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ORIGINAL RESEARCH

Association of depressive symptoms and social support on blood pressure among urban African American women and girls

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Abstract

Purpose: The purpose of this study was to explore the associations between depressive symptoms and perceived social support on blood pressure in African American women.

Data sources: This cross-sectional study was conducted among 159 African American women from multiple sites in the Detroit Metro area.

Conclusions: Results from this study found that both higher systolic and diastolic blood pressure were positively associated with higher depressive symptom scores ($r = .20$ and $.18$, $p < .05$). Higher depressive symptoms scores were, in turn, significantly associated with lower social support scores ($r = -.44$, $p < .001$). However, total social support scores were not significantly correlated with blood pressure readings. Higher depressive symptom scores were associated with increased systolic blood pressure independent of social support.

Implications for practice: Findings of the present study suggest the importance of appropriate social support to help alleviate depressive symptoms. However, to effectively control blood pressure in patients with depressive symptoms, other pathophysiologic mechanisms between depressive symptoms and elevated blood pressures independent of social support should be examined in future research. Future studies should consider a cohort design to examine the temporal relationship of depressive symptoms, social support, and blood pressure readings.

Hypertension is an important risk factor for stroke, heart disease, and premature death from cardiovascular complications (Chobanian et al., 2003). African Americans have disproportionately higher rates of hypertension as compared to other ethnic groups in the United States (National Center for Health Statistics, 2006). Serious negative life events and cardiovascular health concerns have been associated with hypertension. Specific risk factors (e.g., heredity, race, gender, age, obesity, smoking, eating salty, or high-fat foods, ongoing stress, high cholesterol, heavy alcohol consumption, diabetes, use of oral contraceptives, lack of social support, sedentary or inactive lifestyle) can increase the likelihood of developing hypertension (Chobanian et al., 2003). Both lower levels of social support and greater presence of depressive symptoms have been linked to increased blood pressure among African Americans (Artinian, Washington, Flack, Hockman, & Jen, 2006; Davidson, Jonas, Dixon, & Markovitz, 2000; Hasin, Goodwin, Stinson, & Grant, 2005; Jonas, Franks, & Ingram, 1997; Jonas & Lando, 2000; Strogatz & James, 1986). Lower social support is also associated with greater presence of depressive symptoms (Klineberg et al., 2006; Miller et al., 2004).

To understand the associations among social support, depressive symptoms, and blood pressures, and whether depressive symptoms are associated with blood pressure readings independent of social support, we first explored the correlations of (a) social support and depressive symptoms, (b) social support and blood pressure readings, (c) depressive symptoms and blood pressure

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readings, and then (d) examined whether depressive symptoms were associated with blood pressure readings after adjusting for social support. This study is important because this knowledge can be incorporated into future research and clinical practice. Effective interventions for blood pressure control could be developed based on valid and reliable evidence for this high-risk population.

Literature review

Relationships between depressive symptoms and hypertension

Researchers have theorized that the autonomic (sympathetic) nervous system hyperactivity seen in patients with depressive symptoms or anxiety has an aggravated effect on elevated blood pressure (Artinian et al., 2006). Davidson et al. (2000) followed 3343 young African American and Caucasian adults (25–35 years old) for 5 years in the Coronary Artery Risk Development in Young Adults (CARDIA) study. Significant findings included an association between depressive symptoms and hypertension among 1537African Americans, while no association was found among 1806 Caucasians. African Americans with high scores ($\geq$16) and medium scores (8–15) on the Center for Epidemiological Studies Depression (CES-D) Scale were at significantly higher risk for developing hypertension than those with low scores ($\leq$7) (odds ratio [OR] = 2.10; $p < .01$and OR = 1.78; $p < .05$, respectively).

The Jonas et al. (1997) study followed 2992 men and women without evidence of hypertension at baseline. Participants were followed for up to 16 years. Findings suggested that high levels of anxiety and depressive symptoms were predictors of hypertension for African Americans between 25 and 64 years of age. For African Americans aged 25–64 years, high anxiety (relative risk [RR] = 2.74; confidence interval [CI] = .95, 1.35, 5.53), and high depression (RR = 2.99; CI = .95, 1.41, 6.33) remained independent predictors of incidence of hypertension, while Caucasians (45–64 years) had lower relative risk for high anxiety (RR = 1.82; CI.95, 1.30, 2.53) and high depression (RR = 1.80; CI = .95, 1.16, 2.78) on predicting the incidence of hypertension.

The first National Health and Nutritional Examination Survey (NHANES-I) followed 3310 men and women without evidence of hypertension at baseline for a maximum of 22 years. Depressive symptoms and anxiety at baseline were associated with a higher risk of developing hypertension, with the highest risk among African American women (Jonas & Lando, 2000). Artinian et al. (2006) found that African American women with higher depressive symptom scores were more likely to have higher diastolic blood pressure (DBP) readings.

Countering evidence on depressive symptoms and hypertension

The relationship between depressive symptoms and hypertension has been examined by researchers for more than 20 years with varying results, and countering evidence has been published (Jones-Webb, Jacobs, Flack, & Liu, 1996; Lenoir et al., 2008; Reiff, Schwartz, & Northridge, 2001; Shinn, Poston, Kimball, St Jeor, & Foreyt, 2001). Shinn et al. followed 508 adults for 4 years and found no association between either depressive symptoms or anxiety and hypertension. In the CARDIA study, Jones-Webb et al. reported that depressive symptoms and anxiety were not related to increases in blood pressure readings in a sample of 4325 African Americans and Caucasians. In the Harlem Household Survey, 695 African American adults, aged 18–65 years old, were followed for 3 years with no association found between depressive symptoms and elevated blood pressure (Reiff et al., 2001). Furthermore, Lenoir et al. found individuals with depression had lower blood pressure readings than people who were not depressed in a large sample of elderly individuals from the general population.

Pathophysiologic mechanisms between depressive symptoms and hypertension

Hypothalamic-pituitary-adrenal (HPA) hyperactivity is manifested by increased corticotrophin-releasing factor (CRF) in cerebrospinal fluid, decreased adrenocorticotropic hormone (ACTH) response to CRF challenge, and failure of dexamethasone to suppress cortisol (Arborelius, Owens, Plotsky, & Nemeroff, 1999; Plotsky, Owens, & Nemeroff, 1998). Hyperactivity of the HPA axis promotes development of cardiovascular disease (CVD). Elevated cortisol can speed the development of atherosclerosis and hypertension and accelerates injury of vascular endothelial cells (Colao et al., 1999; Troxler, Sprague, Albanese, Fuchs, & Thompson, 1977).

HPA hyperactivity augments sympathoadrenal (SA) hyperactivity via central regulatory pathways. This hyperactivity causes an increase in plasma catecholamines that elevates plasma norepinephrine leading to vasoconstriction, platelet activation, and decreased heart rate variability. These factors have been found to increase blood pressure and damage the cardiovascular system (Remme, 1998). These results suggest that effects of depression on HPA and SA hyperactivity may speed development of hypertension. Therefore, depression may be a risk factor for developing hypertension and CVD.

Relationships among social support and depressive symptoms

Depressive symptoms have been associated with low overall social support, as well as social support from friends and family (Klineberg et al., 2006). In a cross-sectional study by Miller et al. (2004), social support was found to be the most important modifiable risk factor for clinically depressive symptoms compared to other factors (e.g., perceived income inadequacy, obesity). Participants who were more likely to report depressive symptoms also indicated they had low family and overall social support as compared to participants who reported fewer depressive symptoms and high social support. Lack of social support that leads to greater depressive symptoms has also been linked to resultant high blood pressure readings among African Americans (Taylor, Washington, Artinian, & Lichtenberg, 2008). The Taylor et al. study found that participants with lower social support had greater symptoms of depression and higher blood pressure readings.

Relationships between social support and hypertension

Rozanski, Blumenthal, and Kaplan (1999) reviewed 15 studies and found that people who reported low levels of social support were at greater risk for developing CVD. Blazer (1982) published similar findings, indicating that low levels of perceived social support were found to be risk factors for developing cardiac events. Other research has suggested that adherence to drug therapy was strongly associated with family support provided to patients with hypertension (Marin-Reyes & Rodriguez-Moran, 2001). The perceived availability of instrumental social support (e.g., financial needs, child care) may help meet material needs and has been found to be negatively and independently associated with depressive symptoms and hypertension among African Americans (Schaefer, Coyne, & Lazarus, 1981; Strogatz & James, 1986).

Purpose

The purpose of this study was to explore the associations among depressive symptoms and levels of social support on hypertension in African American women. Two hypotheses were tested:

I. African American women with lower social support will have higher depressive symptom scores and higher blood pressure readings.
II. African American women with higher depressive symptom scores will have higher blood pressure levels and greater odds of having hypertension than people with lower depressive symptoms scores.

Methods

Participants

A total of 183 African American female participants from the Detroit metropolitan area were screened for participation in the study. Children less than 18 years old were also included because it is important to understand whether the association of high blood pressure, depressive symptoms, and social support occurs early in life among African American women. The final sample size included 159 participants who had completed the questionnaire and met inclusion criteria. Power analysis was calculated using SAS version 9.1 (SAS Institute, NC). The results indicated that 159 subjects were sufficient to generate a power of .80 at an alpha level of .05 on a multiple regression with eight variables (Cohen, 1992). The proposal was approved through the university's internal review board to ensure that this research presented no greater than minimal risk to the children under 18. Additional recruitment strategies included the Institute of Gerontology participant resource pool at Wayne State University, the University of Michigan Women's Health Registry, Alpha Kappa Alpha Sorority Incorporated, and from fliers posted around the Detroit area (Taylor, 2009). Informed consent was obtained from all participants during home visits. Trained interviewers contacted participants via telephone to schedule home visits and conducted the interview on scheduled days.

Inclusion/exclusion criteria

Inclusion criteria for potential participants were self-identification as African American and female. For women with the diagnosis of hypertension, blood pressure readings at the time of data collection had to average 140/90 or higher without taking hypertensive medication. If participants had diabetes, an average blood pressure of 130/80 without medication was indicative of hypertension and was deemed acceptable for participation in this study. Individuals with medically controlled hypertension because of taking antihypertensive medications were included in the study. Participants with normal blood pressure readings were also included in the sample and in statistical calculations.

Exclusion criteria included having a secondary hypertension, co-morbidity of substance abuse, mental illness, end-stage cancer, end-stage renal disease, or other terminal illness. Information about prior history of depressive symptoms was not obtained in this study. Information

regarding participant's history of depression or depressive symptoms was not obtained.

Measures

Blood pressure, height, and weight. A digital blood pressure monitor was used to measure blood pressure with a size-appropriate upper arm cuff. This blood pressure device was inspected and calibrated at least every 6 months to ensure appropriate functioning and accuracy. Blood pressure measurements represented an average of three seated blood pressure readings. The procedures for measuring blood pressure were in accordance with standard recommendations (Chobanian et al., 2003). Each of the three blood pressure readings was taken 5 min apart. Weight was measured by an electronic scale and height by portable stadiometer. Participants did not wear shoes for either height or weight measurements.

Questionnaires. The demographic survey was intended to obtain information from participants, including age, gender, educational level, household income, marital status, employment status, number of children, and extensive family history of hypertension. The participants were asked to respond in yes/no forced choice format if they had been prescribed antihypertensive medication. If yes, the participant was asked to indicate the name and dosage of medication as prescribed. Adherence to medication regimen was not tested in this study. Participants self-reported these data, with no attempts made to further verify their responses.

Center for Epidemiological Studies of Depression (CES-D) scale. The 20-item CES-D scale, developed by the National Institute of Mental Health Center for Epidemiological Studies, was used to measure symptoms of depression (Radloff, 1977). The scale assessed the frequency and severity of depressive symptoms during the past week. The CES-D has been deemed reliable and valid in previous research (Hann, Winter, & Jacobsen, 1999). The 20 items were scored on a 4-point scale from 0, "rarely or none of the time (< 1 day)" to 3, "most or all of the time (5–7 days)." The responses were summed, with possible scores ranging from 0 to 60. A score of 16 or higher was considered high depressive symptoms, a level which has been used by other investigators and was used in the analysis of this study (Goldberg, Van Natta, & Comstock, 1985). The cut offs for these three subgroups were: 0–6 low symptoms of depression, 7–15 medium or moderate symptoms of depression, 16 or greater indicated the highest propensity for symptoms of depression. The alpha of .83 in the present study was slightly lower than Radloff's (1977) finding (alpha = .85).

Multidimensional scale of perceived social support MSPSS. Social support was assessed using the MSPSS (Zimet, Powell, Farley, Werkman, & Berkoff, 1990). This scale consisted of 12 items that measure the extent of social support received from three specific sources: friends, family, and significant others. Each item was scored on a scale ranging from 1 (*very strongly disagree*) to 7 (*very strongly agree*). Summation of the 12-item scores provided a possible total score ranging from 12 to 84 for overall social support, with higher scores corresponding to higher levels of social support. The cut offs for these three subgroups were 12–60, low; 61–74, medium; 75 or greater, high. The 12 items were divided into three different subclasses (family, friends, significant others) to investigate how each source was differentially related to the outcome. Reliability and validity of the MSPSS has been demonstrated in different ethnic groups (Canty-Mitchell & Zimet, 2000; Clara, Cox, Enns, Murray, & Torgrudc, 2003). A Cronbach's alpha of .89 obtained for the present study was slightly lower than found by Canty-Mitchell & Zimet (2000) in their study of urban adolescents (alpha = .93).

Data analysis

The questionnaires were coded and entered by two research staff into two separate data spreadsheets. The two research staff members were familiar with this project and involved in data collection. The two spreadsheets were crosschecked for accuracy and all errors were corrected prior to starting the statistical analysis. SAS version 9.1 (SAS Institute, NC) was used to analyze the data using Pearson product moment correlations, multiple linear regression models, and logistic regression models. Pearson product moment correlational analysis was used to examine the intercorrelations among blood pressure, CES-D, and social support to test the hypotheses (I) that African American women with lower social support will have higher depressive symptoms scores and higher blood pressure readings and (II) that African American women with higher depressive symptoms scores will have higher blood pressure readings than people with lower depressive symptoms scores. Multiple linear regression analyses were used to examine the association between depressive symptoms scores and blood pressure readings after adjusting for age, body mass index (BMI), income, education, antihypertensive medication, and social support. Finally, logistic regression models were used to test hypothesis II that African American women with higher depressive symptom scores will have greater odds of having higher blood pressure readings than people with lower depressive symptoms scores. This analysis strategy was used to explore the association of hypertension and depressive symptoms after adjusting for age, BMI, income, education, and social support. The

adjusting variables in the regression model included age (continuous), BMI (categorical: BMI < 25 = normal weight, 25–29 = overweight, 30 or greater = obese), education level (categorical: high school/less, some college/associate degree, bachelor's, or higher), household income (categorical: <$20,000, $20,000–$39,999, $40,000–$59,999, ≥$60,000), marital status (categorical: single, married, divorced/separated, widowed), number of children (categorical: none, one, two, three, or more), employment (categorical: working, retired, not working), health insurance (yes = 1/no = 2), and antihypertensive medication (categorical: yes = 1/no = 2). No interaction of depressive symptoms and social support on blood pressure was found in these analyses. All analysis results were considered as statistically significant at alpha level <.05.

Results

Description of the sample

The majority of the 159 women (n = 53, 33.3%) in the sample were between 40 and 59 years of age, with the second largest group between the ages of 20 and 39 (n = 48, 30.2%). The mean age of the women was 46.69 years old (SD = 19.84; see Tables 1 and 2). The majority of participants reported having at least a high school education or greater. Household income ranged from less than $10,000 to more than $80,000, with most respondents (30.2%) reporting incomes between $20,000 and $39,999. The majority of the sample (71.1%) was single/not married. Approximately 80% reported having at least one child and the majority of participants (50.9%) reported they were employed. The majority of the participants in the study had a diagnosis of hypertension (62.9% hypertensive vs. 37.1% normotensive, respectively).

Table 1 Demographic characteristics among African American women

Demographic characteristics (N = 159)	Number	Percent
Age		
13–19 years	15	9.4
20–39 years	48	30.2
40–59 years	53	33.3
60 years and over	43	27.1
Educational level		
High school graduate or less	45	28.3
Some college	60	37.7
Bachelor's degree or higher	54	34.0
Marital status		
Single/never married	57	35.9
Married	43	27.0
Divorced/separated	37	23.3
Widowed	19	11.9
Missing data	3	1.9
Total household income		
Less than $20,000	44	27.7
$20,000 to $39,999	48	30.2
$40,000 to $59,999	31	19.5
≥ $60,000	36	22.6
Employment		
Working	81	50.9
Retired	33	20.8
Not working	45	28.3
Number of children		
None	33	20.7
One	24	15.1
Two	45	28.3
Three or more	57	35.9
Health Insurance		
Yes	144	90.6
No	15	9.4
Hypertension[a]		
Yes	100	62.9
No	59	37.1

[a]For age ≥21(mothers), hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥ 90 mmHg or taking antihypertensive medication. For age <21(daughters), hypertension was defined based blood pressure percentile rankings in the fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents.

Description of health-related factors

The majority of the women reported that they had health insurance (90.6%; Table 1). The mean BMI of the African American women was 32.06 (SD = 8.19) kg/m^2; Table 2). The average systolic blood pressure (SBP) and diastolic blood pressure (DBP) readings were 135 (SD = 21) mmHg and 82 (SD = 12) mmHg, respectively (Table 2).

Description of CES-D and MSPSS scales

The mean CES-D score in this population was 12.56 (SD = 10.10) with a range of scores from 0 to 45 (Table 2). Scores of 16 or greater indicated greater depressive symptoms. In this sample, 53 (33.3%) participants were categorized as having greater depressive symptoms. The social support scores ranged from 12 to 84, with a mean of 65.4 (SD = 14.96; Table 2).

Correlation analyses

CES-D scores were significantly correlated with both systolic (r = .20, $p \leq$.05) and diastolic (r = .18, $p \leq$.05) blood pressure (Table 3). No statistically significant correlations were found between blood pressure and social support scores, with the exception of the "*significant others subscale*" (r = –.18, $p \leq$ .05) which was negatively correlated with systolic blood pressure (Table 3).

Table 2 Descriptive statistics of age, BMI, blood pressure, CES-D score, and social support score among African American women ($N = 159$)

Variable	Number	Mean	SD	Median	Range	
					Minimum	Maximum
Age (years)	159	46.69	19.84	46.00	13.00	93.00
BMI (kg/m^2)	159	32.06	8.19	30.00	18.00	56.00
Systolic BP (mmHg)	159	135.18	21.33	130.67	97.00	203.67
Diastolic BP (mmHg)	159	81.80	12.04	80.00	55.33	132.00
CES-D	159	12.56	10.10	10.00	.00	45.00
Low	56	3.09	2.05	3.00	.00	6.00
Medium	50	10.88	2.59	10.00	7.00	15.00
High	53	24.15	7.94	23.00	16.00	45.00
Social support	159	65.40	14.96	69.00	12.00	84.00
Low	52	47.69	11.02	49.50	12.00	60.00
Medium	54	68.41	4.17	69.00	61.00	74.00
High	53	79.72	3.40	79.00	75.00	84.00
Social support—family	159	22.86	5.75	25.00	4.00	28.00
Social support—friend	159	21.60	6.01	22.00	4.00	28.00
Social support— significant others	159	20.94	7.68	24.00	4.00	28.00

A statistically significant negative correlation was found between scores for depressive symptoms and social support ($r = -.44$, $p \leq .001$). Similar findings were obtained for the correlations between scores for depressive symptoms and social support by family ($r = -.36$, $p \leq .001$), friend ($r = -.34$, $p \leq .001$), and significant others ($r = -.31$, $p \leq .001$).

Hypothesis testing

Hypothesis I. Women with lower social support will have higher depressive symptom scores and higher blood pressure levels. Table 3 displays the negative correlations between depressive symptoms and social support that partially supported the first part of hypothesis I, indicating that participants in the study with lower social support tended to have higher CES-D scores. However, the social support subscale *significant others* was negatively correlated with systolic blood pressure. Based on the findings, the null hypothesis was partially rejected. Generally, social support was not statistically significantly related to either systolic or diastolic blood pressure.

Hypothesis II. Women with higher depressive symptom scores will have higher blood pressure levels and greater odds of having hypertension than people with lower depressive symptoms scores. Table 4 shows that women with high and medium category CES-D scores had higher systolic blood pressure compared to those with low CES-D scores. Women with a medium CES-D score had higher diastolic blood pressure compared to women with lower CES-D scores (Table 5). Women with higher depressive symptom scores had greater odds of having hypertension (Table 6). These findings also were found to be statistically significant after controlling for other variables (e.g., age, income, education, BMI, and social support). These data support hypothesis II.

Multiple linear regression analyses

Multiple linear regression models were used for advanced analysis to adjust for confounding variables. After adjusting for age, BMI, education, income, and antihypertensive medication, regression models showed

Table 3 Intercorrelations between blood pressure, CES-D, and social support ($N = 159$)

Measure	1	2	3	4	5	6	7
1. Systolic BP	–						
2. Diastolic BP	.54***	–					
3. CES-D	.20*	.18*	–				
4. Social support	−.10	−.09	−.44***	–			
5. Social support—family	.05	.04	−.36***	.74***	–		
6. Social support—friend	−.07	−.12	−.34***	.80***	.54***	–	
7. Social support—significant others	−.18*	−.08	−.31***	.77***	.27**	.37***	–

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 4 Multiple linear regression analysis of systolic blood pressure associated with CES-D and social support after adjusting for age, BMI, income, education, and antihypertensive medication ($N = 159$)[a]

	Model 1		
Variable	*B*	*SE B*	*β*
Age	.41	.09	.38***
BMI[b]			
>30	9.33	4.47	.22*
25–30	5.60	4.94	.12
<25	0	0	0
CES-D			
High	10.44	4.21	.23*
Medium	10.27	3.98	.22*
Low	0	0	0
Social support			
High	−3.10	4.42	−.07
Medium	−.71	3.98	−.02
Low	0	0	0
R^2		.27	
F		4.10***	

[a]Controls are age, BMI, income, education, and antihypertensive medication. Education, income, and antihypertensive medication are omitted from the table because they are not significant.

[b]Body mass index (BMI) is measure in kg/m^2. BMI equal to 25 and over is considered overweight, with BMI outcomes equal to and greater than 30 indicative of obesity.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 5 Multiple linear regression analysis of diastolic blood pressure associated with CES-D and social support after adjusting for age, BMI, income, education, and antihypertensive medication ($N = 159$)[a]

	Model		
Variable	*B*	*SE B*	*β*
Age	.05	.06	.08
Education			
Bachelor's or higher	5.01	2.68	.20
Some college/associate degree	4.60	2.45	.19
High school/less	0	0	0
CES-D			
High	4.16	2.64	.16
Medium	5.98	2.50	.23*
Low	0	0	0
Social support			
High	−1.67	2.78	−.07
Medium	−1.83	2.50	−.07
Low	0	0	0
R^2		.10	
F		1.19	

[a]Controls are age, BMI, income, education, and antihypertensive medication. BMI, income, and antihypertensive medication are omitted from the table because they are not significant.

*$p < .05$, **$p < .01$, ***$p < .001$.

significant association between systolic blood pressure and CES-D score (Table 4). This statistically significant association was found even after adjusting for the social support. Among the three subcategories within the CES-D scale, people who scored in the high and medium categories had significantly higher systolic blood pressure compared to those scoring in the low CES-D category (Table 4). However, only the medium category of CES-D provided a statistically significant association with higher diastolic blood pressure even after adjusting for social support (Table 5). No statistically significant associations were found between systolic blood pressure and social support or subscale of social support after adjusting for age, BMI, education, and income. Similar results were found between diastolic blood pressure and social support. Although depressive symptoms (CES-D score) and social support were correlated with each other, no interaction was found in the multiple regression models.

Both age and BMI were found to be statistically significantly associated with systolic blood pressure (Table 4), indicating older participants and those whose weight was in the obese category had higher systolic blood pressure. This association was not found with diastolic blood pressure. Level of education was the only demographic variable that was shown to have a statistically significant association with diastolic blood pressure.

Logistic regression analyses

A statistically significant correlation was found between CES-D scores and blood pressure and between CES-D scores and social support (Table 3). In the logistic regression analyses, CES-D scores were found to be significantly associated with hypertension; however, social support was not found to be related to hypertension (Table 6). The CES-D score was found to be significantly associated with hypertension even after controlling for social support (Table 6). After adjusting for demographic variables such as age, household income, BMI, education, and social support, women with high scores ($\geq$ 16) on the CES-D scale were at greater risk for high blood pressure readings compared to those with low CES-D scores (Table 6). In addition, those with medium scores (7–15) on CES-D scale were at higher risk for hypertension compared to those with low CES-D score. No interaction was found between CES-D and social support in this model.

Limitations of the study

Because this study only recruited African American women, the findings may not be generalizable to women

Table 6 Logistic regression analysis of hypertension associated with CES-D and social support after adjusting for age, BMI, income, and education ($N = 159$)[a]

	Model		
Variable	*B*	*SE B*	e^B
Age/10[b]	.06***	.01	1.07
Income			
$60,000	−1.78*	.69	.17
$40,000–$59,999	−.22	.63	.80
$20,000–$39,999	−.88	.61	.42
<$20,000	0	0	1
CES-D			
High	1.30*	.57	3.67
Medium	1.10*	.54	3.01
Low	0	0	1
Social support			
High	1.11	.61	3.02
Medium	.90	.54	2.46
Low	0	0	1
χ^2		57.05	
df		12	

[a]Controls are age, education, income, and BMI. Education and BMI are omitted from the table. Hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥ 90 mmHg or taking antihypertensive medication (coded as 1 = yes and 0 = no).
[b]Age/10 = age in 10 year units.
*$p < .05$, **$p < .01$, ***$p < .001$.

of other ethnic groups or men. Further, the study population was from a particular urban area. Therefore, women from other geographic areas (suburban and rural), as well as urban areas that differ in social, economic, and environmental factors than Detroit, may have varied experiences that were not examined in this study. The data for the present study were collected one time. Future studies should consider using a longitudinal design and include larger sample size to allow following normotensive and hypertensive individuals with and without depressive symptoms at baseline to examine changes in the relationship between depressive symptoms and hypertension.

Discussion

Findings of the present study offer several substantial additions to the existing literature. First, findings from this study were consistent with previous studies that reported significant relationships between depressive symptoms and hypertension (Artinian et al., 2006; Davidson et al., 2000; Jonas & Lando, 2000; Jonas et al., 1997) and an inverse relationship between depressive symptoms and social support (Klineberg et al., 2006; Miller et al., 2004). In addition, our results indicated that depressive symptoms remained a significant factor for elevated blood pressures even after adjusting for social support and other risk factors (i.e., age, BMI, income, and education), which has not been found in other studies. This finding suggested that to effectively control blood pressures among patients with a higher level of depressive symptoms, other pathophysiologic mechanisms between depressive symptoms and elevated blood pressures besides social support should be examined in future research.

The use of instruments to assess depressive symptoms and social support is not consistent in the literature. Three of four studies that found an association between depressive symptoms and blood pressure used the CES-D scale to assess depressive symptoms as was done in the present study (Jonas et al., 1997; Davidson et al., 2000; Artinian et al., 2006). One study used the Cheerful versus Depressed scale (GWB-D) that assessed unhappiness, sadness, discouragement, hopeless, and lack of cheerfulness, and might not be comparable to the findings in the present study (Jonas & Lando, 2000). The MSPSS and CES-D instruments were used to examine the association between depressive symptoms and social support. However, one study used the MSPSS to assess social support, and the Strengths and Difficulties Questionnaire to measure depressive symptoms (Klineberg et al., 2006). Another study assessed depressive symptoms using the CES-D, but used the Medical Outcomes Study (MOS) Social Support Survey for assessing social support (Miller et al., 2004). The MOS Social Support Survey, a multidimensional self-administered instrument, measured various functional dimensions of social support. The MOS is a different quantitative measurement than the MSPSS. The present study is one of the first studies to use the CES-D and MSPSS for examining the association between depressive symptoms and social support.

Studies with countering evidence

The findings of the present study are contradictory to earlier reports that suggested no or an inverse association between depressive symptoms and hypertension (Jones-Webb et al., 1996; Lenoir et al., 2008; Reiff et al., 2001; Shinn et al., 2001). Several possible reasons have been suggested for these varying results. First, a higher percentage of younger adults were included in those earlier studies compared to the present study. Younger participants were less likely to develop high blood pressure and greater depressive symptoms compared to older adults (Jones-Webb et al., 1996; Shinn et al., 2001). For example, in the CARDIA study, all participants were less than 41 years old, while only 39.6% of the participants were less than 40 years old in the present study

(Jones-Webb et al., 1996). Furthermore, the contradictory evidence in the two CARDIA studies that were conducted 4 years apart could be because of different age ranges and different study design. The supportive evidence in Davidson et al. (2000) included a study sample aged 25–35 years old and followed for 5 years, while the contrary evidence in Jones-Webb et al. included a sample aged 21–41 years with a cross-sectional study design. Therefore, this could be a potential explanation for this contradictory because Jones-Webb et al. also included younger adults in their sample who have lower risk to develop high blood pressures until their later life compared to the other sample aged 25–35 years. Also, previous studies have shown that higher blood pressure and depressive symptoms were more common in older populations compared to younger subjects (Fortmann, Haskell, Vranizan, Brown, & Farquhar, 1983; Jones-Webb et al., 1996). In their cross-sectional study design, it is possible that they did not follow the population long enough to detect the association between depressive symptoms and high blood pressures.

Second, this present study only recruited African American women who have been shown to have higher rates of hypertension and experience lower social support compared with women of other ethnic groups (Artinian et al., 2006). Therefore, previous studies that examined other ethnic groups such as Caucasian might have found different associations between depressive symptoms and hypertension compared to those found in the present study (Lenoir et al., 2008).

Third, in previous studies, various study designs and protocols have been used that may have led to different findings that should be discussed carefully. For example, one study mentioned selection bias in their study arising from recruiting healthier participants at the baseline, which may have resulted in Type 1 error (Shinn et al., 2001). Also, the researchers in these studies scheduled longer and more intense interviews for measurements in their respective studies. The present study used a one-time interview that lasted approximately 1–2 h.

Finally, interpreting and comparing results of statistical analyses using variables measured by various instruments was problematic. For example, the Harlem Household Survey uses a 24-item scale based on the Diagnostic Interview Schedule for measuring depressive symptoms and they indicated that using a nonstandardized depression scale was a limitation of their study (Reiff et al., 2001). Although several studies have reported inverse associations between depressive symptoms and hypertension, the underlying mechanisms behind the findings were unclear and need to be examined in future studies (Jones-Webb et al., 1996; Lenoir et al., 2008; Reiff et al., 2001; Shinn et al., 2001).

Complications of social support, hypertension, and depressive symptoms

Only the "*significant others*" subscale of social support was found to be negatively correlated with systolic blood pressure in this study. This result was consistent with previous studies (Blazer, 1982; Rozanski et al., 1999). Findings of the present study implied the importance of appropriate social support to relieve depressive symptoms and prevent the development of CVD. Social support was found to have an inverse association with depressive symptoms both in the present and previous studies. Low levels of social support may result in increased psychological distress leading to greater depressive symptoms in patients with CVDs (Klineberg et al., 2006; Marin-Reyes & Rodriguez-Moran, 2001; Miller et al., 2004; Schaefer et al., 1981). Having depressive symptoms may result in lower social support among African American women. However, the researchers in the present study were not able to examine the causal relationship between depressive symptoms and social support. Based on previous literature, appropriate social support could be beneficial for people with depressive symptoms, CVD, and disease control and recovery. For example, family support was strongly associated with adherence to drug therapy among hypertensive patients (Marin-Reyes & Rodriguez-Moran, 2001). Therefore, interventions targeted at improving social support networks and alleviating depressive symptoms could be beneficial in decreasing blood pressure among African American women.

Implications for practice

Lowering high blood pressure and ultimately decreasing adverse cardiovascular risks in African American women requires a greater understanding of underlying social inequalities and mental health needs that adversely affect overall health. Depressive symptoms and lack of social support have been linked to several adverse cardiovascular outcomes and are important factors to consider when providing healthcare services to urban African Americans, especially women, with hypertension.

It is imperative for healthcare providers to be cognizant of the relationships between depressive symptoms and hypertension in African American women. Likely, addressing and treating high blood pressure without addressing depressive symptoms will be insufficient to effectively manage hypertension in African American women. Healthcare providers should be encouraged to utilize available depressive symptom screening tools as a part of routine care. Early diagnosis and vigilant management of depressive symptoms and high blood pressure in African American women is important. It is plausible that

treating depressive symptoms may be just as effective as some pharmacological interventions for reducing high blood pressure for some African American women and should be considered when contemplating the management of hypertension in African American women.

Healthcare providers should also consider referring African American women with depressive symptoms and high blood pressure readings to culturally competent treatment services in their community that provide appropriate social support. Findings from this study did not conclude social support was statistically significantly related to blood pressure readings. However, there was a significant inverse relationship between social support and depressive symptoms. Increasing African American women's perceived social support may decrease depressive symptoms, which could result in lower blood pressure. Findings of the present study warrant further research. Future studies should consider the temporal relationship of depressive symptoms, social support, and blood pressure using a cohort design. Furthermore, a larger sample with valid biologic measurements such as cortisol would be helpful to understand the pathophysiologic mechanisms between depressive symptoms and elevated blood pressures.

Conclusion

Findings of the present study were consistent with previous studies that reported significant relationships between depressive symptoms and hypertension and an inverse relationship between depressive symptoms and social support. In addition, our results showed that there remained a significant association between depressive symptoms and elevated blood pressures/hypertension after adjusting for social support and other risk factors, which has not been found in other studies. This finding warrant future research to examine the pathways between depressive symptoms and elevated blood pressures for blood pressures control among patients with higher level of depressive symptoms.

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