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Gender, Weight Status, and CKD among African Americans: The Jackson Heart Study

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Abstract

Background—Obesity has been shown to have implications for chronic kidney disease (CKD); however, it has received minimal attention from scientists studying CKD among African Americans.

Objectives—The purpose of this study was to examine the manner in which weight status has implications for CKD among this group through analysis of data drawn from the Jackson Heart Study (JHS).

Design—Cross-sectional analysis of a single-site longitudinal population-based cohort.

Participants—The data for this study were drawn from the baseline examination of the Jackson Heart Study. The analytic cohort consisted of 3,430 African American men and women (21–84 years of age) living in the tri-county area of the Jackson, Mississippi metropolitan areas with complete data to determine CKD status.

Main Measurements—The primary dependent variable was CKD (defined as the presence of albuminuria or reduced estimated glomerular filtration rate (eGFR) <60 ml/min/1.73m²). Weight status, the primary predictor, was a four-category measure based on body mass index (BMI).

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Conflict of Interest

Each author listed on this manuscript declares no conflicts of interest in relation to this work.

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Results—Associations were explored through bivariable analyses and multivariable logistic regression analyses adjusting for CKD, weight status, diabetes, hypertension, and cardiovascular disease risk factors as well as demographic factors. The prevalence of CKD in the JHS was 20%. The proportion of overweight, class I, and class II obese individuals was 32.5%, 26.9% and 26.2% respectively. In the pooled model, weight status was not found to be associated with CKD; however, subgroup analysis revealed that class II obesity was associated with CKD among males (OR 2.37, CI 1.34–4.19) but not among females (OR 1.32, CI 0.88–1.98). The relationship between CKD prevalence and diabetes and CKD prevalence and hypertension varied by gender and differed across weight categories.

Conclusions—Weight status has implications for CKD among JHS participants and this study underscores the need for additional research investigating the relationship between weight status, gender, and CKD among African Americans.

Keywords

Kidney Disease; Obesity; Gender; African Americans; Jackson Heart Study

Introduction

Kidney disease is one of the most pressing, yet underemphasized, issues in American public health. One out of every eight individuals over 20 years of age has some form of chronic kidney disease (CKD) which means that over 26 million adults in the United States (U. S.) are at risk for kidney failure or end stage renal disease (ESRD) and/or related complications.¹ The number of individuals requiring renal replacement therapy (dialysis treatment or a kidney transplant) has more than doubled over the past two decades.² Recent estimates indicate that well over half of a million U. S. citizens (562,085) need medical interventions to compensate for the loss of renal function.³ Premature morbidity and mortality concerns are exacerbated by the financial burden associated with CKD and ESRD; the annual per patient cost to provide renal replacement therapy in ESRD is approximately \$70,000.^{4–6} The total direct Medicare cost of ESRD alone was estimated to be over \$20 billion in 2007.³ It is noteworthy that these estimates do not account for other costs such as lost productivity.

Kidney disease and kidney failure are not randomly distributed across the U. S. population.^{7–11} African Americans require dialysis or transplantation at younger ages and have greater incidence rates of ESRD at each decade of life as compared to other racial/ethnic groups.^{2,12–14} These disparities have been generally thought to be a function of disproportionately high levels of known CKD risk factors such as diabetes and hypertension.¹⁵ However, a growing segment of the nephrology community have begun to examine other biological and sociological factors.¹⁶ Obesity is an established precursor for both of these risk factors and a growing body of research has begun to consider the relationship between obesity and CKD-related outcomes.^{17–20} Results from this line of work suggest that obesity has implications for kidney disease that are independent of diabetes and hypertension,²⁰ yet research examining the potential additive effects of obesity and diabetes or hypertension for CKD risks among African Americans has infrequently been explored.

Published data from National Health and Nutrition Examination Survey (NHANES) indicated that nearly three out of every four African American adults could be classified as overweight or obese.²¹ While the prevalence of obesity is higher in African American women than men, nearly 40% of African American men ages 40 and older are obese.^{21,22} African American men have higher rates of developing and dying from many conditions and diseases associated with obesity than white men, white women, and African American women.²³ Obesity has received minimal attention as a CKD risk factor from scientists studying CKD and/or ESRD among African Americans. There has been a concomitant rise in kidney disease and obesity among adults over the past decade and the proportion of African Americans classified as overweight or obese has increased substantially during the same period. The purpose of this study was to examine the manner by which weight status has implications for CKD among participants in the Jackson Heart Study (JHS), the largest single-site cohort study of cardiovascular disease (CVD) among African Americans. We hypothesized that obese participants were more likely to have CKD than their counterparts in lower weight classes. We further tested the hypothesis that the patterning of the association between weight status and CKD varies by gender, yet is independent of the relationship between CKD and diabetes or hypertension.

Methods

The data for this study were drawn from the baseline examination of the JHS -- a single-site, longitudinal, population-based cohort study designed to prospectively investigate determinants of CVD among African Americans living in the tri-county area (Hinds, Madison, and Rankin counties) of the Jackson, MS Metropolitan Statistical Area. Baseline data collection occurred between September 2000 and March 2004. Recruitment, sampling, and data collection methods have been described previously.²⁴⁻²⁷ The JHS recruitment protocol limited the age range to 35 to 84 but allowed relatives <35 years and >84 years to enroll in order to increase the sample power of the family component of the study.²⁸ The total cohort consisted of 5,301 African-American men and women between the ages of 21 and 94. Of these, a substantial segment of the total JHS study population (N= 5,301) did not have sufficient urine (n=1792) or serum (n=56) to determine CKD status. A few other participants had restricted consent (n=23), leaving 3,430 to be included in this analysis. An earlier examination of the excluded participants reported elsewhere indicate that these individuals were somewhat more likely to be older, not married, report more difficulty with healthcare access, and have lower education and income levels.¹⁵ However, the analytic sample closely resembled the overall study sample.^{15,29} The institutional review boards of the following participating institutions approved the study: the University of Mississippi Medical Center, Jackson State University, and Tougaloo College. All of the participants provided written informed consent.

The baseline examination had three components: a home interview, self-administered questionnaires, and a clinic visit. Individuals who had taken any medications two weeks prior to the examination were asked to bring them to the clinic to be coded by a pharmacist using the Medispan dictionary with classification according to the Therapeutic Classification System.³⁰ Participants were asked to fast overnight before their clinic visit where anthropometric and the average of two seated blood pressure measurements were obtained.

Venipuncture/urine collections were performed according to the National Committee for Clinical Laboratory Standards.²⁴

Study Variables

CKD was defined as the presence of albuminuria or reduced estimated glomerular filtration rate (eGFR) <60 ml/min/1.73m². The presence of albuminuria was determined by urine albumin to urine creatinine ratio (ACR) based on spot or 24-hour urine values (ACR>30 mg/g). eGFR was assessed using the Modification of Diet in Renal Disease (MDRD) 4-variable formula [$GFR = 186.0 \cdot (\text{serum creatinine})^{-1.154} \cdot \text{age}^{-0.203} \cdot (0.742 \text{ if female}) \cdot (1.212 \text{ if African American})$]. The definition of CKD in this study was broader than other studies that defined CKD based solely on eGFR. Analyses published elsewhere indicated that characteristics of JHS participants with this definition of CKD were similar to those of participants with eGFR alone.²⁹

Weight status was a four-category measure based on body mass index (BMI) calculated from the average of three height and weight measurements [$BMI = \text{weight in kilograms} / (\text{height in meters})^2$]. The four categories were: normal weight (BMI <25), overweight (25 ≤ BMI <30), class I obese (30 ≤ BMI <35), and class II obese (BMI ≥ 35). Known CKD risk factors or comorbidities were represented in this analysis. Hypertension status was defined as a measured blood pressure ≥ 140/90 mmHg and/or use of antihypertensive medications.^{31,32} Presence of Type 2 diabetes mellitus (diabetes) was determined by a measured fasting glucose of ≥ 126 mg/dl or use of insulin and/or oral hypoglycemic agents. Presence of hypercholesterolemia was defined as an elevation in measured fasting total cholesterol (≥ 200 mg/dl), LDL-C (≥ 160mg/dl) and/or use of lipid-lowering medications. Hypertriglyceridemia was defined as elevated triglyceride levels (≥ 150 mg/dl) and/or treatment by fenofibrate or gemfibrozil while gender-specific limits (<50 mg/dl for women and <40 mg/dl for men) were used to define low HDL cholesterol levels.³³ CVD status was defined as the presence of coronary heart disease (electrocardiogram-determined myocardial infarction or self-reported history of myocardial infarction or angioplasty) or cerebrovascular disease (self-reported history of stroke or carotid endarterectomy or angioplasty).

The remaining variables were based on self-report during the baseline interview. Health care access was represented by a variable corresponding to a questionnaire item asking participants to rate difficulty of getting health care services as “not difficult at all” (coded 1), “not too hard” (coded 2), “fairly hard” (coded 3), or “very hard” (coded 4). Socioeconomic status (SES) was represented by educational attainment and annual family income. Both of these factors were represented by four-category variables. Each of these indicators has non-linear relationships with health indices for African Americans; therefore each of these variables were represented by a series of dummy variables. The remaining variables in the analysis were traditional demographic variables (age, gender, and marital status).

Statistical Analysis

Study population characteristics were described overall by weight status strata using means and standard deviations for continuous variables and proportions for categorical variables.

One-way ANOVA and Chi-square tests were used in descriptive analyses assessing how normal weight, overweight, class I obese and class II obese individuals varied across key indicators. In the first analysis, multivariable logistic regression models were estimated to determine the degree to which subgroup models differed from the pooled model and each other. The social patterning of health outcomes for African-Americans has been found to vary by gender.^{15,34-36} In our second analysis, specific regression models (for each weight status category) estimated the associations between select risk factors and prevalent CKD by gender. For both multivariable regression analyses, the dependent variable is CKD prevalence (1=yes; 0=no). All statistical analyses were conducted using StataSE Version 10.

Results

The study population consisted of 3,430 participants with a mean age of 54.3 ($\pm$ 13.1) years, 63.7% were female and 54.8% were married. The prevalence of CKD among JHS participants was 20%. An overwhelming majority (85%) of the individuals in the study could be classified as overweight or obese. Approximately 26% of participants in this study had BMIs greater than 35. A majority of individuals in the analytic sample were female and married and the mean age of the study population was 54. The prevalence of CKD risk factors was high and approximately 62% had hypertension, 31% had hypercholesterolemia, 18% had diabetes, 10% had cardiovascular disease, and 7% had hypertriglyceridemia. Nearly two out of every three participants had at least some college and over half of the study population had incomes classified as upper middle class or affluent. Table 1 presents an overall descriptive profile of the study population.

The results in Table 1 also indicated that the descriptive profile of the study population varied by weight status. Descriptive results for CVD status, hypertriglyceridemia, education, and serum creatinine levels were similar across groups. Group differences for variables such as age, health care access, marital status, income, and hypercholesterolemia were modest and though statistically significant did not appear to be clinically relevant. By contrast, the group-specific results for the major CKD risk factors and CKD measures indicated that obese participants had the largest percentage of individuals with diabetes, hypertension, albuminuria, and reduced estimated glomerular filtration rate.

Table 2 presented estimates from overall and gender-specific logistic regression models examining the association between selected covariates and CKD. The pooled and gender-stratified models had a number of similarities as age, having CVD, diabetes, or hypertension was associated with the likelihood of having CKD in each of the equations reported. Table 2 also highlighted some notable distinctions between these models. Marital status was inversely related with the likelihood of having CKD in the pooled and “women only” models. In the pooled and the “men only” models, the odds of having CKD were lower among high-income persons than their lower income counterparts. Obesity was found to be a significant CKD risk factor for men, but not for women. Males in the heaviest weight category were more than twice as likely to have CKD as their normal weight counterparts. The statistically significant interaction between gender and weight status indicated different patterns of CKD risk for women and men across weight categories.

The findings from gender and weight status-specific logistic regression models presented in Table 3 provided evidence suggesting that the relationship between weight status and CKD vary considerably by gender. Most of the significant relationships were consistent with extant literature; however none of the correlations held across the subgroup models. The modest positive relationship between age and the likelihood of having CKD was significant for normal weight men (OR=1.13), overweight women (OR=1.05) and men (OR=1.04), and class II obese women (OR=1.01). The difficulty of getting health care services was positively related to the likelihood of having CKD for overweight women and inversely correlated for women in the heaviest category. The finding associated with major risk factors were robust, in that hypertension, and diabetes prevalence were positively associated with the likelihood of having CKD in most of the equations reported. Having CVD was associated with the increased odds of CKD prevalence among normal weight women (OR=4.11) and men (OR=3.80); women in the class I obese category (OR=2.14); and women (OR=1.82) and men (OR=8.23) in the class II obese category. The patterning of relationships was different for individuals with hypertension. Having hypertension was associated with a greater likelihood of having CKD among women across all weight class categories; however, the relationship between hypertension and CKD status was only significant for overweight men. Diabetes status was the most robust variable as having diabetes was found to have a positive correlation with the likelihood of having CKD for every subgroup except normal weight women. The hypertriglyceridemia status variable was significant for men in the heaviest weight class category. Class II obese men with hypertriglyceridemia were 3.42 times more likely to have CKD than their Class II male counterparts who did not have hypertriglyceridemia.

Discussion

This is the first study to our knowledge that shows a significant trend between increasing body weight and prevalence of CKD in a large, longitudinal population-based cohort of African Americans. After multivariable adjustment for demographic, clinical and socio-economic variables BMI greater than or equal to 35 remained a significant independent risk factor for CKD among men, but not women. A more refined understanding of the risk for CKD among minority groups, especially African Americans, is critical due to the higher mortality rates at the earlier stages of CKD reported in most analyses^{37,38} and a more rapid progression to kidney failure.¹² High rates of kidney disease and kidney failure among African Americans are believed to be related to the increased prevalence of the two leading risk factors (hypertension and diabetes) for CKD; however, recent research suggests that weight status may also be an important consideration. Several studies have demonstrated that excess body weight can have an adverse impact on kidney functioning and kidney health.¹⁸⁻²⁰ Elsayed and colleagues found waist-to-hip ratio and not BMI was associated with the development of CKD in over 5,000 people followed for 9.3 years.³⁹ The study by Elsayed differed from our study in several respects. The study by Elsayed determined associations for the incidence of CKD and had a larger cohort with a more heterogeneous racial profile and lower prevalence of baseline risk factors such as hypertension, diabetes, and cardiovascular disease. These differences reinforce the need for research examining the obesity-CKD relationship among African Americans, which remains scarce to date. To this

end, data from the JHS were analyzed to investigate the relationship between weight status and CKD. Our results highlight the gender-specific patterning of the weight status-CKD relationship among participants in the JHS, thereby indicating that the relationship between excess weight and kidney disease among African Americans requires further exploration. The results in the “women only” models indicate that overweight, class I obese, and class II obese women did not have statistically distinct risks for CKD relative to normal weight women. Weight status was significant in the “men only” model as men in the heaviest weight category were found to be more than twice as likely to have CKD relative to their normal-weight male counterparts. It is noteworthy that the likelihood of having CKD among overweight and class I obese men was not significantly different from the likelihood of normal weight men having CKD. These results are consistent with earlier data indicating that the relationship between body weight and health outcomes among African Americans is complex; thereby requiring researchers to consider potential nonlinear relationships between weight status and CKD.

Our results also show that the strength of the relationship between established CKD risk factors and CKD can vary considerably by weight status and gender. Diabetes was the most robust correlate in the study; however, the patterns of CKD prevalence for women and men differ across weight categories. In contrast to women, having diabetes increases the odds of having CKD for men regardless of their weight status, however, the strength of the diabetes-CKD relationship appears to be patterned by weight status (Table 3). The strength of the association between diabetes and CKD prevalence is highest among normal weight men and declines in a step-wise fashion across subsequent weight categories. Interestingly, the smallest diabetes coefficient for men is greater than the largest coefficient for women. These findings underscore the need for additional research examining how weight can have implications for gender differences in the diabetes-CKD pathway among African Americans.

Similarly, the hypertension-CKD relationship varies by gender. The presence of hypertension increases significantly with higher weight-status group (Table 1) and in pooled data hypertension is strongly associated with CKD in both men and women. However in women, but not in men having hypertension increases the odds of having CKD for regardless of weight status. The strength of the association between hypertension status and CKD prevalence is considerably larger for normal weight women than women in heavier weight categories. The pattern for men is distinctive as hypertension is only found to be significant for overweight men. Therefore, in both men and women, the strongest correlation of hypertension to CKD is in the non-obese groups. This pattern suggests that the hypertension-CKD relationship may be complicated with health conditions associated with excess weight. A recent study⁴⁰ has shown that the relationship between weight status and blood pressure is complicated among African American men and it is likely that this complex relationship has implications for the hypertension-CKD relationship among this group. In contrast to estrogens, which may attenuate CKD progression by lowering the cardiovascular stress response to adrenergic stimuli⁴¹, testosterone may not provide the same level of vascular protection and explain in part the increased rate of CKD among men.^{42,43}

Other findings of note are those associated with CVD, healthcare access, and hypertriglyceridemia. Cardiovascular disease (CVD) is often considered a co-morbidity of kidney disease and the results suggest that the presence of CVD is associated with CKD for both men and women in the JHS. Normal weight and class II obese women and men with CVD have higher risks for CKD. Gender differences are observed however as class I obese women with CVD are found to greater odds of having CKD while CVD among men in this weight class is not found to be associated with a greater likelihood of having kidney disease. The results for healthcare access and hypertriglyceridemia are noteworthy because neither variable is significant in the any of the multivariable models in Table 2; yet in isolation, each is found to have implications for CKD prevalence among specific subgroups. Healthcare access is found to have a relationship with the having CKD among women in the overweight and class II obese categories. Hypertriglyceridemia is associated with an elevated risk for CKD among the heaviest group of men in the study.

This study is significant because the results provide a deeper insight into the complex relationship between CKD, weight status and known risk factors for CKD among African Americans, a population disproportionately at risk for kidney disease and its complications. There are some limitations worth noting however. The analytic models are estimated using data drawn from a sample of African Americans residing the South; therefore, the results are not generalizable to all African Americans. Furthermore, all of the usual limitations of cross-sectional studies apply.(26)

Limitations of this study include lack of measured waist-to-hip ratio and absence of a gold standard for measurement of visceral fat such as Dual-energy x-ray absorptiometry (DEXA). Also our analysis was limited to the prevalence and not the incidence of CKD, making it less likely to identify CKD as a potential cause of metabolic abnormalities predisposing to obesity or hypertriglyceridemia as well as cardiovascular events.³⁹ The lack of measurements of urinary creatinine clearance in a cohort of individuals with increased BMI could lead to a bias of a subset with larger muscle mass and higher production of creatinine leading to underestimation of estimated GFR and misclassification of “CKD.”

Finally, the use of an exclusively African American sample may be considered a limitation because of the lack of a comparison group and more limited generalizability, but it is more specific to African Americans, a historically understudied and heterogeneous group of Americans with health outcomes that differ substantially from other groups. The level of heterogeneity within a single ethnic group, like African Americans, is often masked in comparative studies between ethnic groups. The observations in this study highlight further the importance of conducting studies in predominantly African American cohorts if we are to address this group's disparities in CKD and its risk factors. These study findings also highlight the critical need to conduct future research that examines the role of gender in the health patterns of African Americans.

Conclusion

Weight status has implications for CKD prevalence among African Americans in the JHS, although results were not linear or consistent across gender. The findings from subgroup

analyses revealed patterns of relationships often masked in pooled models, thereby underscoring the need for additional research investigating the relationship between weight status and CKD among African American men and women. Future studies that incorporate group-specific processes associated with excess weight and health-outcomes will lay the foundation for interventions that can slow CKD development and progression among groups most at risk.

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Table 1

Characteristics of JHS Participants by Sex and Weight Status, n=3,430

	Analysis Sample	Weight Status* for Women				Weight Status* for Men				** p
		Normal	Overweight	Class I	Class II	Normal	Overweight	Class I	Class II	
Age (y)	54.3±13.1	54.1 ± 15.1	57.0 ± 13.2	54.7 ± 12.2	53.8 ± 12.4	52.9 ± 15.4	54.7 ± 12.9	52.7 ± 12.0	53.3 ± 12.5	.001
Married (%)	54.8	46.0	45.6	49.8	41.5	56.5	74.6	73.2	71.1	<.001
Health care access***	1.4 ± 0.8	1.5 ± 0.8	1.4 ± 0.8	1.4 ± 0.9	1.6 ± 0.6	1.5 ± 0.8	1.3 ± 0.7	1.4 ± 0.8	1.4 ± 0.8	.04
CVD (%)	10.4	8.8	9.0	10.9	9.4	10.8	10.9	11.9	13.2	.8
Diabetes (%)	17.9	7.7	15.3	22.0	25.5	6.9	12.9	19.6	23.9	<.001
Hypertension (%)	62.6	49.0	62.0	66.7	70.7	48.7	58.2	62.5	69.5	<.001
Hypercholesterolemia (%)	30.5	28.4	33.3	31.1	29.5	23.7	32.6	29.2	32.0	.09
Hypertriglyceridemia (%)	6.7	3.8	4.8	4.3	5.0	6.5	9.0	13.1	12.7	.03
Education (%)										.07
< High School	16.1	12.3	16.6	16.6	17.8	20.7	17.0	12.5	10.7	
High School	19.9	20.7	17.7	22.7	21.1	19.8	20.3	18.8	17.3	
Some College	30.3	25.3	27.9	30.4	32.9	30.6	28.3	33.6	34.5	
College Degree	33.5	41.8	37.8	30.4	28.3	28.9	34.4	35.1	37.6	.001
Income (%)										
Low Income	12.0	19.6	15.3	14.7	21.4	17.1	6.7	6.4	10.4	
Lower Middle	19.7	22.0	25.7	27.4	26.2	23.6	19.0	18.9	20.1	
Upper Middle	25.7	25.4	29.8	33.1	32.4	27.1	32.8	31.8	27.4	
High Income	25.8	33.0	29.2	24.8	20.0	32.2	41.5	42.9	42.1	
eGFR distribution (%)										.03
eGFR >90	40.5 (1384)	43.3	34.4	38.7	37.9	54.3	41.6	45.7	42.9	
60> eGFR<90	49.8 (1699)	48.7	53.1	51.2	49.9	37.1	52.2	48.4	47.5	
30> eGFR<60	8.5 (291)	7.3	10.9	8.6	11.3	7.8	5.1	5.1	8.7	
eGFR<30	1.2 (41)	0.8	1.7	1.6	1.0	0.9	1.2	0.9	1.0	
Albuminuria (ACR>30) (%)	12.5 (429)	9.6	9.5	12.0	16.4	9.1	10.2	15.2	19.3	.002
Serum creatinine (mg/dL)	1.1 ± 0.6	1.0 ± 0.7	1.0 ± 0.6	1.0 ± 0.8	1.0 ± 0.4	1.2 ± 0.6	1.2± 0.4	1.2 ± 0.8	1.3 ± 0.8	.3
CKD (eGFR<60 or ACR>30) (%)	20.0 (685)	16.5	19.6	20.1	25.3	14.2	14.3	19.4	28.9	<.001

Notes: Values expressed as percent or mean ± SD.

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(Numbers are expressed in parentheses.)

* Normal=BMI<25, Overweight=25 BMI<30, Class I Obese=30 BMI<35, Class II Obese=BMI 35.

** p trend

*** Health care access is an ordinal variable with values denoting difficulty of getting health care services (1=not difficult at all, 2 =not too hard, 3=fairly hard, 4=very hard)

Table 2

Association of Weight Status and CKD in the Jackson Heart Study

Variable	Pooled Model OR (95% CI)	Women Only OR (95% CI)	Men Only OR (95% CI)
Male	0.85 (0.50 -- 1.46)	--	--
Age (y)	1.03 (1.02 -- 1.04)	1.03 (1.02 -- 1.04)	1.04 (1.03 -- 1.06)
Married	0.79 (0.65 -- 0.96)	0.79 (0.62 -- 1.00)	0.78 (0.54 -- 1.12)
Healthcare Access [*]	1.03 (0.93 -- 1.16)	1.00 (0.88 -- 1.14)	1.12 (0.91 -- 1.37)
Cardiovascular Disease	1.76 (1.36 -- 2.27)	1.79 (1.29 -- 2.47)	1.76 (1.15 -- 2.69)
Diabetes	2.51 (2.04 -- 3.09)	1.96 (1.52 -- 2.52)	4.19 (2.90 -- 6.05)
Hypertension	2.43 (1.89 -- 3.14)	2.66 (1.93 -- 3.67)	2.09 (1.37 -- 3.20)
Hypercholesterolemia	1.15 (0.94 -- 1.39)	1.17 (0.92 -- 1.49)	1.12 (0.79 -- 1.59)
Hypertriglyceridemia	1.28 (0.91 -- 1.79)	1.10 (0.68 -- 1.76)	1.48 (0.91 -- 2.42)
<u>Education</u>			
< High School	1.00	1.00	1.00
High School	0.88 (0.67 -- 1.16)	0.83 (0.59 -- 1.16)	1.01 (0.61 -- 1.67)
Some College	0.78 (0.58 -- 1.04)	0.78 (0.55 -- 1.11)	0.80 (0.48 -- 1.34)
College Degree	0.76 (0.56 -- 1.02)	0.70 (0.48 -- 1.00)	0.96 (0.56 -- 1.64)
<u>Income</u>			
Low Income	1.00	1.00	1.00
Lower Middle	0.93 (0.73 -- 1.20)	0.94 (0.70 -- 1.26)	0.90 (0.56 -- 1.47)
Upper Middle	0.92 (0.72 -- 1.19)	0.83 (0.61 -- 1.14)	1.04 (0.66 -- 1.62)
High Income	0.69 (0.51 -- 0.93)	0.77 (0.53 -- 1.12)	0.60 (0.36 -- 0.98)
<u>Weight Status</u>			
Normal <i>BMI</i> < 25	1.00	1.00	1.00
Overweight 25 ≤ <i>BMI</i> < 30	0.95 (0.62 -- 1.45)	0.97 (0.64 -- 1.48)	0.86 (0.52 -- 1.42)
Class I Obese 30 ≤ <i>BMI</i> < 35	0.96 (0.63 -- 1.46)	1.00 (0.65 -- 1.52)	1.25 (0.74 -- 2.12)
Class II Obese <i>BMI</i> ≥ 35	1.27 (0.84 -- 1.91)	1.32 (0.88 -- 1.98)	2.37 (1.34 -- 4.19)
<i>P</i> trend	.0001	.12	.0003
Weight Status [*] Male <i>P</i>	.05		

Note: All variables included in the analysis are listed in the table.

CI, confidence interval; OR, odds ratio

^{*} Health care access is an ordinal variable with values denoting difficulty of getting health care services (1 =not difficult at all, 2=not too hard, 3=fairly hard, 4=very hard)

Table 3

Association of Weight Status and CKD by Sex in the Jackson Heart Study

<i>Variable</i>	<i>Normal Weight OR (95% CI)</i>		<i>Overweight OR (95% CI)</i>		<i>Class I Obese OR (95% CI)</i>		<i>Class II Obese OR (95% CI)</i>	
	Women	Men	Women	Men	Women	Men	Women	Men
Age (y)	1.03 (0.99 -- 1.06)	1.13 (1.07 -- 1.20)	1.05 (1.02 -- 1.07)	1.04 (1.01 -- 1.07)	1.02 (0.99 -- 1.04)	1.01 (0.99 -- 1.04)	1.01 (1.00 -- 1.04)	1.02 (0.98 -- 1.05)
Married	0.64 (0.27 -- 1.49)	1.03 (0.34 -- 3.18)	0.70 (0.43 -- 1.15)	0.67 (0.35 -- 1.30)	0.94 (0.59 -- 1.51)	0.76 (0.39 -- 1.49)	0.94 (0.64 -- 1.39)	0.86 (0.36 -- 2.03)
Healthcare access [*]	0.96 (0.58 -- 1.60)	1.20 (0.63 -- 2.30)	1.33 (1.00 -- 1.77)	1.06 (0.70 -- 1.59)	1.04 (0.81 -- 1.35)	1.34 (0.91 -- 1.98)	0.78 (0.62 -- 0.98)	1.06 (0.64 -- 1.76)
Cardiovascular Disease	4.11 (1.34 -- 12.62)	3.80 (1.02 -- 14.06)	1.11 (0.57 -- 2.20)	1.40 (0.67 -- 2.91)	2.14 (1.15 -- 3.97)	0.96 (0.40 -- 2.27)	1.82 (1.02 -- 3.21)	8.33 (2.44 -- 28.39)
Diabetes	1.87 (0.57 -- 6.10)	5.94 (1.34 -- 26.26)	1.81 (1.04 -- 3.11)	5.11 (2.69 -- 9.75)	3.17 (1.93 -- 5.21)	4.68 (2.42 -- 9.05)	1.85 (1.23 -- 2.75)	4.23 (1.79 -- 10.04)
Hypertension	4.89 (1.76 -- 13.64)	3.07 (0.82 -- 11.46)	2.28 (1.25 -- 4.16)	2.51 (1.15 -- 5.48)	2.70 (1.40 -- 5.19)	2.05 (0.94 -- 4.50)	2.45 (1.42 -- 4.24)	1.26 (0.50 -- 3.16)
Hypercholesterolemia	0.62 (0.26 -- 1.50)	1.06 (0.31 -- 3.57)	1.37 (0.86 -- 2.20)	1.64 (0.90 -- 2.99)	1.17 (0.73 -- 1.88)	1.09 (0.57 -- 2.10)	1.30 (0.88 -- 1.95)	0.56 (0.24 -- 1.28)
Hypertriglyceridemia	0.36 (0.35 -- 3.68)	0.33 (0.04 -- 2.77)	0.82 (0.31 -- 2.16)	1.60 (0.66 -- 3.89)	1.55 (0.59 -- 4.06)	1.16 (0.48 -- 2.80)	1.28 (0.60 -- 2.73)	3.42 (1.19 -- 9.87)

Note: All variables included in the analysis are listed in the table.

CI, confidence interval; OR, odds ratio

^{*} Health care access is an ordinal variable with values denoting difficulty of getting health care services (1=not difficult at all, 2=not too hard, 3=fairly hard, 4=very hard)