



A Comparison of Measured and Self-Reported Blood Pressure Status among Low-Income Housing Residents in New York City

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A Comparison of Measured and Self-Reported Blood Pressure Status among Low-Income Housing Residents in New York City

James H. Williams AB , *New York University School of Medicine*, james.williams@med.nyu.edu

Dustin T. Duncan ScD , *New York University School of Medicine*, dustin.duncan@nyumc.org

Jonathan Cantor MS , *New York University School of Medicine*, jonathan.cantor@nyumc.org

See next page for additional authors

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Abstract

Self-report is widely used to measure hypertension prevalence in population-based studies, but there is little research comparing self-report with measured blood pressure among low-income populations. The objective of this study was to compare self-reported and measured blood pressure status among a sample of low-income housing residents in New York City (n=118). We completed a cross-sectional analysis comparing self-report with measured blood pressure status. We determined the sensitivity, specificity, and positive predictive value (PPV) of each self-report metric. Of the sample, 68.1% was Black, 71.1% had a household income under \$25,000/year, and 28.5% did not complete high school. In our study, there was a discrepancy in the prevalence hypertension by self-report (30.5%) versus measurement (39.8%). PPV of self-report was 94.4%. Specificity was 97.2%. Hypertension awareness (sensitivity) was 72.3%. Of individuals not reporting hypertension, 15.9% had measurements in the hypertensive range and 43.9% had measurements in the borderline hypertensive range. Our findings suggest that self-reported and objective measures of hypertension are incongruent among low-income housing residents and may have important implications for population-based research among low-income populations.

Keywords

hypertension; blood pressure; self-report; low-income housing residents; low-income population; health disparities

Cover Page Footnote

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Authors

James H. Williams AB, Dustin T. Duncan ScD, Jonathan Cantor MS, Brian Elbel PhD MPH, Gbenga Ogedegbe MD MS MPH, and Joseph Ravenell MD MS



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James H. Williams, New York University School of Medicine
Dustin T. Duncan, ScD, New York University School of Medicine
Jonathan Cantor, MS, New York University School of Medicine
Brian Elbel, PhD, MPH, New York University School of Medicine
Gbenga Ogedegbe, MD, MS, MPH, New York University School of Medicine
Joseph Ravenell, MD, MS, New York University School of Medicine

ABSTRACT

Self-report is widely used to measure hypertension prevalence in population-based studies, but there is little research comparing self-report with measured blood pressure among low-income populations. The objective of this study was to compare self-reported and measured blood pressure status among a sample of low-income housing residents in New York City (n=118). We completed a cross-sectional analysis comparing self-report with measured blood pressure status. We determined the sensitivity, specificity, and positive predictive value (PPV) of each self-report metric. Of the sample, 68.1% was Black, 71.1% had a household income under \$25,000/year, and 28.5% did not complete high school. In our study, there was a discrepancy in the prevalence hypertension by self-report (30.5%) versus measurement (39.8%). PPV of self-report was 94.4%. Specificity was 97.2%. Hypertension awareness (sensitivity) was 72.3%. Of individuals not reporting hypertension, 15.9% had measurements in the hypertensive range and 43.9% had measurements in the borderline hypertensive range. Our findings suggest that self-reported and objective measures of hypertension are incongruent among low-income housing residents and may have important implications for population-based research among low-income populations.

Keywords: Hypertension; Blood pressure; Self-report; Low-income Housing Residents; Low-income Population; Health Disparities

INTRODUCTION

Hypertension remains a major health concern in the United States and worldwide due to its high prevalence and because it is a prominent risk factor for cardiovascular disease and stroke (Danaei et al., 2009; Kearney et al., 2005). Population-based studies commonly use self-report to measure of hypertension prevalence, and significant research has been invested toward refining the validity of self-reported hypertension estimates (Dave et al., 2013; de Menezes, Oliveira, & de Sousa Fischer, 2014; Mentz et al., 2012). While self-report has high validity among certain well-educated or elderly populations (Alonso, Beunza, Delgado-Rodriguez, & Martinez-Gonzalez, 2005; de Menezes et al., 2014; White et al., 2012), differences have been noted based on locality, socioeconomic status, comorbidities, gender, insurance status, primary care access, and ethnicity (Dave et al., 2013; Mosca, Bhuchalla, & Kenny, 2013; Muhajarine, Mustard, Roos, Young, & Gelskey, 1997; Tolonen et al., 2014; Van Eenwyk, Bensley, Ossiander, & Krueger, 2012; Wilper et al., 2009; Yi, Johns, & Lim, 2016). Among low-income, uninsured, or racial minority populations, self-report may have low validity due to low rates of hypertension awareness (CDC, 2013; Egan, Li, Small, Nietert, & Sinopoli, 2014; Fisher-Hoch et al., 2012; Ostchega, Hughes, Wright, McDowell, & Louis, 2008; Wilper et al., 2009; Zallman et al., 2013). From recent NHANES data, hypertension awareness among Black and Hispanic individuals was 70-80% (CDC, 2013), and hypertension awareness among uninsured patients was about 65% (Egan et al., 2014).

Because health disparities research often relies on self-report to estimate hypertension prevalence, it is important to examine the validity of self-report among low-income populations (Digenis-Bury, Brooks, Chen, Ostrem, & Horsburgh, 2008; Kaplan, Huguet, Feeny, & McFarland, 2010; White et al., 2011). While past research has been invested toward validating self-reported blood pressure status among racial/ethnic minorities, less is known about this topic among racial minority populations who are also low-income. To our knowledge, there have been few studies directly comparing self-reported and measured blood pressure status among low-income populations, and none that have examined this topic among low-income and racial/ethnic minority populations in an intersectional manner. One study compared self-report with chart-identified hypertension in a sample of predominately Latino seniors (55.6% Latino, mean age 73.1 years) at a low-income, inner-city primary care clinic (Leikauf & Federman, 2009). Another study in West Virginia examined self-reported hypertension among a low-income sample that was all female, mostly White (94%) well-educated (>80% completed high school), and had received a clinical breast exam in the last year (Ahluwalia, Tessaro, Rye, & Parker, 2009). Both studies only included individuals with regular access to a healthcare provider, and past research has shown that individuals with frequent healthcare provider contact may be more aware of their blood pressure status (Gooding, McGinty, Richmond, Gillman, & Field, 2014; Ostchega et al., 2008; R. Victor et al., 2008). There remains a need to examine the validity of self-reported hypertension among additional low-income populations, including predominately racial/ethnic minority community-based urban populations and low-income housing residents. Therefore, the purpose of this study is to examine self-reported and measured blood pressure status among a community-based sample of predominately racial/ethnic minority low-income housing residents in New York City.

METHODS

Data was collected as part of the NYC Low-Income Housing, Neighborhoods and Health Study ($n=120$), a global positioning system (GPS) study examining neighborhood influences on cardiovascular health in New York City (D. Duncan et al., 2014; D. Duncan, Regan, SD, 2015). Recruitment for the study was conducted through community outreach, including handing out and posting flyers in public housing developments and local businesses in four different New York City neighborhoods, working through community-based organizations, and through word-of-mouth among participants. Participants were eligible for the study if they were currently living in low-income housing (e.g. public housing) in New York City, were 18 years of age or older, spoke and read English, self-reported being non-pregnant, reported having no restrictions to usual physical activity, and were willing to wear a GPS device for one week. The vast majority (80%) of the participants reported living in public housing (versus other low-income housing) and all participants reported being low-income (5.8% of participants in the study reported living in Section 8 housing). Upon completion of the survey and return of the GPS device after one week, participants received a cash incentive for their participation. All data was collected between June and July 2014. Informed consent was obtained prior to data collection, and the study's methods were reviewed and approved by the New York University School of Medicine Institutional Review Board.

Self-Reported Blood Pressure Status. Participants were asked: "Has a doctor, nurse, or other health professional ever told you that you had hypertension (also called high blood pressure) or borderline hypertension?" Response options were: "yes", "borderline", or "no". Additionally, participants were asked if they were currently taking medications for high blood pressure. These questions have been used in the Behavioral Risk Factor Surveillance System (BRFSS) (Borrell & Crawford, 2008; Borrell, Crawford, Barrington, & Maglo, 2008).

Blood Pressure Measurement. Following a 30-60 minute survey in which participants were surveyed about blood pressure status and use of blood pressure lowering medications, blood pressure was measured with a Welch Allyn Vital Signs 300 monitor following a standard protocol (Hess et al., 2007; Ravenell et al., 2013; R. G. Victor et al., 2011). Blood pressure was measured once in the seated position with the participants' legs uncrossed and arms outstretched after the participants had been seated for 15-30 seconds. Consistent with multiple prior studies (Ahluwalia et al., 2009; de Menezes et al., 2014; Mosca et al., 2013; White et al., 2012; Yi, Johns, et al., 2016) and the latest Joint National Commission (JNC) 8 guidelines (James et al., 2014), a hypertensive measurement was classified as a systolic pressure ≥ 140 mmHg or a diastolic pressure ≥ 90 mmHg or the use of blood pressure lowering medications. A pre-hypertensive reading was classified as a systolic pressure between 120-139 mmHg or a diastolic pressure between 80-89 mmHg. A normal blood pressure measurement was classified as a systolic pressure below 120 mmHg and a diastolic pressure below 80 mmHg.

Body Mass Index. We measured participants' height to the nearest tenth of a centimeter (Seca 213 stadiometer) (Abidin & Adam, 2013; Bacardí-Gascón, Jones, & Jiménez-Cruz, 2013; Geeta et al., 2009; McGurk, Jackson, & Elia, 2013; Prushansky, Geller, Avraham, Furman, & Sela, 2013) and weight to the nearest tenth of a kilogram (Tantina 351 scale) (Bacardí-Gascón et al., 2013; Bammann et al., 2013; Geeta et al., 2009; Thomas et al., 2010; Yahia, El-Ghazale, Achkar, & Rizk, 2011). We then used standard body mass index (BMI) calculations (NIH, 2016): BMI

under 18.5 was classified as underweight, between 18.5 and 24.9 was classified as normal weight, between 25 and 29.9 was classified as overweight, and above 30 was classified as obese. *Demographics.* Participants reported age (years), gender (male, female), race/ethnicity (Black, White, Hispanic, Asian, Other), household income (less than \$25,000, \$25,000 to \$49,999, \$50,000 to \$74,999, greater than \$75,000), educational attainment (less than 12th grade, high school or GED, some college, bachelor's degree, graduate degree), and employment status (working full-time, working part-time, not working, retired, in school). Additionally, participants were asked if they had health insurance (yes, no) and if they had a regular doctor or healthcare provider (yes, no).

Data Analysis. Of the 120 participants in the study, 118 were included in our analytic sample. Two individuals were excluded from the analysis because of missing data on self-reported blood pressure status. We divided the sample into three groups (self-reported normal blood pressure, self-reported borderline hypertension, and self-reported hypertension) and examined descriptive statistics on demographic, BMI, and healthcare access variables. We calculated the sensitivity (proportion of positives correctly identified by self-report), specificity (proportion of negatives correctly identified by self-report), and positive predictive value (proportion of self-report who were positive by measurement) for each self-reported metric. Overall agreement between self-report and measured blood pressure status was assessed. For each self-report measurement, kappa coefficients were calculated to determine agreement with measurement among the entire sample (Fleiss, 1981). STATA statistical software (version 10.0; Stata Corp, College Station, Texas) was used to perform the statistical analysis.

RESULTS

The mean age of the sample was 38.5 (SD=14.2). Slightly more than half (55.2%) of the sample was female, and the majority (68.1%) was Black. A total of 71.0% of the sample had an annual household income below \$25,000, 28.5% of the sample had not completed high school, and 54.3% were not currently working. Thirty-six (30.5%) participants reported having hypertension, while 14.4% reported having borderline hypertension, and the remainder (55.1%) reported having normal blood pressure. Compared to the group reporting normal blood pressure, the self-reported hypertensive sample was older (50.7 vs. 32.5 years, $p=0.034$) and more individuals in this group were obese (58.3% vs. 26.2%, $p=0.006$). A greater percentage of individuals in the self-reported hypertensive group were insured (97.1% vs. 84.6%, $p=0.163$), and more reported having a doctor they see regularly (88.6% vs. 76.2%, $p=0.238$), but these differences were not significant. The majority (88.6%) of the self-reported hypertensive group took medications to control their high blood pressure. Individuals in the self-reported borderline hypertensive group were slightly older (38.2 years) and more were obese (58.8%) compared to the group reporting normal blood pressure. The percentage of insured individuals in the self-reported borderline hypertensive group was similar (88.2%), but a higher percentage reported seeing a healthcare provider regularly (88.2%). Full socio-demographic information can be found in Table 1.

Table 1: Participant Demographics

		Self-Reported Measurement			
	Total (n=118)	Normal Blood Pressure (n=65)	Borderline (n=17)	Hypertension (n=36)	T-test or X^2 Statistic (p-value)
Age in years, mean (SD)	38.46 (14.24)	32.46 (12.16)	38.20 (12.79)	50.65 (10.92)	0.034
Gender					0.660
Male	44.83%	48.44%	37.50%	41.67%	
Female	55.17%	51.56%	62.50%	58.33%	
Race/Ethnicity					0.267
Black	68.10%	64.62%	58.82%	79.41%	
White	4.31%	6.15%	0.00%	2.94%	
Hispanic	23.28%	24.62%	41.18%	11.76%	
Asian	0.86%	0.00%	0.00%	2.94%	
Other	3.45%	4.62%	0.00%	2.94%	
Household Income					0.352
Less than \$25,000	71.05%	68.25%	58.82%	82.35%	
\$25,000 to \$49,999	21.93%	22.22%	29.41%	17.65%	
\$50,000 to \$74,999	5.26%	6.35%	11.76%	0.00%	
Greater than \$75,000	1.75%	3.17%	0.00%	0.00%	
Education					0.187
Less than 12 th Grade	28.45%	33.33%	23.53%	22.22%	
High school degree/GED	39.66%	39.68%	41.18%	38.89%	
Some college	25.00%	25.40%	17.65%	27.78%	
Bachelor's degree	5.17%	0.00%	17.65%	8.33%	
Graduate degree	1.72%	1.59%	0.00%	2.78%	
Employment Status					0.028
Working full-time	14.66%	17.46%	17.65%	8.33%	
Working part-time	18.97%	20.63%	17.65%	16.67%	
Not working	54.31%	52.38%	64.71%	52.78%	
Retired	5.17%	0.00%	0.00%	16.67%	
In school	6.90%	9.52%	0.00%	5.56%	
Mean BMI (SD)	29.35 (7.77)	26.80 (6.63)	31.51 (5.14)	33.00 (9.19)	0.451
BMI					0.006
Underweight (<18.5)	1.69%	3.08%	0.00%	0.00%	
Normal Weight	32.20%	44.62%	5.88%	22.22%	

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(18.5-24.9)					
Overweight (25.0-29.9)	25.42%	26.15%	35.29%	19.44%	
Obese (>30.0)	40.68%	26.15%	58.82%	58.33%	
Insurance					0.163
Yes	88.89%	84.62%	88.24%	97.14%	
No	11.11%	15.38%	11.76%	2.86%	
Doctor seen regularly					0.238
Yes	81.74%	76.19%	88.24%	88.57%	
No	18.26%	23.81%	11.76%	11.43%	
BP Medications					0.000
Yes	71.55%	1.54%	6.25%	88.57%	
No	28.45%	98.46%	93.75%	11.43%	

SD=standard deviation

The prevalence of hypertension as determined by measurement or the use of antihypertensive drugs was 39.8% (Table 2). Of this sample, 23.4% were included because of antihypertensive medication use while 76.6% had elevated blood pressure readings. Of this sample, 70.2% reported taking blood pressure-lowering medications. Prevalence of borderline high blood pressure and normal blood pressure by measurement were 31.4% and 28.8%, respectively. Among individuals reporting borderline hypertension, 23.5% had measurements in the hypertensive range or reported using blood pressure medications, 47.1% had measurements in the pre-hypertensive range, and 29.4% had a normal blood pressure measurement. Of the sample reporting normal blood pressure, 43.1% had readings in the normal range, 43.1% had pre-hypertensive measurements, and 13.8% had high blood pressure readings or used antihypertensive medications. Among all individuals who did not report having hypertension, 15.9% had readings in the hypertensive range, and 43.9% had readings in the pre-hypertensive range.

Table 2: Comparison of Self-Reported and Measured Blood Pressure

	Self-Reported Measurement		
	Normal Blood Pressure	Borderline	Hypertension
Measured Blood Pressure			
Hypertension	13.85%	23.53%	94.44%
Prehypertension	43.08%	47.06%	2.78%
Normal	43.08%	29.41%	2.78%
Mean systolic pressure (SD)	123.06 (14.72)	125.94 (17.29)	142.64 (19.07)

Mean diastolic pressure (SD)	72.20 (10.28)	76.76 (14.43)	85.81 (12.42)
Statistical Measures			
Reported prevalence	55.08	14.41	30.51
Measured prevalence	28.81	31.36	39.83
Percent Agreement	63.56	67.80	87.29
Kappa coefficient	0.3013	0.1232	0.7239
Sensitivity	82.35	21.62	72.34
Specificity	55.95	88.89	97.18
Positive Predictive Value	43.08	47.06	94.44
Negative Predictive Value	88.68	71.29	84.15

SD=standard deviation

We found that the sensitivity of self-reported hypertension among this sample was 72.3%, and specificity was 97.2% (Table 2). The PPV of self-reported hypertension was 94.4%. Self-reported borderline hypertension had poor predictive value, with sensitivity 21.6% and PPV 47.1%. The specificity of self-reported borderline hypertension was 88.9%. Self-reported normal blood pressure had a low PPV (43.1%), and 56.9% of individuals had readings outside the normal range. In the overall sample, there was a high degree of agreement between self-report and measured hypertension (87.3% agreement, kappa=0.7239). However, there was lower agreement for self-reported borderline hypertension (67.8% agreement, kappa=0.1232) and self-reported normal blood pressure (63.6% agreement, kappa=0.3013).

The percentage of aware hypertensive individuals in the sample was 72.3%. Of all individuals with elevated blood pressure readings, 64.9% had readings in the Stage 1 range and 35.1% had readings in the Stage 2 range. Of individuals with readings in the hypertensive range, 59.5% reported taking blood pressure medications. Of individuals who reported taking blood pressure medications, 33.3% had readings below 140/90 mmHg, the recommended target for blood pressure control.

DISCUSSION

Population-based studies, including studies examining health disparities among low-income populations, often rely on self-report to measure the prevalence of hypertension (Digenis-Bury et al., 2008; Kaplan et al., 2010; White et al., 2011). Past research has identified a high burden of undiagnosed hypertension among low-income, uninsured, and racial minority populations (CDC, 2013; Egan et al., 2014; Fisher-Hoch et al., 2012; Ostchega et al., 2008; Wilper et al., 2009; Zallman et al., 2013). However, the limited research that has examined the validity of self-reported measures among low-income populations has focused on predominately White, female, and well-educated samples, or samples of elderly individuals with access to primary care (Ahluwalia et al., 2009; Leikauf & Federman, 2009). To our knowledge, no study

has examined this topic among racial/ethnic minority populations who are also low-income. In this study, we compared self-reported and measured blood pressure status in a mostly Black community-based sample of low-income housing residents in New York City and thus our study provides a meaningful contribution to the literature. We found that there is a discrepancy between measured and self-reported blood pressure status among this population, and many individuals reporting normal blood pressure status had elevated blood pressure readings. Hypertension awareness in our sample was 72.3%, which is consistent with NHANES estimates among racial/ethnic minority populations (CDC, 2013). In our study, 59.5% of individuals with elevated blood pressure readings reported use of medications, suggesting that there may poor levels of blood pressure control among hypertensive patients in this population.

Past research has revealed that self-report of blood pressure status has high validity among well-educated populations and older populations who may have more frequent contact with a healthcare provider than younger populations (Alonso et al., 2005; de Menezes et al., 2014; White et al., 2012). In our study, the self-reported normal blood pressure sample was younger and 13.9% of these individuals were found to have elevated blood pressure readings, consistent with prior research that suggests that self-report has lower validity among young adults (Gooding et al., 2014; Ostchega et al., 2008; R. Victor et al., 2008). In the overall sample of individuals who did not report hypertension, 15.9% had measurements in the hypertensive range and an additional 43.9% had a reading consistent with borderline high blood pressure, indicating that there may be a high rate of undiagnosed hypertension among younger members of this predominantly racial/ethnic minority low-income population.

While self-reported hypertension was found to be strongly correlated with clinically measured hypertension among a sample of low-income women in West Virginia, the sample only included individuals who had received a clinical breast examination in the year before the study, and therefore may have biased the sample toward individuals with regular healthcare access (Ahluwalia et al., 2009). Past research in Boston has suggested that low-income or public housing residents have substantially poorer health (including higher rates of hypertension) compared with other city residents despite similar utilization of routine primary care services (Digenis-Bury et al., 2008). While regular access to primary care may increase the validity of self-report, our finding that there were no statistically significant differences in insurance or health care access between groups in our study suggests that other factors may shape health disparities among predominantly racial/ethnic minority low-income housing residents. The low-income housing population is characterized by high rates of poverty, large racial/ethnic minority populations, limited access to healthcare, and high rates of other cardiovascular risk factors. Low-income housing residents represent a distinct group in this intersectional overlap of racial and socioeconomic factors.

The discrepancy between measured and self-reported blood pressure status among this sample may have important implications for studies that examine health disparities among low-income populations. Past research elsewhere has aimed to develop a correction factor to more accurately estimate the prevalence of hypertension in community-based studies utilizing self-report (Mentz et al., 2012; Yi, Johns, et al., 2016). While we do not aim to develop a similar correction factor with this study, we argue that it is particularly important to be aware of the discrepancy between self-report and measured blood pressure status in New York City, where there is a large population of low-income housing residents, there are significant intersections of

racial/ethnic minority and low-income populations, and annual city-administered health surveys utilize self-report to measure hypertension prevalence among various low-income populations (Lim, Yi, Lundy De La Cruz, & Trinh-Shevrin, 2015; Yi, Thorpe, Zanowiak, Trinh-Shevrin, & Islam, 2016). Moreover, our findings may have important implications for other municipalities that have large low-income housing populations and employ similar community-based surveys, and could guide future work to better characterize this discrepancy in other locations. Lastly, the discrepancy we identify further underscores the importance of utilizing objective measures of blood pressure status among low-income populations when possible.

This study has some limitations. First, this was a relatively small convenience sample of low-income housing residents in New York City. Our findings, therefore, might not be generalizable to low-income populations in other regions of the country. The study was limited to English speaking residents of low-income housing, and therefore our results may not be generalizable to non-English speaking low-income housing populations. Additionally, a clinical diagnosis of hypertension usually requires multiple blood pressure measurements. In this study, we measured blood pressure once due to time constraints (e.g. the survey took 30-60 minutes to complete) and to allow time for counseling about cardiovascular health in keeping with our community-based approach. While there are prior examples of studies in the health disparities literature that have utilized a single blood pressure measurement when examining hypertension prevalence and/or control (Downie et al., 2011; Hu, Wallace, Jones, & Liu, 2009; Morales-Asencio et al., 2013), a single blood pressure measurement may overestimate the prevalence of hypertension and multiple measurements would improve the validity of these findings in future work. Our study also has several important strengths, including our unique sample of predominantly racial/ethnic minority low-income housing residents and measuring blood pressure with an automated machine, which may reduce human error. Additionally and importantly, the rate of hypertension awareness in our sample was consistent with values from national studies that have used multiple blood pressure readings (CDC, 2013; Egan et al., 2014).

CONCLUSION

Despite these limitations, our study illustrates that there are discrepancies between self-reported and measured blood pressure status among this sample of low-income housing residents. Our results suggest there are high rates of undiagnosed and inadequately treated hypertension among this population and may have important implications for community-based studies among low-income populations that utilize self-report to measure hypertension prevalence. Future research would benefit from a larger study that diversifies the population under study to include low-income individuals from different geographies and with different levels of nativity and who speak different languages and includes multiple blood pressure measurements over time. Nevertheless, this research presents an important finding that self-reported and objective measures of blood pressure status may be incongruent among low-income housing residents.

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