine causes increased blood pressure [44] and is associated with hypertension which can lead to strokes and cardiovascular dysfunction.

Nutrition was a protective factor for hypertension. Results of bivariate analysis shows nutrition (healthy eating) subscale scores were significantly associated with hypertension and homelessness. Our mediational model had nutrition as the mediator. Several studies have shown that the food that homeless people are given and consume is high in fat, high in carbohydrate, low in protein and deficient in fruits and vegetables and essential vitamins and minerals.

This type of a diet is associated with being overweight and undernourished. There have been reports that 46% to 54.8% of homeless persons report chronic conditions, such as obesity, diabetes, hypertension, anemia and other cardiovascular diseases [16].

Providing appropriate nutrition with attendant availability, affordability and ease of preparation of food is an important mediator for homeless people who are at high risk for hypertension and other chronic diseases [34]. Providing nutritious food is a necessary, but not a sufficient, condition for preventing or treating hypertension in homeless population. Increasing the salience of quality nutritious food as opposed to quantity is important in making appropriate food choices.

## Implications

One of the major implications of this study is the importance of good nutrition in the homeless and those living in poor and medically underserved areas. Quality affordable and accessible food that is easy to prepare is essential to treat and prevent hypertension in these populations. Of all the risk factors that homeless and poor people encounter in life that predisposes them to hypertension and other chronic illnesses, our data suggest the importance of nutrition as a critical protective factor.

The problem of homelessness and hypertension is not a unidimensional problem. Providing nutritious, affordable and accessible foods are an essential, but not a sufficient, condition for the long term treatment and prevention of hypertension in homeless and people living in poor socioeconomic and medically underserved environmental conditions.

The other two constructs of personal (demographic) and behavioral determinants of overt actions need also be taken into consideration. From the personal perspective, lack of knowledge about nutritional

values of affordable, accessible, quality foods and their preparation are a few of the barriers for making wise decisions for selecting appropriate foods.

Some interventions have shown the positive effects of involving African American women and supportive social relationships to cushion some of the negative effects of exposure to social and economic adversities among homeless people [45,46]. In addition, homeless individuals with mental illnesses need governmental and institutional help to assist them with chronic illnesses such as hypertension.

## Limitations of the study

One limitation of the study is the cross-sectional nature of the data. Several variables used in the analysis are self-reported, including the outcome variable of hypertension. While the proportion of individuals in the sample who were homeless was sufficient to find the effect of nutrition on hypertension, length of time spent as homeless was not captured. It is possible that longer periods of homelessness could have a stronger effect on hypertension.

The study also did not have information on types of health services the respondents were using and how food insecurity impacts homelessness; studies have shown that the homeless seek services from emergency rooms when they need food [47].

## Conclusion

Future research focused on hypertension in homeless individuals should consider mediation models that control for other health conditions of the respondents [32]. Continued and expanded access to Medicaid [48] and engaging individuals to use primary care in transition clinics [49] should be investigated.

Research has shown that homeless individuals are more likely to have their blood pressure checked and to receive medication for hypertension when they have sought care from an emergency room and are less likely to receive either of these things when they seek care from a physician [50].

The purpose of this study was to determine the correlates of hypertension in homeless and people living in economically underserved areas. Findings showed that homeless and individuals who are married, divorced, separated as opposed to being single, and individuals who are of African-American ethnicity, and female are at high risk for hypertension.

Nutrition was found to be a mediating factor between homelessness and hypertension to cushion the adverse effect of homelessness on hypertension. Implications suggest the need for patient education and for providers of food assistance to the homeless regarding the importance of good nutrition.

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