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Blood pressure, and sexual activity and dysfunction in women with hypertension: baseline findings from the Systolic Blood Pressure Intervention Trial (SPRINT)

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Abstract

Introduction—Sexual function, an important component of quality of life, is gaining increased research and clinical attention in older women with hypertension.

Aims—To assess the association between systolic blood pressure (SBP) and other variables, and sexual activity and sexual dysfunction in hypertensive women.

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[9]A complete list of the members of the Systolic Blood Pressure Intervention Trial (SPRINT) Research Study Group is provided as a Supplementary Appendix

Conflict of Interest: None

Methods—Baseline analysis of 635 women participants of a larger randomized clinical trial of 9361 men and women.

Main Outcome Measures—Self-reported sexual activity (yes/no), and sexual function using the Female Sexual Function Inventory (FSFI).

Results—452 participants (71.2%) reported having no sexual activity during the previous 4 weeks. The mean (SD) FSFI score for sexually active participants was 25.3 (6.0), and 52.6% of the sample reported a FSFI score ≤26.55 designating sexual dysfunction. In logistic regression models, SBP was not significantly associated with sexual activity (AOR = 1.002; p >0.05). Older age (AOR=0.95, p <0.05), and lower education (AOR for <high school vs. college degree = 0.29, p <0.05) were associated with lower odds of being sexually active, as was living alone vs. living with others (AOR = 0.56, p <0.05). Higher weekly alcohol consumption was associated with increased odds of being sexually active (AOR = 1.39; p<0.05). In logistic regression models among sexually active participants, SBP was not associated with sexual dysfunction (AOR = 1.01; p>0.05). Higher depressive symptoms from the Patient Health Questionnaire-9 (PHQ-9) was associated with higher odds of sexual dysfunction (AOR = 1.24, p<0.05), as was increased number of physical comorbidities (AOR = 1.25, p <0.05). Diuretic use was associated with lower odds of being sexually active in CKD participants (AOR = 0.33, p<0.05).

Conclusions—Younger age, higher education, living with others, and higher weekly alcohol consumption were significantly associated with higher odds of being sexually active in a sample of middle-aged and older women with hypertension. Increased depressive symptoms and increased physical comorbidities were significantly associated with increased odds of sexual dysfunction. SBP was not significantly associated with sexual activity or sexual dysfunction.

Trial Registration: ClinicalTrials.gov Identifier: NCT01206062

Introduction

Sexual activity and function are important components of health-related quality of life (HRQL) throughout the lifespan[1]. Sexual dysfunction, defined by the World Health Organization as “the various ways in which an individual is unable to participate in a sexual relationship as he or she would wish”[2] presents a considerable challenge to HRQL, interpersonal relationships, and mood states[3]. Intriguingly, some studies[4;5] have found that women report a higher prevalence of sexual dysfunction than men. The issue of female sexual dysfunction (FSD) has generated increased[6], albeit controversial[7] interest in recent years, with many researchers agreeing that rather than being a disorder solely of psychological origin, FSD may result from a complex interplay of several psychosocial, metabolic and physiological factors[8], and physical health[9].

The association between one physiological variable, blood pressure, and FSD is unclear, with some recent studies[10;11], but not all[12] finding that hypertensive women are more likely to report FSD than normotensive women. The association between blood pressure and FSD is biologically plausible given the assertion that FSD is influenced by vascular factors, as elevated blood pressure may result in reduced release of nitric oxide, which may result in endothelial dysfunction, which may consequently result in reduced relaxation of smooth muscle tissue[13]. Manolis and Doumas[1], in their review of literature on the association

between hypertension (HTN) and sexual dysfunction, note the relative paucity of literature in this area, and the need for well-designed studies to address this issue. Furthermore, the association between HTN and sexual function is further complicated by the issue of antihypertensive medications, which also have been postulated as a possible cause of sexual dysfunction. While this issue has garnered considerable attention in men, comparatively little is known about the effect of pharmacological antihypertensive treatment on female sexual function[14]. Some studies[11;15–17] have found that treatment with various classes of antihypertensive medications may be associated with increased prevalence of FSD. In addition, few studies have investigated sexual activity or function in middle-aged or older women who are likely postmenopausal[18], or in subgroups of women with hypertension, such as women with chronic kidney disease[19].

Aims

In consideration of these issues, the purpose of this investigation was to assess the cross-sectional association between baseline blood pressure and sexual activity and sexual function among women participants in the Systolic Blood Pressure Intervention Trial (SPRINT) Health-Related Quality of Life (HRQL) subsample. SPRINT offers the opportunity to examine this association in a multi-ethnic sample after adjustment for several demographic, behavioral, psychosocial and clinical factors.

Methods

Participants

SPRINT is a large, two-armed, multi-center randomized clinical trial designed to test whether treatment of systolic blood pressure (SBP) to a goal of <120 mmHg will reduce CVD and unfavorable renal and cognitive outcomes compared to a treatment goal of <140 mmHg in a multi-ethnic sample of 9361 men and women with HTN. Details regarding the design, recruitment and objectives of SPRINT have been previously published[20]. Briefly, inclusion criteria for SPRINT are described in Table 1, with exclusion criteria provided in the publically-available SPRINT protocol document[21]. SPRINT also includes several subsamples, including a Health-Related Quality of Life (HRQL) subsample consisting of 1987 men and women participants, who were selected using a probabilistic algorithm that preserved the randomization blocking and allowed the sampling fraction to vary by clinical site and over time. This investigation involves the 635 women participants in the SPRINT HRQL subsample who completed baseline assessments before the interventions began.

Measures

Main Outcome Measures

Sexual Activity and Sexual Function: Sexual activity during the previous 4 weeks was assessed by an item with the question “Have you engaged in sexual activity of any kind with a partner and/or by yourself (masturbation)?” This item served as a skip pattern question which instructed participants who answered “yes” to engaging in sexual activity to complete questions regarding sexual function during the past 4 weeks using a modified version of the Female Sexual Function Inventory (FSFI)[22;23]. The FSFI is a 19-item measure that assesses

6 domains of sexual function (desire, arousal, lubrication, orgasm, satisfaction and pain) as well as a total score. Each domain score is calculated by adding the sum of items for the domain, and multiplying the sum by a domain-specific weight. A previously validated total score of ≤26.55 was used in these analyses to categorize sexual dysfunction.[24] Interestingly, three FSFI items (Items 1, 2 and 16) which relate to sexual desire and satisfaction do not require individuals to have engaged in sexual activity. Thus, based on previous recommendations regarding administration of the FSFI[25], these items are moved to the beginning of the questionnaire before the sexual activity skip pattern item. Also, a person who has not engaged in sexual activity will report a score of 0 on the original FSFI, which is not truly indicative of sexual dysfunction. Thus, the aforementioned skip pattern question allowed removal of the zero category (0 = No Sexual Activity) for each question.[25]

Independent Variables

Blood Pressure: After a 5-minute rest, resting seated blood pressure was measured three times at 1-minute intervals using automated, programmable identical equipment (Omron HEM-907 XL, Omron Healthcare, Lake Forest, IL) by centrally trained technicians. These measurements were taken while participants were on their usual care for blood pressure treatment. The average of the three measurements was used as the blood pressure for the visit.

Demographic, Behavioral, Clinical and Psychosocial Variables: Age, gender, race/ethnicity (white, black and other), highest educational attainment, living arrangement (alone vs. with others) and alcohol consumption (typical drinks/week) were assessed by self-report. Use of beta-blockers, diuretics, calcium channel blockers, angiotensin converting enzyme inhibitors, angiotensin receptor blockers, or any cholesterol medications was assessed via trained personnel who referred to the US FDA lists of approved antihypertensive and cholesterol medications. Height and weight were directly measured according to standardized procedures, and Body Mass Index (BMI) was calculated as weight in kilograms/(height in meters)^2. Estimated glomerular filtration rate (eGFR) was calculated using the four-variable MDRD formula[26], and expressed as mL/min/1.73m^2. Cognitive function was assessed via standardized interview using the Montreal Cognitive Assessment (MoCA) total score[27]. Depressive symptoms were assessed via self-report using the Patient Health Questionnaire (PHQ-9)[28] total score. Total number of physical comorbidities were assessed via self-report using the sum of the Selim Comorbidity Index physical comorbidity score[29].

Statistical Analyses

Descriptive summary statistics were generated to determine the baseline characteristics for the sample. Means and standard deviations were reported for continuous variables and frequencies for categorical variables. Statistics were partitioned by sexual activity status during the past 4 weeks (yes or no), and by categories of systolic blood pressure (<140 mmHg, 140–160 mmHg, and >160 mmHg) for sexual dysfunction. To test bivariate associations, Pearson's chi-square tests were used and one-way ANOVA or Kruskal-Wallis tests, as appropriate, were used to examine differences between groups depending on the variable distribution P-values were reported.

The association between baseline systolic and diastolic blood pressure (in 5mmHg increments) and sexual activity was examined through an unadjusted logistic regression model and several adjusted logistic models in which odds ratios and 95% confidence intervals were calculated. Adjusted model 1 examined the association between baseline systolic and diastolic blood pressure and sexual activity, after adjustment for baseline demographic factors (age, race/ethnicity, education, and living arrangement). Adjusted Model 2 included the variables in Adjusted Model 1, with the addition of drinks per week of alcohol, class of antihypertensive medication, and cholesterol medication. Finally, Adjusted Model 3 portrayed Adjusted Model 2 plus BMI, eGFR, MoCA total score, PHQ-9 total score, and total number of physical comorbidities. We also repeated the models assessing sexual activity in a sample of participants with chronic kidney disease (n =198), defined as eGFR <60 mL/min/1.73m^2. These models were repeated to determine the association between baseline blood pressure and sexual dysfunction. Our initial strategy included assessing the association of several additional covariates (glucose, total cholesterol, use of hormonal therapy for menopause, use of antidepressive medications, family history of CVD, smoking, and physical activity), but these variables were not significantly associated with sexual activity or sexual function, and thus are not presented in the logistic regression models, but are presented in the initial descriptive analyses. In addition, the models on sexual dysfunction in participants with CKD failed to converge, and thus are not presented. The a priori alpha level of significance for all analyses was set at 0.05, and all analyses were conducted using SAS version 9.3.

Results

The mean (SD) age was 67.4 (10) years, with an age range of 44 years. The youngest participant was aged 50 years, and the oldest participant was aged 90 years. 452 participants (71.2%) reported having no sexual activity during the previous 4 weeks. The mean (SD) FSFI score for sexually active participants was 25.3 (6.0), and 52.6% of the sample reported a FSFI score ≤26.55 designating sexual dysfunction. Table 2 displays descriptive statistics for the total sample, partitioned by sexual activity status among the 635 participants who answered the sexual activity question. Collectively, sexually active women (n= 183; 28.8%) were younger, more highly educated, more likely to be living with others, consumed more weekly alcohol than women who were not sexually active, and were more likely to take beta-blockers. In addition, sexually active women were less likely to take cholesterol medication, and have more favorable MoCA scores than women who were not sexually active. Finally, sexually active women reported fewer physical comorbid conditions than sexually inactive women.

Table 3 presents descriptive statistics for the total sample, partitioned by categories of systolic blood pressure. There were no differences among blood pressure categories in the selected baseline characteristics, with the exception of age, indicating that participants in the SBP <140 mmHg category were younger than participants in the 140–160 mmHg and >160 mmHg categories. Among participants with CKD (Table 4), sexually active participants were significantly younger, more likely to live with others, had higher pack-years of smoking and alcohol consumption, and had higher (more favorable) MoCA scores.

Table 5 depicts the results of the unadjusted and adjusted logistic regression models to examine the association between blood pressure (expressed in 5 mmHg units) and being sexually active. In the unadjusted model, higher SBP was associated with lower odds of being sexually active ($p<0.05$), while increased DBP was associated with higher odds of being sexually active ($p<0.05$). However, in the adjusted models, the association between blood pressure and sexual activity was no longer significant. Among covariates, in all adjusted models, older age was associated with lower odds of being sexually active. In all adjusted models, participants with less than high school education, high school education/GED, and post high school education all were less likely to be sexually active compared to participants who graduated from college ($p<0.05$). Participants who lived alone were less likely to be sexually active compared to participants who lived with others ($p<0.05$). Finally, in adjusted models 2 and 3, increased alcohol consumption was associated with higher odds of being sexually active ($p<0.05$).

Table 6 communicates the results of the unadjusted and adjusted logistic regression models to examine the association between baseline blood pressure and sexual dysfunction among the 183 participants who reported engaging in sexual activity in the past 4 weeks. In all models, the association between blood pressure and sexual dysfunction was not significant. In addition, none of the covariates in Adjusted Models 1 and 2 were significantly associated with sexual dysfunction. However, in adjusted model 3, increased PHQ-9 score was associated with higher odds of sexual dysfunction ($p<0.05$), as was increased number of physical comorbidities ($p<0.05$).

Table 7 exhibits the results of the unadjusted and adjusted logistic models examining the association between blood pressure and sexual activity in the 198 participants with chronic kidney disease. In the unadjusted model, increased SBP was associated with lower odds of being sexually active ($p<0.05$). Among covariates, older age was associated with lower odds of being sexually active in all adjusted models, as was living alone. Increased alcohol consumption in participants with CKD was associated with higher odds of being sexually active ($p<0.05$), while use of diuretics was associated with lower odds of being sexually active ($p<0.05$).

Discussion

The primary purpose of this investigation was to determine if baseline systolic blood pressure was associated with being sexually active or having sexual dysfunction in a sample of middle-aged and older women with HTN, after adjustment for several demographic, behavioral and clinical variables. We were also interested in assessing the prevalence of sexual activity and dysfunction in this sample. Collectively, we found that neither systolic blood pressure nor use of antihypertensive medications was associated with sexual activity or function after adjustment for covariates. These findings contribute to the ongoing discussion regarding sexual dysfunction in adults with HTN. Importantly, we also found that a substantial percentage (71.2%) of our sample had not engaged in sexual activity over the previous 4 weeks, and that sexual dysfunction was highly prevalent in our sample.

In our descriptive analyses, we found that roughly 28.8% of the sample had been sexually active in the previous 4 weeks, which is slightly lower than that of other reports. Spatz et al.[12], studying a nationally-representative sample of 1390 middle-aged and older women in the National Social Health, Life and Aging Project, found that the weighted prevalence of sexual activity among treated and untreated women with HTN was 35.2% and 38.3% respectively, while the weighted percentage of sexually activity in women without HTN was 58%. Prevalence of sexual activity in our sample is also slightly lower than that found by Gass et al.[30] in a sample of 27,347 women in the Women's Health Initiative. In that study, the prevalence of sexual activity was 40.5% among 3,145 participants who reported using antihypertensive medications. The results of our study and others confirm that sexual activity is prevalent among many older women with HTN[31].

We also found that 52.6% of our sample reported sexual dysfunction as assessed using the FSFI. This finding corroborates those of several other studies which have reported high prevalence of sexual dysfunction in patients with HTN. Chedraui et al.[32] found that a sexual dysfunction prevalence of 55.7% among women aged 40 to 59 years. De Franciscis et al.[33], studying sexually active women outpatients at a menopausal clinic, aged 48 to 55 years, found that 20% of normotensive women, 38% of women with untreated HTN, and 27% of women with treated HTN reported sexual dysfunction. Coupled with the findings of other reports, these results emphasize the need for assessment of sexual activity and sexual dysfunction in women with or without HTN[34].

In our primary analyses, neither baseline blood pressure nor antihypertensive medication use was related to sexual activity or sexual dysfunction in the total sample, after adjustment for several variables in logistic regression analyses. Our findings are consistent with those of Spatz et al.[12], who found no association between antihypertensive medication class and sexual activity or function, but are in contrast to several studies[10,11] which found that women with HTN are more likely to report FSD compared to normotensive women. The finding that antihypertensive medication class was unrelated to sexual activity or function in the total sample, taken together with previous research indicating lower prevalence of FSD in women with treated vs. untreated HTN, may help alleviate the reluctance among patients and providers to initiate or adhere to hypertension treatment due to widespread beliefs that medications are implicated in the development of sexual dysfunction. While some studies have found associations between beta blockers and FSD[15], several studies have found no association between antihypertensive medications and FSD[35;36]. Indeed, this area of research has been critiqued for producing more reviews, commentaries and debates than original, data-driven investigations[14]. However, as stated by other researchers, unravelling the complicated milieu of associations among HTN, its pharmacological treatment, and sexual function continue to spawn multiple conceptualizations and present formidable challenges to researchers and clinicians[37].

In subgroup analyses among participants with CKD, blood pressure was not found to be associated to sexual activity. Interestingly however, diuretic use was found to be associated with lower odds of sexual activity in CKD patients. The literature regarding sexual activity and function among women with CKD is scant, although studies have found that a majority of female dialysis patients report difficulty in sexual arousal[38], and in sexual function[39].

Strippoli et al.[40], studying 1472 women with end-stage renal disease who were undergoing dialysis, found that diuretic use was associated with sexual dysfunction as assessed with the FSFI. In particular, thiazide diuretic use is postulated to be associated with decreased libido and vaginal lubrication[41]. However, as the authors state, future research is needed to determine whether diuretic treatment in CKD patients is directly associated with sexual dysfunction, or whether it reflects comorbidity[40]. As noted earlier, we did not have an adequate sample size of CKD participants to conduct logistic regression analyses on the associations between blood pressure, medication use and sexual function.

We also found several factors that were independently associated with sexual dysfunction in our sample of hypertensive women. Younger age[42], higher education and increased alcohol consumption were associated with increased odds of being sexually active. Other investigations have reported similar findings. For instance, Bach et al[43]., studying 11,635 community-dwelling retirement village residents, found that younger age, higher education, and greater alcohol consumption were all significantly associated with sexual activity. We also found that higher levels of depressive symptoms were associated with increased odds of sexual dysfunction, as has been found in various samples[44–47]. Not surprisingly, greater number of physical comorbidities were associated with higher odds of sexual dysfunction, which has been demonstrated among women in at least one previous study[9]. Our results, coupled with previous reports, point to the importance of assessing the interrelationships among multiple conditions upon health during middle and older age[9].

This investigation had several strengths, including direct, rigorous assessment of blood pressure and antihypertensive medications, a multiethnic sample, and validated measures of sexual function, cognitive function, comorbidities and kidney function. In addition, our analyses adjusted for several relevant demographic and clinical covariates, and included direct standardized anthropometric measures. Finally, SPRINT affords the opportunity to assess sexual activity and function in an older cohort of women with HTN.

However, several limitations of this investigation must be noted, one of the foremost of which is the relatively small sample size of sexually active participants at baseline (n=183; 28.8%, Table 2), and the small number of participants with CKD (n=198), which may have limited the ability to detect differences in sexual function. In addition, very few sexually active participants (n=17) had systolic blood pressure >160 mmHg. Also, while we assessed the associations of different classes of antihypertensive medications with sexual activity and function, it is conceivable that participants were taking medications that actually may have opposing effects on sexual function.

Additional limitations relate to the FSFI, which assesses sexual activity over the previous 4 weeks; thus, participants who are not inactive, yet engage in sexual activity less frequently were not counted as being “sexually active”[23;48]. Due to the potentially sensitive nature of questions in the FSFI regarding sexual function, some participants may have chosen to respond that they were not sexually active to avoid answering additional questions. Furthermore, we did not ask why participants had not engaged in sexual activity, and thus we cannot determine whether sexually inactive participants also had sexual dysfunction. Also, although SPRINT assesses living arrangement, we did not initially ask participants

regarding relationship status, availability of a sexual partner[31]; or the health or sexual function of partners, each of which may influence sexual activity and satisfaction.

Also, as SPRINT only enrolls participants with HTN, we were not able to compare sexual activity and function between women with HTN and women without HTN. Also, our sample was highly educated, with 68.8% of participants reported having post high-school education (Table 2). Although our middle-aged and older sample was most likely menopausal, we did not assess menopausal status directly. Other factors that may be associated with sexual activity, such as body image issues, dermatologic problems and gum disease[43] are not assessed in SPRINT. Finally, our cross-sectional investigation prohibits us from inferring causal associations. It will be intriguing to assess changes in sexual activity and sexual function over the duration of this longitudinal study.

Conclusions

In this cross-sectional baseline investigation among middle-aged and older women with HTN, neither blood pressure nor antihypertensive medication class was found to be associated with sexual dysfunction in the total sample. However, diuretic use was found to be associated with lower odds of being sexually active in participants with CKD. In addition, this investigation revealed several issues that should be considered by providers caring for women with HTN, including high prevalence of sexual inactivity and dysfunction. Several variables, such as younger age, increased education, and increased alcohol use, were found to be associated with higher odds of sexual activity, and increased depressive symptoms and increased physical comorbidities were associated with increased odds of sexual dysfunction. Some of these variables, such as alcohol consumption, may be modifiable. The longitudinal SPRINT trial is well poised to assess changes in sexual activity and function, as well as determining whether intensive blood pressure has an effect upon sexual function.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

An acknowledgement page has been uploaded on the website as a separate file.

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Table 1

Inclusion Criteria for SPRINT Participants. To be eligible, a screenee must meet criteria 1, 2, and 3.

General Inclusion Criteria for SPRINT

1 Age ≥50 years

2 Systolic Blood Pressure (SBP)

- SBP: 130–180 mmHg on 0 or 1 medication
- SBP: 130–170 mmHg on up to 2 medications
- SBP: 130–160 mmHg on up to 3 medications
- SBP: 130–150 mmHg on up to 4 medications

3 At risk for CVD events based on at least one of the following:

a. Presence of clinical or subclinical cardiovascular disease (CVD) other than stroke

i. Clinical CVD (other than stroke)

a. Previous myocardial infarction (MI), percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), carotid endarterectomy (CE), carotid stenting

b. Peripheral artery disease (PAD) with revascularization

c. Acute coronary syndrome with or without resting ECG change, ECG changes on a graded exercise test (GXT), or positive cardiac imaging study

d. At least 50% diameter stenosis of a coronary, carotid, or lower extremity artery

e. Abdominal aortic aneurysm (AAA) > 5 cm with or without repair

ii. Subclinical CVD

a. Coronary artery calcium score > 400 Agatston units within the past 2 years

b. Ankle brachial index (ABI) <0.90 within the past 2 years

c. Left ventricular hypertrophy (LVH) by ECG (based on computer reading) echocardiogram report, or other cardiac imaging procedure report within the past 2 years

b. Chronic kidney disease, defined as estimated glomerular filtration rate 20 – 59 mL/min/1.73^2

c. Framingham risk score for 10-year CVD risk >15% based on clinical features and laboratory results within the past 12 months

Targeted high-risk subgroup inclusion criteria
Chronic kidney disease: Qualifying chronic kidney disease was defined by estimated glomerular filtration rate, determined at baseline between 20 and 59 mL/min/1.73 m2, inclusive, based on the four-variable MDRD equation.
Senior: Participants who were at least 75 years old at the baseline visit.
CVD: Participants who met any of the inclusion criteria listed in 3a above at baseline.

Table 2

Baseline Characteristics of Female Participants According to Sexual Activity Status

Characteristic	Overall n=635	Sexually Active n=183 (28.8%)	Not Sexually Active n=452 (71.2%)	p-value*
Demographic				
Age (yrs)[a]	67.4 (10)	63.4 (9.1)	69.0 (9.8)	**<.001**
Race/Ethnicity				0.61
White[b]	43.2	41.5	43.8	
African-American[b]	40.0	39.3	40.3	
Other[b]	16.8	19.1	15.9	
Education				**<0.001**
Less than High School[b]	12.1	7.1	14.2	
High School Graduate/GED[b]	19.1	14.2	21.0	
Post High School[b]	34.8	34.4	35.0	
College Degree[b]	34.0	44.3	29.9	
Lives with Others	65.2	74.9	61.3	**<0.01**
Behavioral Risk Factors				
Smoking (pack-yrs) [§]	0 (0 – 10.4)	0.2 (0 – 12)	0 (0 – 10.1)	0.12
Alcohol (drinks/typical week) [§]	1.0 (0 – 1)	1.0 (0 – 2)	0 (0 – 1)	**<.0001**
Moderate-intensity physical activity				0.15
0–60 minutes per day[b]	72.1	66.7	74.3	
1–4 hours per day[b]	20.4	24.0	18.9	
4 or more hours per day[b]	7.6	9.3	6.9	
Systolic Blood Pressure				0.13
< 140 mmHg[b]	47.1	47.0	47.1	
140 – 160 mmHg[b]	39.7	43.7	38.1	
>160 mmHg[b]	13.2	9.3	14.8	
Antihypertension Medications				

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Characteristic	Overall n=635	Sexually Active n=183 (28.8%)	Not Sexually Active n=452 (71.2%)	p-value*
Use of beta-blockers[b]	30.9	24.6	33.4	**0.03**
Use of diuretics[b]	50.2	51.4	49.8	0.72
Use of calcium channel blockers[b]	32.1	27.3	34.1	0.099
Use of angiotensin receptor converting enzyme inhibitors[b]	33.5	35.5	32.7	0.50
Use of angiotensin receptor blockers[b]	25.2	27.9	24.1	0.33
Total number of antihypertensive medications [a]	1.87 (1.0)	1.77 (1.0)	1.91 (1.0)	0.10
Cardiometabolic and Psychosocial Variables				
Glucose (mg/dL) [a]	97.1 (14.3)	97.8 (13.4)	96.9 (14.7)	0.45
Total Cholesterol (mg/dL) [a]	207.9 (39.5)	213.5 (38.3)	205.6 (39.8)	**0.02**
Any anti-cholesterol medication[b]	41.6	35.0	44.3	**0.03**
Any menopausal hormones[b]	8.4	8.2	8.4	0.93
Any antidepressant medication[b]	16.4	16.6	16.3	0.92
BMI (kg/m^2) [a]	30.1 (6.7)	30.7 (6.4)	29.9 (6.8)	0.17
eGFR (mL/min/1.73 m^2) [a]	71.2 (22.2)	73.7 (20.3)	70.2 (22.8)	0.08
Chronic Kidney Disease (eGFR <60 mL/min/1.73m^2)[b]	31.2	23.0	34.6	**0.004**
CVD Family History[b]	33.8	36.9	32.5	0.31
MoCA Score [a, c]	22.4 (4.7)	23.4 (3.4)	21.9 (5.0)	**<.0001**
PHQ-9 Total Score [§, d]	2 (1 – 6)	2 (0 – 6)	2.5 (1 – 6)	0.72
Number of Physical Comorbidities [a, d]	4.4 (2.6)	4.1 (2.3)	4.5 (2.7)	**0.03**

[a]Data presented as mean(standard deviation);

[§]Data presented as median (Interquartile range);

[b]data presented as %

[c]Higher scores indicate better function

[d] Higher scores indicate poorer function

* p-value from Chi Square test for categorical variables and Student's t-test for continuous variables significant ($p<0.05$) values presented in **bold**

Table 3

Baseline Characteristics of Sexually Active Female Participants According to Blood Pressure Status

Characteristic	Overall n=183	SBP<140 mmHg n=86	SBP 140–160 mmHg n=80	SBP>160 mmHg n=17	p-value
FSFI Score [a]	25.3 (6.0)	24.6 (6.0)	25.9 (6.3)	26.5 (4.3)	0.24
Sexual dysfunction (FSFI score ≤26.55)[b]	52.6	59.3	45.0	52.9	0.18
Demographic					
Age (yrs)[a]	63.4 (9.1)	61.0 (7.4)	65.5 (9.5)	65.6 (12.2)	**0.003**
Race/Ethnicity					0.42
White[b]	41.5	40.7	46.3	23.5	
African-American[b]	39.3	38.4	36.3	58.2	
Other[b]	19.1	20.9	17.5	17.7	
Education[b]					0.059
Less than High School[b]	7.1	9.3	2.5	17.7	
High School Graduate/GED[b]	14.2	11.6	13.8	29.4	
Post High Schoo[b]	34.4	30.2	40.0	29.4	
College Degree[b]	44.3	48.8	43.8	23.5	
Lives with Others[b]	74.9	80.2	72.5	58.8	0.14
Behavioral Risk Factors					
Smoking (pack-yrs) [§]	0.2 (0 – 12)	0.7 (0 – 12.8)	0 (0 – 12)	1.1 (0 – 8)	0.80
Alcohol (drinks/typical week) [§]	1.0 (1 – 2)	1.0 (0 – 2)	1.0 (0 – 2)	1.0 (0 – 2)	0.17
Antihypertension Medications					
Use of beta-blockers[b]	24.6	22.1	28.8	17.7	0.48
Use of diuretics[b]	51.4	57.0	47.5	41.2	0.32
Use of calcium channelblockers[b]	27.3	27.9	27.5	23.5	0.93
Use of angiotensin receptor converting enzyme inhibitors[b]	35.5	34.9	37.5	29.4	0.81
Use of angiotensin receptor	27.9	25.6	30.0	29.4	0.81

Characteristic	Overall n=183	SBP<140 mmHg n=86	SBP 140–160 mmHg n=80	SBP>160 mmHg n=17	p-value
blockers[b]					
Total number of antihypertensive medications [a]	1.8 (1.0)	1.7 (1.0)	1.8 (1.0)	1.6 (0.9)	0.73
Cardiometabolic and Psychosocial Variables					
Glucose[a]	97.8 (13.4)	96.8 (12.7)	99.0 (14.2)	97.2 (12.8)	0.57
Total Cholesterol (mg/dl)[a]	213.5 (38.3)	215.2(38.8)	211.3 (39.4)	215.2(31.5)	0.80
Any Anti-cholesterol medication[b]	35.0	39.5	33.8	17.7	0.21
Any menopausal hormones[b]	8.2	4.7	11.3	11.8	0.19
Any antidepressant medication[b]	16.6	20.0	12.5	18.8	0.37
BMI (kg/m^2) [a]	30.7 (6.4)	31.0 (6.4)	30.1 (6)	32.1 (8.2)	0.45
eGFR (mL/min/1.73 m^2) [a]	73.7 (20.3)	72.1 (19.4)	75.1 (21.2)	75.1 (21.5)	0.60
Chronic Kidney Disease (eGFR <60 mL/min/1.73m^2) [b]	23.0	30.2	16.3	17.7	0.09
MoCA Score [a, c]	23.4 (3.4)	23.6 (3.4)	23.4 (3.6)	22.7 (3.1)	0.94
PHQ-9 Total Score [§, d]	2.0 (2 – 6)	3.0 (0 – 7)	2.0 (0 – 4)	3.0 (1 – 7)	0.09
Number of Physical Comorbidities[a,d]	4.1 (2.3)	4.0 (2.2)	4.0 (2.4)	4.4 (2.3)	0.80

[a]Data presented as mean(standard deviation);

[§]Data presented as median (Interquartile range)

[b]data presented as %

[c]Higher scores indicate better function

[d]Higher scores indicate poorer function

[*]p-value from Chi Square test for categorical variables and Student's t-test for continuous variables significant (p<0.05) values presented in **bold**

Table 4

Baseline Characteristics of Female Participants with Chronic Kidney Disease According to Sexual Activity Status

Characteristic	Overall n=198	Sexually Active n=42	Not Sexually Active n=156	p-value*
Demographic				
Age (yrs)[a]	70.1(9.6)	65.1 (9.4)	71.5 (9.2)	**0.0001**
Race/Ethnicity				0.57
White[b]	57.1	64.3	55.1	
African-American[b]	36.9	31.0	38.5	
Other[b]	6.1	4.8	6.4	
Education[b]				0.46
Less than High School[b]	14.1	9.5	15.4	
High School Graduate/GED[b]	22.7	16.7	24.4	
Post High School[b]	33.8	38.1	32.7	
College Degree[b]	29.3	35.7	27.6	
Lives with Others[b]	65.2	85.7	59.6	**0.0016**
Behavioral Risk Factors				
Smoking (pack-yrs)[§]	1.0 (0 – 20)	1.5 (0 – 19)	0 (0 – 10)	**0.046**
Alcohol (drinks/typical week)[§]	1.0 (0 – 2)	1.0 (0 – 1)	0 (0 – 1)	**0.004**
Moderate-intensity physical activity				0.25
0–60 minutes per day[b]	78.3	69.1	80.8	
1–4 hours per day[b]	15.7	21.4	14.1	
4 or more hours per day[b]	6.1	9.5	5.1	
Systolic Blood Pressure				0.29
< 140 mmHg[b]	54.0	61.9	51.9	
140 – 160 mmHg[b]	31.8	31.0	32.2	
>160 mmHg[b]	14.1	7.1	16.0	
Antihypertension Medications				

Characteristic	Overall n=198	Sexually Active n=42	Not Sexually Active n=156	p-value*
Use of beta-blockers[b]	38.9	40.5	38.5	0.81
Use of diuretics[b]	45.5	28.6	50.0	**0.013**
Use of calcium channel blockers[b]	36.4	38.1	35.9	0.79
Use of angiotensin receptor converting enzyme inhibitors[b]	36.4	33.3	37.2	0.65
Use of angiotensin receptor blockers[b]	23.7	28.6	22.4	0.41
Total number of antihypertensive medications [a]	2.05 (1.0)	1.9 (1.0)	2.1 (1.0)	0.37
Cardiometabolic and Psychosocial Variables				
Glucose (mg/dL) [a]	95.6 (13.5)	94.8 (12.0)	95.8 (13.9)	0.67
Total Cholesterol (mg/dL) [a]	199.9 (37.9)	199.9 (34.4)	199.9 (38.9)	0.99
Any anti-cholesterol medication[b]	47.0	52.4	45.5	0.43
Any menopausal hormones[b]	10.1	16.7	8.3	0.15
Any antidepressant medication[b]	19.7	19.1	19.9	0.91
BMI (kg/m^2) [a]	29.7 (6.9)	29.3 (5.5)	29 8 (7.3)	0.62
eGFR (mL/min/1.73 m^2) [a]	46.5 (10.6)	47.4 (11.1)	46.2 (10.5)	0.52
CVD Family History[b]	33.7			
MoCA Score [a, c]	22.6 (4.8)	23.8 (3.3)	22.3 (5.1)	**0.026**
PHQ-9 Total Score [§, d]	2.0 (0 – 4))	2.0 (0 – 6)	2.0 (0 – 6)	0.67
Number of Physical Comorbidities [a, d]	5.3 (2.7)	4.9 (2.1)	5.5 (2.9)	0.16

[a]Data presented as mean(standard deviation);

[§]Data presented as median (Interquartile range)

[b]data presented as %

[c]Higher scores indicate better function

[d]Higher scores indicate poorer function

*p-value from Chi Square test for categorical variables and Student's t-test for continuous variables significant (p<0.05) values presented in **bold**

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Table 5

Baseline Correlates of Being Sexually Active among Female Participants (for unadjusted and adjusted logistic regression analyses)

	Unadjusted Model n=635		Adjusted Model 1 n=635		Adjusted Model 2 n=631		Adjusted Model 3 n=621	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Unadjusted Model								
Systolic blood pressure (mmHg)	**0.981**	**(0.97,0.99)**	0.998	(0.98,1.01)	1.001	(0.99,1.02)	1.002	(0.99,1.02)
Diastolic blood pressure (mmHg)	**1.039**	**(1.02,1.06)**	1.007	(0.99,1.03)	1.000	(0.98,1.02)	1.001	(0.98,1.03)
Demographic Variables (Adjusted Model 1)								
Age (yrs).	---	---	**0.942**	**(0.92,0.97)**	**0.947**	**(0.92,0.97)**	**0.947**	**(0.92,0.98)**
African-American vs. White	---	---	0.805	(0.52,1.25)	0.853	(0.53,1.36)	0.928	(0.56,1.54)
Other vs. White	---	---	0.939	(0.55,1.61)	0.968	(0.55,1.71)	1.015	(0.54,1.91)
< High school vs. College Graduate	---	---	**0.272**	**(0.14,0.55)**	**0.256**	**(0.12,0.53)**	**0.295**	**(0.13,0.68)**
High School graduate/GED vs. College Graduate	---	---	**0.403**	**(0.23,0.70)**	**0.374**	**(0.21,0.66)**	**0.371**	**(0.20,0.69)**
Post High School vs. College Graduate	---	---	**0.603**	**(0.39,0.93)**	**0.626**	**(0.40,0.98)**	0.643	(0.41,1.02)
Lives alone vs. Lives with Others	---	---	**0.627**	**(0.42,0.95)**	**0.579**	**(0.38,0.89)**	**0.562**	**(0.36,0.87)**
Behavioral Risk Factor and Medication Use Variables (Adjusted Model 2)								
Alcohol Consumption (drinks/typ wk)	---	---	---	---	**1.342**	**(1.16,1.56)**	**1.386**	**(1.19,1.62)**
Beta-blockers (BB) vs. no BB	---	---	---	---	0.674	(0.44,1.04)	0.670	(0.43,1.04)
Diuretics vs. no diuretics	---	---	---	---	1.075	(0.73,1.59)	1.164	(0.78,1.74)
Calcium channel blockers vs.no calcium channel blockers	---	---	---	---	0.816	(0.54,1.24)	0.819	(0.53,1.25)
Angiotensin receptor blockers (ARB) vs. no ARB	---	---	---	---	1.566	(0.97,2.52)	1.523	(0.94,2.47)
Angiotensin Converting Enzyme (ACE) inhibitors vs. no ACE					1.511	(0.98,2.34)	1.470	(0.94,2,30)
Any Cholesterol Medication	---	---	---	---	0.761	(0.51,1.13)	0.731	(0.49,1.10)
Cardiometabolic and Psychosocial Variables (Adjusted Model 3)								
BMI (kg/m^2)	---	---	---	---	---	---	1.000	(0.97,1.03)
eGFR (mL/min/1.73 m^2)	---	---	---	---	---	---	0.993	(0.98,1.00)
MoCA score[a]	---	---	---	---	---	---	1.021	(0.97,1.08)
PHQ-9 Total Score[b]	---	---	---	---	---	---	0.971	(0.92,1.02)

	Unadjusted Model n=635		Adjusted Model 1 n=635		Adjusted Model 2 n=631		Adjusted Model 3 n=621	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Number of Physical Comorbidities[b]	---	---	---	---	---	---	0.993	(0.91,1.09)

--- variable not included in model

[a]Higher scores indicate better function

[b]Higher scores indicate poorer function significant (p<0.05) Adjusted Odds Ratios and 95% Confidence Intervals presented in **bold**

Table 6

Baseline Correlates of Sexual Dysfunction[§] among Female Participants (for adjusted and unadjusted logistic regression analyses)

	Unadjusted Model n=183		Adjusted Model 1 n=183		Adjusted Model 2 n=181		Adjusted Model 3 n=178	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Unadjusted Model								
Systolic blood pressure (mmHg)	0.997	(0.98,1.02)	0.995	(0.97,1.02)	0.996	(0.97,1.02)	1.008	(0.98,1.04)
Diastolic blood pressure (mmHg)	0.985	(0.96,1.01)	0.992	(0.96,1.03)	0.988	(0.95,1.03)	0.987	(0.94,1.03)
Demographic Variables (Adjusted Model 1)								
Age (yrs).	---	---	1.012	(0.96,1.06)	1.014	(0.96,1.07)	1.020	(0.96,1.08)
African-American vs. White	---	---	0.713	(0.34,1.50)	0.662	(0.30,1.46)	1.328	(0.52,3.42)
Other vs. White	---	---	0.983	(0.42,2.30)	0.821	(0.33,2.03)	1.649	(0.54,5,03)
< High school vs. College Graduate	---	---	2.092	(0.60,7.27)	1.907	(0.52,7.03)	0.765	(0.13,4.43)
High School graduate/GED vs. College Graduate	---	---	2.006	(0.78,5.15)	2.132	(0.80,5.67)	1.306	(0.42,4.10)
Post High School vs. College Graduate	---	---	1.068	(0.54,2.13)	1.063	(0.52,2.18)	1.018	(0.43,2.40)
Lives alone vs. Lives with Others	---	---	1.167	(0.57,2.39)	1.131	(0.54,2.37)	0.818	(0.35,1.91)
Behavioral Risk Factor and Medication Use Variables (Adjusted Model 2)								
Alcohol Consumption (drinks/typ wk)	---	---	---	---	1.209	(0.98,1.49)	1.232	(0.95,1.60)
Beta-blockers (BB) vs. no BB	---	---	---	---	0.820	(0.39,1.71)	0.809	(0.34,1.92)
Diuretics vs. no diuretics	---	---	---	---	1.228	(0.65,2.33)	1.453	(0.68,3.10)
Calcium channel blockers vs.no calcium channel blockers	---	---	---	---	1.129	(0.56,2.28)	0.796	(0.35,1.81)
Angiotensin Converting Enzyme (ACE) inhibitors vs. no ACE					1.604	(0.78,3.30)	2.003	(0.84,4.76)
Angiotensin receptor blockers (ARB) vs. no ARB	---	---	---	---	1.658	(0.75,3.68)	2.188	(0.88,5.46)
Any Cholesterol Medication	---	---	---	---	0.980	(0.49,1.96)	0.874	(0.39,1.94)
Cardiometabolic and Psychosocial Variables (Adjusted Model 3)								
BMI (kg/m^2)	---	---	---	---	---	---	0.947	(0.89,1.01)
eGFR (mL/min/1.73 m^2)	---	---	---	---	---	---	0.985	(0.96,1.01)
MoCA score[as]	---	---	---	---	---	---	1.027	(0.92,1.15)
PHQ-9 Total Score[b]	---	---	---	---	---	---	**1.260**	**(1.12,1.42)**

	Unadjusted Model n=183		Adjusted Model 1 n=183		Adjusted Model 2 n=181		Adjusted Model 3 n=178	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Number of Physical Comorbidities[b]	---	---	---	---	---	---	**1.234**	**(1.03,1.48)**

[§] defined as Female Sexual Function Index (FSFI) score ≤26.55

--- variable not included in model

[a] Higher scores indicate better function

[b] Higher scores indicate poorer function significant ($p<0.05$) Adjusted Odds Ratios and 95% Confidence Intervals presented in **bold**

Table 7

Baseline Correlates of *BeingSexually Active* among Female Participants with Chronic Kidney Disease[§] (for unadjusted and adjusted logistic regression analyses)

	Unadjusted Model n=198		Adjusted Model 1 n=198		Adjusted Model 2 n=197		Adjusted Model 3 n=195	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
Unadjusted Model								
Systolic blood pressure (mmHg)	**0.967**	**(0.94,0.99)**	0.988	(0.96,1.02)	0.983	(0.95,1.02)	0.977	(0.94,1.01)
Diastolic blood pressure (mmHg)	1.025	(0.99,1.06)	0.988	90.95,1.03)	0.982	(0.94,1.03)	0.986	(0.94,1.04)
Demographic Variables (Adjusted Model 1)								
Age (yrs).	---	---	**0.924**	**(0.87,0.98)**	**0.927**	**(0.87,0.98)**	**0.917**	**(0.86,0.98)**
African-American vs. White	---	---	0.606	(0.25,1.49)	0.645	0.23,1.82)	0.637	(0.20,2.00)
Other vs. White	---	---	0.427	(0.08,2.33)	0.511	(0.09,2.94)	0.446	(0.07,2.93)
< High school vs. College Graduate	---	---	0.363	(0.09,1.44)	0.397	(0.08,1.91)	0.387	(0.07,2.29)
High School graduate/GED vs. College Graduate	---	---	0.476	(0.15,1.48)	0.451	(0.13,1.53)	0.389	(0.10,1.55)
Post High School vs. College Graduate	---	---	0.908	(0.36,2.29)	0.869	(0.31,2.42)	0.823	(0.28,2.38)
Lives alone vs. Lives with Others	---	---	**0.286**	**(0.11,0.76)**	**0.200**	**(0.07,0.60)**	**0.197**	**(0.07,0.60)**
Behavioral Risk Factor and Medication Use Variables (Adjusted Model 2)								
Alcohol Consumption (drinks/typ wk)	---	---	---	---	**1.512**	**(1.02,2.24)**	**1.560**	**(1.04,2.34)**
Beta-blockers (BB) vs. no BB	---	---	---	---	1.418	(0.61,3.28)	1.532	(0.65,3.61)
Diuretics vs. no diuretics	---	---	---	---	**0.283**	**(0.12,0.70)**	**0.329**	**(0.13,0.86)**
Calcium channel blockers vs.no calcium channel blockers	---	---	---	---	1.677	(0.67,4.18)	1.539	(0.60,3.95)
Angiotensin Converting Enzyme (ACE) inhibitors vs. no ACE					0.818	(0.31,2.18)	0.926	(0.33,2.57)
Angiotensin receptor blockers (ARB) vs. no ARB	---	---	---	---	1.017	(0.35,3.00)	1.091	(0.35,3.36)
Any Cholesterol Medication	---	---	---	---	1.204	(0.50,2.90)	1.199	(0.47,3.05)
Cardiometabolic and Psychosocial Variables (Adjusted Model 3)								
BMI (kg/m^2)	---	---	---	---	---	---	0.950	(0.88,1.02)
eGFR (mL/min/1.73 m^2)	---	---	---	---	---	---	0.990	(0.95,1.04)
MoCA score[a]	---	---	---	---	---	---	0.972	(0.86,1.10)

	Unadjusted Model n=198		Adjusted Model 1 n=198		Adjusted Model 2 n=197		Adjusted Model 3 n=195	
Characteristic	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**	**Odds Ratio**	**95% CI**
PHQ-9 Total Score[b]	---	---	---	---	---	---	0.978	(0.87,1.10)
Number of Physical Comorbidities[b]	---	---	---	---	---	---	0.951	(0.78,1.16)

[§] defined as estimated glomerular filtration rate of <60 mL/min/1.73m^2)

--- variable not included in model

[a] Higher scores indicate better function

[b] Higher scores indicate poorer function significant ($p<0.05$) Adjusted Odds Ratios and 95% Confidence Intervals presented in **bold**