

Original Research

The Relationship between Socioeconomic Status and Adherence to Antihypertensive Treatment Regimen in a Metropolitan Community Sample of Hypertensive African Americans in New York

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ABSTRACT

Introduction

Low socioeconomic status (SES) is one of the strongest predictors of morbidity and premature mortality worldwide, as well being associated with large increases in cardiovascular disease in both men and women. Uncontrolled hypertension contributes to cardiovascular disparity. Non-adherence to antihypertensive regimens worsens the cardiovascular burden and further widens the health disparity gap. A hierarchical multiple regression study of multiple factors impacting adherence among urban residents in a New York metropolitan region found socioeconomic factors as the strongest factors impacting adherence in this cardiovascular high-risk population.

Methods

Secondary analysis of data of a cross-sectional, correlation design study of a dissertation study, with each of the SES variables analyzed against adherence and self-efficacy variables.

Results

Overall, only three SES variables (years with the same provider, work status and income) were significantly related to adherence and/or self-efficacy. Years with the same provider was related to adherence with correlation of $r_s=0.16$ ($p=0.048$), and to self-efficacy $r_s=2.0$ ($p=0.016$). Work status was related to adherence with difference in adherence scores between retired and unemployed subjects ($KS=38.6$, $p=0.013$ with Bonferroni adjustment; means=3.7 and 3.3, respectively). Work status was not related to self-efficacy scores. Income level was significantly related to the self-efficacy scores, but not the adherence scores. Difference noted between earners <\$10,000/year and >\$80,000/year ($KS=-44.2$, $p=0.037$, with Bonferroni adjustment; means=3.06 and 3.51, respectively).

Discussion

Low socioeconomic status and non-adherence to antihypertensive regimens remain important factors which worsen cardiovascular health and widen health disparity health gaps. This is evident among the cardiovascular high-risk persons of African descent including those residing in the New York metropolitan regions. Self-efficacy is implicated as a mediating variable between income and adherence. The inverse relationship between fulltime work status and adherence was no longer noted. Further investigation on the associations between income, full time status and adherence among young, hypertensive Blacks/African Americans; as well as self-efficacy mediating effects on income and adherence is recommended.

Keywords

Socioeconomic status or poverty or low income; Adherence or compliance; Hypertension treatment or hypertension therapy; Blacks or African Americans.

INTRODUCTION

Low socioeconomic status (SES) is one of the strongest predictors of morbidity and premature mortality worldwide,¹ and associated with large increases in cardiovascular disease in both men and women.² With rising prevalence of many chronic disease risk factors, the global burden of cardiovascular diseases is expected to increase, particularly in the low- and middle-income countries where over 80% of all cardiovascular diseases (CVD) deaths occur.³ In high-income countries, an inverse association between SES and CVD risk results from the high prevalence, and compounding effects of multiple behavioral and psychosocial risk factors in people of low SES. Psychosocial factors, inequalities in health services, and the influence of area of residence strengthen these relationships.² SES refers to a wide range of factors that affects the quality of health care a patient receives, and includes educational level, health literacy, income level, employment status, insurance status and ability to access care.^{4,5}

Low social economic factors have long been linked to cardiovascular health disparity.⁶ In the United States, disparities in racial and socioeconomic-related CVD mortality are noted between Blacks/African Americans and their racial counterparts. Between 1969 and 2013, CVD mortality rates decreased by 2.66% per year for whites and 2.12% for Blacks. In 2013, Blacks/African Americans had 30% higher CVD mortality than Whites and 113% higher mortality than Asians/Pacific Islanders.³

Hypertension is the strongest modifiable risk factor for CVD worldwide,⁷ a global public health issue, and contributes to cardiovascular morbidity, premature mortality and disability.⁸ Similar to other health disparities like obesity and diabetes mellitus, Blacks/African Americans have higher prevalence of hypertension, lower rates of controlled hypertension and higher incidences of hypertension-related morbidity and mortality than other ethnic groups.^{9,10} For example, compared to Whites, Blacks/African Americans have a 30% greater rate of nonfatal stroke, 80% greater rate of fatal stroke, and a 420% greater rate of end-stage kidney disease.¹¹ The prevalence of hypertension in Blacks in America is the highest in the world; it develops at an early age, progresses quickly and is not easily controlled.¹⁰ However, non-adherence is an increasing challenge.

Socioeconomic factors impact hypertension control with respect to diagnosis, treatment, and patient's access and long-term adherence to recommended treatment regimens, and studies suggest that patients with lower SES receive fewer preventive services, lower rates of use of evidence-based therapies, and fewer indicated interventions such as coronary angiography and organ transplantation.¹²⁻¹⁴ The World Health Organization (WHO) Global Action Plan for the Prevention and Control of non-communicable diseases (NCDs) targets seven major health risk factors, including insufficient physical activity, current tobacco use and raised blood pressure, for reducing premature mortality from non-communicable diseases by 25% by 2025. Despite being one of the strongest predictors of morbidity and premature mortality worldwide, low socioeconomic status was not included among

modifiable risk factors. Authors have suggested that socioeconomic adversity be included as a modifiable risk factor in local and global health strategies, policies, and health-risk surveillance.¹⁴ Clinicians are advised to address the association between SES and CVD by incorporating SES into CVD risk calculations and screening tools; as well as reducing behavioral and psychological risk factors through effective primary and secondary prevention. In addition, multidisciplinary approaches to assess inequalities in healthcare delivery and outcomes through health equity audits are advised.²

In essence, socioeconomic status, uncontrolled hypertension and non-adherence to recommended hypertension treatment regimens seem to worsen the cardiovascular burden noted among the cardiovascular high-risk Black/African American groups, further widening the health disparity gap. Self-efficacy (also investigated in the parent study) has been found as an important, as well as mediating variable with respect to adherence to antihypertensive regimens among African American subjects.¹⁵ This paper presents a secondary analysis of data of a recent dissertation study to further describe the noted strong relationships between socioeconomic factors and hypertension treatment adherence in persons of African descent residing in a metropolitan region of NY in the United States.¹⁶ Self-efficacy variable (investigated in the parent study) will be included as an additional outcome variable to evaluate results.

A meta-analysis of 51 studies on socioeconomic status and hypertension published in English,¹⁷ found an overall increased risk of hypertension among the lowest SES for all three indicators: income [pooled odds ratio (OR) 1.19, 95% confidence interval (CI) 0.96-1.48], occupation (pooled OR 1.31, 95% CI 1.04-1.64) and education (pooled OR 2.02, 95% CI 1.55-2.63). The associations between these variables were significant in high-income countries; the increased risk of hypertension for the lowest categories of all SES indicators was most evident for women, with men having less consistent associations.

In many countries, socioeconomic status and mortality have been found to be comparable. For example, data from more than 1.7 million individuals in 48 independent cohort studies from seven countries and found that the independent association between socioeconomic status and mortality is comparable in strength and consistency to those of six 25×25 risk factors (tobacco use, alcohol consumption, insufficient physical activity, raised blood pressure, obesity, diabetes).¹ This study was considered one of the largest studies to date to examine the association between socioeconomic status and premature mortality and the first large-scale investigation to directly compare the importance of socioeconomic circumstances as determinants of health with six major risk factors targeted in global health strategies for the reduction of premature mortality. Based on their findings, the authors suggested that socioeconomic adversity be included as a modifiable risk factor in local and global health strategies, policies, and health-risk surveillance.

A stratified analysis of a cross-sectional survey in urban clinics of twelve low- and middle-income countries (N=2198)

showed significantly worse antihypertensive medication adherence in low-income countries (based on wealth index) ($p < 0.001$) compared to middle income countries.¹⁸ Demographics, treatment, clinical data and self-reported adherence questionnaire were collected by physicians. Factors associated with low adherence were investigated using logistic regression with a random effect on countries. Overall, 678 (30.8%), 738 (33.6%), 782 (35.6%) participants had respectively low, medium and high adherence to antihypertensive medication. Multivariate analysis showed that the use of traditional medicine (OR: 2.28, 95% CI [1.79-2.90]) and individual wealth index (low *vs.* high wealth: OR: 1.86, 95% CI [1.35-2.56] and middle *vs.* high wealth: (OR: 1.42, 95% CI [1.11-1.81]) were significantly and independently associated with poor adherence to medication. In addition, 26.5% of the patients admitted having stopped their treatment for financial reasons, with the proportion being 4-fold higher in the lowest than highest wealth group (47.8% *vs.* 11.4%) ($p < 0.001$).¹⁸

Even in countries that provide publicly funded comprehensive medical coverage, cardiovascular mortality is linked to socioeconomic status. For example, in an earlier prospective cohort study of 3407 patients hospitalized for acute myocardial infarction (MI) in 53 large-volume hospitals Canada between December 1999 to February 2003, income was strongly and inversely correlated with 2-year mortality rate (crude hazard ratio for high-income *vs.* low-income tertile, 0.45 [95% CI, 0.35 to 0.57]; $p < 0.001$). Age, past cardiovascular events, and current vascular risk factors, however, accounted for most of the income–mortality gradient after acute MI.¹⁹

Psychosocial factors seem to be the driving force of the relationships between socioeconomic factors and adherence.^{14,16} For example, in a cross sectional study of randomly selected hypertensive patients (N=992) under a comprehensive cardiovascular health program, the associations of education, income, diabetes, obesity, physical activity, psychosocial characteristics, smoking, and alcohol abuse with blood pressure control and adherence were evaluated by multivariate logistic regression.¹⁴ Uncontrolled blood pressure was significantly associated with low family income, high emotional-stress-depression score and sedentary life style, among other factors.

Self-efficacy theory is a commonly used behavioral theory in other chronic diseases like diabetes mellitus, depression, and heart failure. Some authors report self-efficacy as a significant and well-documented patient-related factor among patients undergoing treatment, often associated with medication adherence in hypertensive Blacks.²⁰⁻²² Hence, self-efficacy, one of the variables studied in the original study, is hereby included in this secondary analysis study.

In summary, the literature points to the important role which social economic status plays, particularly with respect to disparity in cardiovascular health morbidity and mortality. In consideration of similar relationships found between socioeconomic status and adherence in the original dissertation study, this second-

ary analysis of data is being conducted to describe the relationships in greater detail.

Conceptual Model

The biopsychosocial model of illness and health guided the original study.²³ The core assumption central to the biopsychosocial model is the belief that illness is not just the result of discrete pathological processes but can be meaningfully explained in terms of personal, psychological and socio-cultural factors.²⁴ Dr. Engel noted that the dominant biomedical model of disease management left no room within its framework for the social, psychological, and behavioral dimensions of illness. He therefore, proposed the framework as an approach which systematically considers the biological, psychological and social factors as well as their complex interactions in understanding health, illness and healthcare delivery. Whereas the traditional biomedical models of clinical medicine focus on pathophysiology and the other biological approaches to disease, the biopsychosocial approach emphasize the importance of understanding human health and illness in their fullest contexts.²⁵

The adaptation to chronic illness framework, an elaboration of the Roy adaptation model for chronic illness²⁶ seem to fit well into this study. Long-term adherence to hypertensive treatment regimens is one of importance in a chronic disease like hypertension, especially when the disease is largely asymptomatic. Adapting to a chronic illness encompass internal and external processes that influence responses and behaviors. An individual uses conscious awareness and choice to allow for creative personal and environmental integration.²⁷ The goal in living with a chronic illness becomes one of recognizing the realities imposed by the illness and restructuring self and the environment amid the new realities of living with the new experience. Psychosocial factors and perception of the impact of illness are as important as physiological factors in adaptation. In the adaptation to chronic illness model, the focal stimulus is defined as the type and duration of the chronic illness; and the contextual stimuli as demographic characteristics, ability to tolerate stress, hardiness, health promotion behaviors, and participation in health education programs. The regulator and cognator subsystems are the interaction between stimuli and the perceived degree of illness or disability caused by the chronic illness. Physiologic adaptation implies the biological responses to the specific chronic illness and psychosocial adaptation is the personal responses related to self-concept, role function, and social function.²⁸

Hypertension and long-term adherence to recommended treatments seem to fit into the above models. Although the disease may not manifest with obvious physiological symptoms in the earlier stages, the related complications (stroke, myocardial infarction, heart failure, kidney disease, etc.) pose physiological and psychosocial adaptation challenges.^{10,11} The findings of the parent study points to the socioeconomic and psychological factors as significant determinants of adherence in the hypertensive Black/African Americans under study.¹⁶

METHODS

This paper presents a secondary analysis of data originally conducted¹⁶ to determine the effects of biopsychosocial factors on adherence to a hypertension treatment regimen in persons of African descent in the United States (US). The results of that study found that the strongest relationships were between socioeconomic factors and adherence. The analysis published in this paper serves to describe that relationship in greater detail.

The procedure employed in collecting data in the original study involved a review for human subjects' protection and approval by the Adelphi University (Garden City, NY, USA) Institutional Review Board (IRB). The subjects comprised a convenience sample of individuals residing in 21 neighborhoods with a high concentration of residents of African descent, in the New York metropolitan region. Subjects were solicited by the researcher for participation in the study at a number of free blood pressure screening fairs and through flyers at local houses of worship and libraries. The study's recruitment criteria specified individuals of African descent and a history of hypertension treatment. The data was collected through self-administered questionnaires without personal identifiers in order facilitate confidentiality. Those that participated received a \$5 gift card to a well-known coffee shop chain.

Sample Size Estimation

To determine the necessary sample size for a correlation test with power of 0.80, alpha of 0.05, a medium effect size, and a two-tailed analysis, a minimum of 89 subjects was calculated.²⁹

Measurement Tools

The outcome variables were measured using two scales. The first is the hill-bone compliance to high blood pressure therapy scale (HBCHBPTS).³⁰ The original scale consisted of 14 items. For the purpose of this study, a modified 10-item, 4-point Likert scale using Black, urban, hypertensive, South African outpatients, with a demonstrated reliability of Cronbach alphas between 0.74 and 0.84 was used.³¹

The second outcome variable (self-efficacy) was measured using a 13-item tool, 4-point Likert scale: medication adherence self-efficacy scale-revised (MASES-R).³² This instrument demonstrated good reliability with Cronbach's alpha coefficients of 0.92 and 0.90 at baseline and at 3-months respectively.³²

RESULTS

Treatment of the Data

The sample size consisted of 148 subjects. Among all the items in the questionnaire, only 12 data points were missing (age [8.1% of cases], and number of years with same healthcare provider [1.4% of cases]). In each of those cases, the mean was substituted in place of the missing value. The data was then analyzed for nor-

mality of the distributions of the HBCHBPTS and the MASES-R scales. Using a 95% confidence interval, less than 5% of the data were identified as outliers. As a result, the outliers were not removed in order to maximize the integrity of the data with respect to subjects' responses. A Shapiro-Wilk test of the HBCHBPTS and MASES-R indicated that the distributions are skewed and do not meet the criterion for normality (HBCHBPTS: mean=3.16, median=3.31, sd=0.84, skew=-0.98; MASES-R: mean=3.57, median=3.7, sd=0.40, skew=-1.6). In addition, a review of the histograms of the distributions clearly demonstrated negative skew for both scales. As a result, non-parametric tests were used for all the analyses.

Descriptive Statistics

The majority of subjects are female (70%), African American (32%), employed full-time (55%) and earn less than \$40,000 per

Table 1. Descriptive Statistics of the Sample (n=148)

Variable	N	%
Gender		
Male	43	29.10
Female	105	70.90
Race/Ethnicity		
Black/American	48	32.40
Black/Caribbean	34	23.00
Black/African	50	33.80
Black Hispanic	2	1.40
Black/Other	6	4.10
Black Multiple	8	5.40
Work Status		
Full-Time	82	55.40
Part-Time	16	10.80
Retired	32	21.60
Freelance	0	0.00
Unemployed	18	12.20
Income/Year		
<\$10,000	37	25.00
\$10,001-\$20,000	21	14.20
\$20,001-\$40,000	25	16.90
\$40,001-\$80,000	33	22.30
\$80,001 or more	32	21.60
Insurance Status		
Private Insurance	70	47.30
Medicare	30	20.30
Medicaid	32	21.60
No insurance	6	4.10
Multiple	10	6.80
Marital Status		
Married/Common-law	85	57.40
Separated	10	6.80
Widowed	10	6.80
Single	33	22.30
Divorced	10	6.80

year (56%). Most have proprietary insurance or Medicare (67%) and are married or live with a partner (57%). See Table 1 that summarizes the demographic statistics.

Univariate and Bivariate Analyses

The Mann-Whitney U and Kruskal-Wallis tests were used for univariate analyses and the Spearman correlation was used for bivariate analyses. Among all the demographic variables, only 3 indicated statistical significance. Of note, no significant relationships were found with respect to insurance type or marital status.

- Both, the HBCHBPTS and the MASES-R scores were significantly related to the number of years the subject received treatment from the same healthcare provider. The subjects indicated affiliation with their current provider for a mean of 8.9-years with a standard deviation of 6.9-years and a range from 0 to 27-years. The relationship of this variable to the HBCHBPTS indicated a small effect size with a correlation of $r_s=0.16$ ($p=0.048$), and to the MASES-R found a small-medium effect size with an $r_s=2.0$ ($p=0.016$).
- Work status was significantly related to HBCHBPTS scores with respect to the difference between retired and unemployed subjects ($KS=38.6$, $p=0.013$ with Bonferroni adjustment; means=3.7 and 3.3, respectively). Work status was not found to be related to MASES-R scores.
- Income level was significantly related to the MASES-R scores, but not the HBCHBPTS scores. The only difference in scores was observed between those subjects that earned less than \$10,000 per year and those that earned greater than \$80,000 per year ($KS=-44.2$, $p=0.037$, with Bonferroni adjustment; means=3.06 and 3.51, respectively). See Table 2 that depicts the relationships of the demographics to the HBCHBPTS and the MASES-R.

Table 2. Relationships of Demographics to the HBCHBPTS and the MASES-R²

Analysis	Independent Variables	Test	p-value
1	Number of years treated by same provider ^{1,2}	Spearman Correlation	<0.05
2	Work status ¹	Kruskal-Wallis Test	<0.05
3	Income status ²	Kruskal-Wallis Test	<0.05
4	Insurance type	Kruskal-Wallis Test	NS
5	Marital status	Kruskal-Wallis Test	NS

DISCUSSION AND CONCLUSION

The current paper presents a secondary analysis of data originally conducted to determine the effects of Biopsychosocial factors on adherence to a hypertension treatment regimen in persons

of African descent in the United States.¹⁶ In the current paper, each of the SES variables was analyzed against adherence and self-efficacy. Self-efficacy has been shown to be an important independent as well as a mediating variable impacting adherence among hypertensive African American subjects.¹⁵

The focus of this paper is on socioeconomic factors, the main factors found to impact adherence among the multiple independent factors studied in the parent study. Interestingly, only years with the same provider, work status and income were found to significantly relate to both adherence and self-efficacy in the current analysis. Interestingly, the only these three variables were also found to be related to adherence and self-efficacy (years with the same provider, work status and income) were also found to be related to adherence alone in the parent study. These findings are consistent with the literature. Prior authors found different factors impacting adherence to recommended antihypertensive regimens: financial reasons¹⁸; income and occupation¹⁷; and years with the same provider improved adherence to treatment.¹⁶ The persistence of the relationships between socioeconomic factors and adherence to antihypertensive treatments seem crucial when addressing care among individual with cardiovascular high-risk populations like Blacks/African Americans.

With respect to work status, the current analysis found that being retired was associated with greater adherence, while being unemployed was related to lower adherence. This is consistent with literature. Prior authors have found unemployment as a socioeconomic factor impacting adherence.^{12,17,18} In prior studies that included the young and older age groups, some authors found the trends towards the younger participants being less adherent than the older participants.^{20,33} It is possible that the younger participants are less adherent due to responsibilities with work.

In the current analysis, adherence to therapy among full-time employed subjects was not significantly different than any other category of employment. This is an interesting finding since the parent study showed that participants with full-time work status had significantly less adherence scores than the retired group. It is possible that the other variables, other than employment status which were found to be related to adherence in the parent study, as well other studies in the literature, account for the difference noted in the relationships between full time work status and adherence. Such factors may include work-related stress, insurance status and income.^{16,20,33} Further studies on the impact of employment status on adherence is suggested; particularly among younger hypertensive patients.

Perhaps the most interesting finding in the current analysis is that income was not found to be significantly related to adherence, but to self-efficacy. The KW statistic was negative. The subjects who earned less than 10 k had lower self-efficacy than those that earned 80 k+. This suggests that confidence in adherence to a blood pressure regimen is somehow related to income, even though actual adherence is not. These results were

compared with findings from prior studies. Less income has been linked to less adherence to treatment. When considering sample size, methodology, statistical analysis and potential sample biases, the literature overwhelmingly points to strong relationships between income and adherence. The meta-analysis of 51 studies on the impact of socioeconomic status and hypertension showed an overall increased risk of hypertension among the lowest SES for all three indicators: occupation, education, income [pooled OR 1.19, 95% CI 0.96-1.48], where the associations were also significant in high-income countries.

That the results of the current analysis suggest that income was related to self-efficacy, although not to adherence point to the importance of self-efficacy as both an important determinant, as well as a mediating variable in adherence among Black/African American hypertension patients. A prior study have found that self-efficacy mediated the relationship between depressive symptoms and medication adherence¹⁵; another study found that self-efficacy mediated perceived weight-based discrimination and adherence among hypertensive African hypertensive patients.²¹ Further studies on the mediating effect of income on adherence may be warranted.

The current study seem to strengthen the importance of considering socioeconomic factors (embedded in social determinants of health) in chronic disease management. The results of the current study add to the literature, suggesting that the primary factors which shape the health of all persons are social determinants of health (SDH) and include education, employment, income and other important variables.³⁴ The parent study found income and employment status to be related to adherence to antihypertensive regimens in the cardiovascular high-risk Black/African American population. Prior literature suggest similar findings, and the current analysis has further described those relationships. These are important socioeconomic variables which deserve further consideration.

The WHO framed health as a social phenomenon emphasizing health broadly as a topic of social justice. Hence, a conceptual framework for action on social determinants of health was formed. Consequently, health equity (described as the absence of unfair and avoidable or remediable differences in health among social groups), became a guiding criterion or principle in addressing health issues.³⁵ Over the past two decades, a large and compelling body of evidence reveals the powerful role social factors (apart from medical care) play in shaping health across health settings and populations.³⁶⁻³⁸ The literature suggest that medical care alone does not determine health status. Rather, the effects of any given factor are contingent upon the presence of a myriad of other factors which include the social, economic, psychological, environmental, genetic, and epigenetic attributes.³⁸⁻⁴⁰

The socioeconomic differences in health are embedded in a larger problem of health disparities associated with a social disadvantage.³⁶ Nations with health policy frameworks which address social and behavioral determinants of health achieve better population health, less inequality, and lower costs than occurs in

the United States.^{36,41} Residents of nations with higher ratios of spending on social services to spending on health care services also have better health and live longer.⁴² The US, however, spends far more money per capita on medical services than these nations, and less is spent on social services, accounting for the lagging behind of health indicators in the US than other counties.⁴³ Maslow hierarchy of needs phenomena further discusses the primary importance of considering basic needs of individuals.⁴⁴ Such considerations may place individuals in a more comfortable position to consider treatment recommendations offered by healthcare professionals.

LIMITATIONS OF THE STUDY

The findings of this study are limited by certain methodological conditions. First, the use of a convenience sample (lack of randomized selection) may have contributed to higher levels of adherence or self-efficacy than that which is typically found in the population and may be the reason for the skewed data distributions. Second, the nature of correlational studies does not permit the interpretation of causality. For example, the relationship between years of affiliation with the same provider may contribute to higher levels of adherence and self-efficacy or it could be the other way around.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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