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Awareness of Kidney Disease among US Adults: Findings from the 2011 Behavioral Risk Factor Surveillance System

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Abstract

Background—The prevalence of chronic kidney disease as measured by biomarkers is increasing, but the recognition for this condition remains low in the USA. Little is known about the awareness of kidney disease at the state level.

Methods—Data from 490,302 adults aged 18 years or older in all 50 states as well as the District of Columbia who participated in the 2011 Behavioral Risk Factor Surveillance System were analyzed. Kidney disease diagnosis, a measure of individual awareness, was ascertained by participants' self-report in the telephone survey. Prevalence ratios of self-reported kidney disease in sub-populations were estimated and tested using log-linear regression analyses with a robust variance estimator.

Results—The unadjusted prevalence of self-reported kidney disease was estimated to be 2.5%. After adjustment for age and all other selected covariates, Hispanics had a higher prevalence than non-Hispanic whites (adjusted prevalence ratio 1.2, 95% CI 1.0–1.4). Persons who were unemployed (adjusted prevalence ratio 1.4, 95% CI 1.2–1.5) had a higher prevalence than those who were employed. Persons who had hypertension (adjusted prevalence ratio 1.9, 95% CI 1.7–2.1), diabetes (adjusted prevalence ratio 1.7, 95% CI 1.5–1.8), cardiovascular disease (coronary heart disease, myocardial infarction or stroke; adjusted prevalence ratio 1.5, 95% CI 1.4–1.6) or cancer (adjusted prevalence ratio 1.5, 95% CI 1.3–1.6) had a higher prevalence of self-reported kidney disease than those without these conditions.

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Disclosure Statement

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Conclusion—The overall awareness of kidney disease was low in the general population. Efforts are needed to promote the awareness and early detection of kidney disease in public health services and clinical practice.

Keywords

Kidney disease; Prevalence; Awareness; Hypertension; Diabetes

Introduction

Chronic kidney disease (CKD), defined as the presence of kidney damage (i.e. albuminuria) or decreased kidney function (i.e. glomerular filtration rate <60 ml/min/1.73 m^2) irrespective of cause for 3 months or more, has emerged as a public health concern [1, 2]. Persons with CKD are at increased risk of developing kidney failure, complications from reduced kidney function and cardiovascular diseases [1, 2]. Moreover, persons with CKD are more likely to die from all causes, particularly from cardiovascular diseases [1–3].

In the US adult population, the prevalence of CKD based on biochemical markers was estimated to be 10% during 1988–1994, 13% during 1999–2004 and 14% during 2005–2010 in adults aged 20 years or older based on data from the National Health and Nutrition Examination Survey (NHANES) [4, 5]. The prevalence of CKD was estimated to be 26% among high-risk persons with diabetes or hypertension or with a first-order relative with diabetes, hypertension or kidney disease during 2000–2009 based on data from the National Kidney Foundation's Kidney Early Evaluation Program (KEEP) [6]. Nevertheless, awareness of kidney disease remains low such that only 6% of adults with CKD stage 1–4 reported being told that they had weak or failing kidneys [7]. About 9% of the participants in the KEEP study reported being aware of kidney disease [6]. The differences in the prevalence and awareness estimates of CKD between NHANES data and KEEP data could be due to the study populations represented (general population vs. high-risk population). However, little is known about the awareness of kidney disease among US adults at the state level and among sub-populations in the general population.

The prevalence of kidney disease diagnosis based on participants' self-report is an important indicator for the overall awareness, recognition, health care access and utilization, and disease burden of this chronic condition in the general population. It is imperative to assess the awareness of kidney disease according to geographic areas and subpopulations deemed to be at a higher risk for kidney disease, because such information is helpful in understanding the burden or awareness of this condition. Thus, the objective of our study was to analyze a state-based sample from the 2011 Behavioral Risk Factor Surveillance System (BRFSS) in the USA to determine the awareness of kidney disease in all 50 states as well as the District of Columbia (D.C.). In addition, we estimated the prevalence and prevalence ratios of self-reported kidney disease among subpopulations stratified by demographic characteristics, health risk behaviors and chronic conditions.

Materials and Methods

Behavioral Risk Factor Surveillance System

The BRFSS is a standardized telephone survey which assesses key behavioral risk factors, lifestyle habits and chronic illnesses and conditions among adults aged ≥ 18 years in all 50 US states, D.C. and US territories annually. In 2011, the BRFSS collected data using a dual sampling frame (i.e. landline and cell phone) among adults with landline telephone or those with cell phone only in their households [8]. Response rates for BRFSS are calculated using standards set by the American Association of Public Opinion Research Response Rate Formula No. 4 (http://www.aapor.org/Standard_Definitions2.htm). The response rate is the number of respondents who completed the survey as a proportion of all eligible and likely eligible persons. The median survey response rate across all 50 states and D.C. was 49.7%, and ranged from 33.8 to 64.1%. For detailed information, see the BRFSS 2011 Summary Data Quality Report [9]. BRFSS data have consistently been found to provide valid and reliable estimates when compared with results from other national household surveys [10–12].

Assessment of Self-Reported Kidney Disease

Diagnosis of kidney disease was ascertained by asking participants the following question: ‘Has a doctor, nurse, or other health professional EVER told you that you have kidney disease (Do NOT include kidney stone, bladder infection or incontinence)?’ Responses were coded as ‘yes’, ‘no’, ‘don’t know/not sure’ or ‘refused’. Participants who had an affirmative answer to this question were considered to have self-reported kidney disease. Participants who answered ‘don’t know/not sure’ or ‘refused’ to this question (n = 2,838) were considered to have missing data and were excluded from the analyses.

Assessment of Demographic Characteristics, Health Risk Factors and Chronic Health Conditions

The following demographic characteristics were considered for this analysis: age at time of survey (years), sex, race/ethnicity [non-Hispanic (NH) white, NH black, Hispanic, NH other], educational attainment (<high school, high school, some college or above) and employment status (employed or self-employed, retired, not employed including adults who were unemployed, homemakers, students and those who were unable to work at the time of survey). Health insurance coverage at the time of survey (any vs. none), health status (excellent, very good, good, fair or poor), smoking status (current, former or never), heavy drinking (yes or no) and leisure-time physical activity (any or none) were ascertained by participants’ self-report. Body mass index (BMI; weight in kilo-grams/height in meters squared) was calculated by using self-reported weight and height. Participants were grouped into six categories of BMI (<18.5, 18.5–24.9, 25.0–29.9, 30.0–34.5, 35.0–39.9 and 40.0 or above) [13]. Six physician-diagnosed chronic health conditions that could be potentially associated with kidney disease according to previous studies included hypertension, diabetes, coronary heart disease, myocardial infarction, stroke and cancer.

Statistical Analysis

Unadjusted and age-adjusted prevalence estimates of self-reported kidney disease were estimated for each state and D.C. among participants who had no missing responses on the kidney disease question and age (main sample). The main sample comprised adults aged 18 years or older who participated in the 2011 BRFSS and had valid responses on the kidney disease question and age in all 50 US states and D.C. (n = 490,302). Of the main sample, the subsample further excluded pregnant women (n = 3,047) and participants with missing data on demographic characteristics (n = 8,299) and on selected covariates (n = 74,238). Participants included in the subsample (n = 404,718) had similar characteristics to the main sample.

The 2010 US Census age distribution of the adult population aged 18 years or older was used to generate the age-adjusted prevalence for each state and D.C. [14]. The age-specific prevalence estimate of self-reported kidney disease was estimated for men and women in the total sample. To further assess differences in the prevalence estimates of self-reported kidney disease among various subpopulations, we conducted a secondary analysis in the sub-sample of participants who had no missing data on all selected covariates. The demographic characteristics, distribution of health and behavioral risk factors, and chronic health conditions were compared between adults with and without self-reported kidney disease. The unadjusted prevalence was estimated for each subgroup, and prevalence ratios adjusted for age and age squared (model 1) and further adjusted for all other selected covariates (model 2) were estimated in log-linear regression analyses with a robust variance estimator. Age was centered at its grand mean in the regression models.

Two-sample t tests were used to compare equality in the distribution of covariates in adults with and without self-reported kidney disease. Orthogonal polynomial contrasts were used to test equality in the unadjusted prevalence estimates of self-reported kidney disease across subpopulations. All analyses were performed with SAS (version 9.2) and SUDAAN software (release 10.0, Research Triangle Institute, Research Triangle Park, N.C., USA). Sample weights, generated using an iterative proportional fitting (raking) method for combined landline and cell phone datasets [8], were used to account for the varying probabilities of complex sampling design and nonresponse. Results with a two-tailed p value <0.05 or a 95% CI for a prevalence ratio not including 1 were considered to be statistically significant.

Results

Using the main sample, both the unadjusted and age-adjusted prevalence of self-reported kidney disease were estimated to be 2.5%. The unadjusted prevalence varied from 1.5% in Iowa to 3.5% in Arizona (table 1). The age-adjusted prevalence varied from 1.4% in Iowa to 3.5% in Arizona.

The top 5 states with the highest age-adjusted prevalence were Arizona (3.5%), Hawaii (3.2%), Utah (3.1%), Florida (3.1%) and Oklahoma (3.1%). The bottom 5 states with the lowest prevalence were North Dakota (1.9%), Maryland (1.9%), Connecticut (1.8%), Minnesota (1.7%) and Iowa (1.4%). There was an increasing trend in the awareness of

kidney disease by age for both men and women (both $p < 0.0001$; fig. 1). Moreover, the prevalence among men was lower than among women at ages 25–29 years ($p < 0.01$) and 50–54 years ($p < 0.05$), whereas the prevalence was higher among men than among women at ages 60–64 years ($p < 0.05$) and ≥ 80 years ($p < 0.05$).

The characteristics of participants in the subsample according to the status of self-reported kidney disease are shown in table 2. In general, adults with self-reported kidney disease differed significantly on all selected covariates except race/ethnicity. The unadjusted prevalence, age-adjusted prevalence ratio and prevalence ratio adjusted for all selected covariates are summarized in table 3. After adjustment for possible confounding effects of selected covariates, the prevalence of self-reported kidney disease was about 10–20% higher among women, Hispanic adults, former smokers, adults with no leisure-time physical activity and adults who reported having diagnosed myocardial infarction than their referent counterparts. The awareness of kidney disease was about 30–40% higher among retirees or those not employed compared to the currently employed. Self-reported kidney disease prevalence was more than 50% higher among adults with self-reported hypertension, diabetes, cardiovascular disease or cancer. In contrast, adults with a high school or less than high school education, adults with no health insurance, heavy drinkers and adults with BMI <18.5 or ≥30 were less likely to report having kidney disease than their referent counterparts. Adults who self-rated their health as poor, fair, good or very good had an awareness of kidney disease about 5.7, 3.7, 2.0 and 1.3 times higher, respectively, than those with self-rated excellent health ($p < 0.0001$ for linear trend).

Discussion

Data from the BRFSS, the world's largest telephone survey, were used to estimate an overall unadjusted self-reported kidney disease prevalence of 2.5%. The prevalence estimates varied from 1.5 to 3.5% across all 50 states and D.C. The prevalence was higher among Hispanics, adults who were currently unemployed, adults with diagnosed hypertension, diabetes, coronary heart disease, myocardial infarction, stroke or cancer, and adults who reported fair or poor health compared to their counterparts after adjustment for possible confounding effects of age and other health-related factors.

The major strength of our study was the use of a large population-based sample, which enabled us to provide stable prevalence estimates of self-reported kidney disease among adults in the general population in the USA, particularly at the state level. The large population-based sample also enabled us to estimate the awareness of kidney disease in subpopulations. Our nationwide prevalence estimate of self-reported kidney disease in 2011 was slightly higher than that in a previous study of a national representative sample in 1999–2000 in the USA (2.5 vs. 2.0%) [15]. Since BRFSS data provide comparable estimates to NHANES data in a similar time period [10–12], the higher awareness of kidney disease estimated in 2011 BRFSS data could be an indication of increased disease burden, higher awareness of this condition or both in more recent years.

The prevalence of self-reported kidney disease may be a composite indicator of awareness for this condition from both health care providers and patients, severity of the disease,

advances in early screening and detection, health care access and public health education. Inadequate knowledge and recognition and poor adherence to guidelines for clinical diagnosis from both primary care providers and patients may contribute to the underdiagnosis of CKD. Findings from a large managed care cohort suggest that only about 14% of patients with CKD stage 3–5 have a documented diagnosis for this condition [16]. In a random sample of primary care physicians and nephrologists, about 59% of family medicine physicians and 78% of internal medicine physicians correctly identified patients with CKD stage 3–4 [17]. Furthermore, only 35% of US physicians have been adhering to guidelines of recommended clinical testing and management for CKD [18]. Meanwhile, inadequate patient knowledge and recognition of the risk factors, early signs and symptoms for CKD may delay the early detection, diagnosis and treatment of this condition [19].

Some types of CKD in their early stages may be asymptomatic and thus can be underdiagnosed [2]; therefore, the awareness of kidney disease may serve as an indicator of severe or symptomatic CKD. Findings from the NHANES data have shown that the prevalence of kidney disease awareness is 41.8% among persons who had clinically identified CKD stage 4, whereas the prevalence is 3.7, 3.5 and 7.8%, respectively, among persons who had CKD stage 1, 2 and 3, respectively [7]. The awareness of kidney disease is higher among persons with macroalbuminuria (33%) than those with microalbuminuria (11%) or those without proteinuria (4.5%) [7]. Moreover, as shown in the KEEP study [6], patients with CKD stage 1–4 who are aware of the disease are at a higher risk of progressing to end-stage renal disease and have a higher risk of mortality than those who are unaware of their disease. Our results on the graded association between self-rated health and awareness of kidney disease provided further support that persons with a worse health condition may be more likely to seek medical assessment and thus more likely to be diagnosed with the disease.

Consistent with previous findings [6, 7, 19], our results demonstrated that persons with diagnosed hypertension and diabetes have a high awareness of kidney disease after adjustment for age and other health risk factors and chronic conditions. Hypertension and CKD are linked with each other in a pathogenic bidirectional fashion such that high blood pressure leads to the worsening of kidney function, whereas kidney disease causes resistant hypertension [20]. A recent study using data from NHANES 1999–2006 showed that the prevalence of CKD stage 1–4 combined is 32.0% among persons with diagnosed hypertension, whereas the awareness of kidney disease is 9.1%, suggesting substantially low awareness of CKD [21]. Diabetic nephropathy is a major microvascular complication due to long-term harmful effects of hyperglycemia among persons with diabetes [22]. Among participants aged 20 years or older, the prevalence of CKD stage 1–4 combined was 39.6% among persons with diagnosed diabetes [23], whereas the awareness of kidney disease based on the NHANES 1999–2004 data was 17.8%, also suggesting substantially low awareness of CKD [7].

There were several limitations in this study. Firstly, the question for measuring kidney disease did not specify the type and duration of kidney disease and thus we could not rule out the possibility of acute kidney disease episodes and other types of kidney disorders. Persons who had never undergone kidney disease-related clinical assessment or diagnosis

(e.g. in early CKD stages or had no kidney disease-related clinical symptoms or had no health care access) may not have been told by health professionals that they had kidney disease. It was also possible that persons who had a clinical diagnosis of kidney disease had not been told by health professionals or had forgotten the diagnosis at the time of survey. Thus, information bias could have led to underestimation of the prevalence. Secondly, due to lack of information on medication for hypertension, diabetes, cardiovascular disease or cancer, we were unable to assess whether an elevated prevalence of CKD was associated with certain types of medications. Findings from a previous study have shown that among persons with hypertension, those who are on medication have a higher prevalence of CKD stage 3 and 4 than those without medication [21]. Therefore, future research on the association between specific types of medication for hypertension, diabetes or cardiovascular disease and risk of CKD may be warranted. Thirdly, detection bias may be possible as our results showed that persons without health insurance were less likely than those with health insurance to report a kidney disease diagnosis. Fourthly, the BRFSS survey excludes adults who have been institutionalized or are hospitalized; therefore, this exclusion may have led us to underestimate the kidney disease awareness among US adults.

In sum, using data from a large population-based survey, we found that the prevalence of self-reported kidney disease was about 2.5% among US adults. Persons who had hypertension, diabetes, cardiovascular disease or cancer had about 50–90% higher prevalence compared with those without such chronic conditions. As CKD has emerged as an important public health issue, greater efforts are warranted to improve the awareness, early detection, clinical management and surveillance for CKD.

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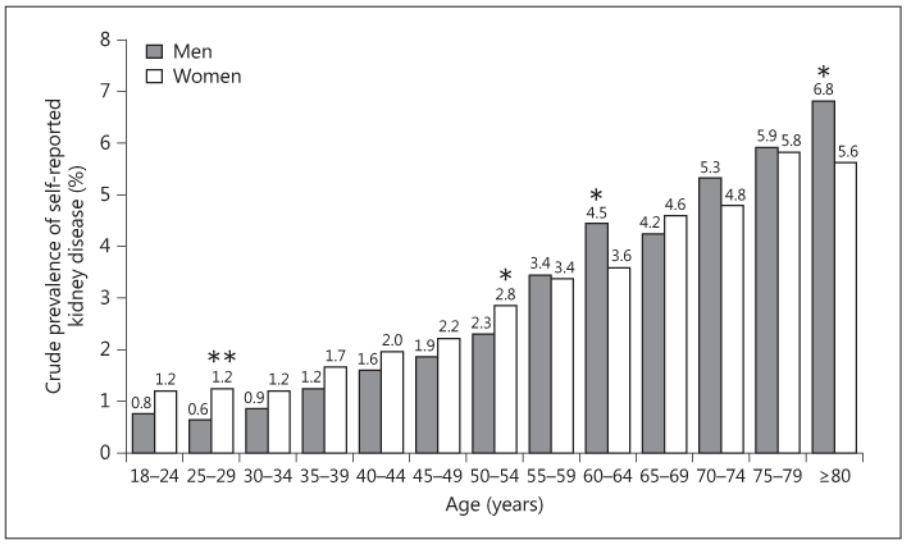

Fig. 1.

Crude prevalence estimates of self-reported kidney disease by age and sex, BRFSS 2011. *p < 0.05, **p < 0.01.

Table 1

Prevalence of self-reported kidney diseases among adults aged 18 years or older in the USA, 2011 BRFSS

State	n	Unadjusted prevalence, %	Age-adjusted prevalence, %
All	490,302	2.5 (0.1)	2.5 (0.1)
Alabama	7,608	2.7 (0.2)	2.6 (0.2)
Alaska	3,494	2.3 (0.3)	2.7 (0.4)
Arizona	6,379	3.5 (0.4)	3.5 (0.4)
Arkansas	4,666	2.9 (0.3)	2.9 (0.3)
California	16,898	2.6 (0.2)	2.7 (0.2)
Colorado	13,384	2.2 (0.2)	2.3 (0.2)
Connecticut	6,704	1.9 (0.2)	1.8 (0.2)
Delaware	4,712	2.5 (0.3)	2.4 (0.3)
District of Columbia	4,463	2.7 (0.3)	2.9 (0.3)
Florida	12,192	3.3 (0.2)	3.1 (0.2)
Georgia	9,826	2.8 (0.2)	3.0 (0.2)
Hawaii	7,523	3.3 (0.3)	3.2 (0.3)
Idaho	5,985	2.4 (0.2)	2.5 (0.2)
Illinois	5,447	2.8 (0.4)	2.8 (0.4)
Indiana	8,384	2.1 (0.2)	2.1 (0.2)
Iowa	7,249	1.5 (0.2)	1.4 (0.2)
Kansas	20,536	2.3 (0.1)	2.3 (0.1)
Kentucky	10,716	2.5 (0.2)	2.4 (0.2)
Louisiana	10,813	2.6 (0.2)	2.6 (0.2)
Maine	13,101	2.4 (0.2)	2.2 (0.1)
Maryland	9,939	1.9 (0.2)	1.9 (0.2)
Massachusetts	21,835	1.9 (0.1)	1.9 (0.1)
Michigan	10,904	3.0 (0.2)	3.0 (0.2)
Minnesota	15,199	1.7 (0.1)	1.7 (0.1)
Mississippi	8,808	2.4 (0.2)	2.4 (0.2)
Missouri	6,337	2.3 (0.2)	2.3 (0.2)
Montana	10,163	2.6 (0.2)	2.4 (0.2)
Nebraska	25,221	2.2 (0.1)	2.2 (0.1)
Nevada	5,380	2.5 (0.3)	2.6 (0.3)
New Hampshire	6,250	2.5 (0.3)	2.4 (0.3)
New Jersey	15,090	2.0 (0.2)	1.9 (0.2)
New Mexico	9,316	3.1 (0.2)	3.0 (0.2)
New York	7,576	2.8 (0.3)	2.8 (0.3)
North Carolina	11,363	2.2 (0.2)	2.2 (0.2)
North Dakota	5,234	1.9 (0.2)	1.9 (0.2)
Ohio	9,771	2.5 (0.2)	2.4 (0.2)
Oklahoma	8,482	3.1 (0.2)	3.1 (0.2)
Oregon	6,172	2.5 (0.2)	2.4 (0.2)

State	n	Unadjusted prevalence, %	Age-adjusted prevalence, %
Pennsylvania	11,352	2.5 (0.2)	2.4 (0.2)
Rhode Island	6,410	2.3 (0.2)	2.2 (0.2)
South Carolina	12,778	2.2 (0.2)	2.1 (0.2)
South Dakota	8,189	2.0 (0.2)	1.9 (0.2)
Tennessee	5,841	2.1 (0.3)	2.1 (0.3)
Texas	14,767	2.7 (0.2)	2.8 (0.2)
Utah	12,507	2.8 (0.2)	3.1 (0.2)
Vermont	7,006	2.2 (0.2)	2.1 (0.2)
Virginia	6,507	1.9 (0.3)	2.0 (0.3)
Washington	14,553	2.3 (0.2)	2.3 (0.2)
West Virginia	5,235	2.8 (0.2)	2.6 (0.2)
Wisconsin	5,242	2.2 (0.3)	2.1 (0.3)
Wyoming	6,795	2.1 (0.2)	2.1 (0.2)
Minimum	3,494	1.5	1.4
Maximum	25,221	3.5	3.5
Median	8,384	2.4	2.4

Total numbers included participants who had complete data on age and self-reported kidney disease in all 50 states as well as D.C. Age-adjusted prevalences were standardized using the 2010 US Census population age distribution (i.e. age adjustment weights of 0.130762, 0.350158, 0.347408 and 0.171672 for age groups 18 – 24, 25 – 44, 45 – 64 and ≥65 years, respectively) [14]. Values in parentheses represent standard errors.

Table 2

Demographic characteristics, health risk factors and chronic condition profiles among men and nonpregnant women aged 18 years or older with and without self-reported kidney disease in the USA, BRFSS 2011

Characteristic	Total (n = 404,718		Adults with self-reported kidney disease (n = 12,470)		Adults without self-reported kidney disease (n = 392,248)		p value
	n	estimate	n	estimate	n	estimate	
Age							
Mean, years	404,718	46.7 (0.1)	12,470	57.8 (0.4)	392,248	46.4 (0.1)	<0.001
18 – 24 years	17,216	12.4 (0.1)	134	4.4 (0.8)	17,082	12.6 (0.1)	<0.001
25 – 44 years	91,900	34.9 (0.2)	1,140	18.5 (0.9)	90,760	35.4 (0.2)	<0.001
45 – 64 years	169,249	35.2 (0.1)	4,858	40.1 (1.0)	164,391	35.1 (0.1)	<0.001
≥65 years	126,353	17.5 (0.1)	6,338	37.0 (0.9)	120,015	17.0 (0.1)	<0.001
Sex							
Men	163,735	49.8 (0.2)	4,698	46.3 (1.0)	159,037	49.9 (0.2)	<0.001
Race/ethnicity							
Non-Hispanic white	326,774	69.4 (0.2)	9,771	68.8 (1.0)	317,003	69.4 (0.2)	0.59
Non-Hispanic black	31,559	11.0 (0.1)	1,180	11.4(0.7)	30,379	11.0 (0.1)	0.56
Hispanic	23,758	12.7 (0.1)	749	13.0 (0.8)	23,009	12.7(0.1)	0.75
Other	22,627	6.9 (0.1)	770	6.9 (0.7)	21,857	6.9 (0.1)	0.89
Education							
Less than high school	31,674	13.4 (0.1)	1,631	20.7 (0.9)	30,043	13.2 (0.1)	<0.001
High school	116,841	29.0 (0.2)	3,850	28.5 (0.8)	112,991	29.0 (0.2)	0.56
Some college or above	256,203	57.6 (0.2)	6,989	50.8 (1.0)	249,214	57.8 (0.2)	<0.001
Employment							
Employed or self-employed	205,368	56.5 (0.2)	3,195	31.3 (1.0)	202,173	57.1 (0.2)	<0.001
Retired	112,909	16.4 (0.1)	5,469	32.9 (0.8)	107,440	16.0 (0.2)	<0.001
Not employed[1]	86,441	27.1 (0.2)	3,806	35.8 (1.0)	82,635	26.9 (0.2)	<0.001
Having any type of health insurance	360,296	83.0 (0.1)	11,586	89.6 (0.7)	348,710	82.8 (0.1)	<0.001
Smoking status							
Current smoker	68,008	20.0 (0.1)	1,950	20.1 (0.9)	66,058	20.0 (0.1)	0.88
Former smoker	120,417	25.1 (0.1)	4,744	34.5 (0.9)	115,673	24.9 (0.1)	<0.001
Never smoked	216,293	54.8 (0.2)	5,776	45.4 (1.0)	210,517	55.1 (0.2)	<0.001

Characteristic	Total (n = 404,718		Adults with self-reported kidney disease (n = 12,470)		Adults without self-reported kidney disease (n = 392,248)		p value
	n	estimate	n	estimate	n	estimate	
Heavy drinking	24,240	6.9 (0.1)	419	3.8 (0.4)	23,821	6.9 (0.1)	<0.001
Physically inactive	107,684	25.4 (0.1)	4,977	38.7(1.0)	102,707	25.1 (0.1)	<0.001
BMI, kg/m^2							
Mean	404,718	27.6 (0.1)	12,470	29.0 (0.1)	392,248	27.6 (0.1)	<0.001
<18.5	6,318	1.7(0.1)	233	1.6 (0.2)	6,085	1.7 (0.1)	0.46
18.5–24.9	135,402	34.4 (0.2)	3,316	27.0 (0.9)	132,086	34.6 (0.2)	<0.001
25.0–29.9	147,232	35.8 (0.2)	4,266	35.5 (1.0)	142,966	35.8 (0.2)	0.79
30.0–34.5	71,819	17.4 (0.1)	2,487	19.5 (0.7)	69,332	17.3 (0.1)	0.004
35.0–39.9	27,461	6.7 (0.1)	1,219	8.8 (0.5)	26,242	6.6 (0.1)	<0.001
≥40	16,486	4.1 (0.1)	949	7.7 (0.5)	15,537	4.0 (0.1)	<0.001
High blood pressure	159,089	31.4 (0.1)	8,724	65.4 (1.0)	150,365	30.6 (0.1)	<0.001
Diabetes	48,189	9.5 (0.1)	4,181	31.7 (0.9)	44,008	9.0 (0.1)	<0.001
CHD	24,234	4.3 (0.1)	2,640	17.9 (0.6)	21,594	3.9 (0.1)	<0.001
MI	22,917	4.1 (0.1)	2,274	16.2 (0.7)	20,643	3.8 (0.1)	<0.001
Stroke	15,584	2.8 (0.1)	1,566	11.0 (0.5)	14,018	2.6 (0.1)	<0.001
CVD[2]	45,003	8.0 (0.1)	4,131	28.6 (0.8)	40,872	7.5 (0.1)	<0.001
Cancer	67,452	11.3 (0.1)	4,042	26.6 (0.8)	63,410	11.0 (0.1)	<0.001
Self-reported health status							
Excellent	73,782	19.5 (0.1)	652	6.0 (0.6)	73,130	19.8 (0.1)	<0.001
Very good	134,835	33.0 (0.2)	2,003	16.2 (0.8)	132,832	33.4 (0.2)	<0.001
Good	122,216	30.6 (0.2)	3,556	27.1 (0.8)	118,660	30.6 (0.2)	<0.001
Fair	52,040	12.5 (0.1)	3,461	28.5 (0.9)	48,579	12.1 (0.1)	<0.001
Poor	21,845	4.5 (0.1)	2,798	22.3 (0.8)	19,047	4.1 (0.1)	<0.001

Data are means (standard error) for continuous variables or percentages (standard error) for categorical variables. For p values, two-sample t tests were used to test for equality between adults with and without self-reported kidney disease. CHD = Coronary heart disease; MI = myocardial infarction; CVD = cardiovascular disease.

[1]Including adults who were unemployed, homemakers, students or unable to work.

[2]Including coronary heart disease, myocardial infarction or stroke.

Table 3

Prevalence and prevalence ratios of self-reported kidney disease according to demographic characteristics, health risk factors and chronic condition profiles among men and nonpregnant women aged 18 years or older in the USA, BRFSS 2011

Characteristic		Unadjusted prevalence	Prevalence ratio	
			model 1	model 2
Sex	Men (Ref)	2.3 (0.1)	1.0 (Ref)	1.0 (Ref)
	Women	2.6 (0.1)***	1.1 (1.0 – 1.1)	1.1 (1.0 – 1.2)
Race/ethnicity	Non-Hispanic white (Ref)	2.5 (0.1)	1.0 (Ref)	1.0 (Ref)
	Non-Hispanic black	2.6 (0.2)	1.3 (1.1 – 1.5)	1.0 (0.9 – 1.1)
	Hispanic	2.5 (0.2)	1.4 (1.2 – 1.7)	1.2 (1.0 – 1.4)
	Other race/ethnicity	2.4 (0.2)	1.3 (1.0 – 1.5)	1.1 (0.9 – 1.3)
Education	Some college or above (Ref)	2.2 (0.1)	1.0 (Ref)	1.0 (Ref)
	High school	2.4 (0.1)	1.0 (1.0 – 1.1)	0.8 (0.8 – 0.9)
	Less than high school	3.8 (0.2)***	1.6 (1.4 – 1.8)	0.9 (0.8 – 1.0)
Employment	Employed (Ref)	1.4 (0.1)	1.0 (Ref)	1.0 (Ref)
	Retired	5.0 (0.1)***	1.7 (1.5 – 1.9)	1.3 (1.1 – 1.4)
	Not employed[1]	3.3 (0.1)***	2.4 (2.2 – 2.7)	1.4 (1.2 – 1.5)
Health insurance	Any (Ref)	2.7 (0.1)	1.0 (Ref)	1.0 (Ref)
	None	1.5 (0.1)***	0.9 (0.7 – 1.0)	0.7 (0.6 – 0.8)
Smoking status	Never smoked (Ref)	2.0 (0.1)	1.0 (Ref)	1.0 (Ref)
	Former smoker	3.4 (0.1)***	1.2 (1.1 – 1.3)	1.1 (1.0 – 1.2)
	Current smoker	2.5 (0.1)**	1.4 (1.2 – 1.6)	1.0 (0.9 – 1.2)
Heavy drinking	No (Ref)	2.6 (0.1)	1.0 (Ref)	1.0 (Ref)
	Yes	1.4 (0.1)***	0.7 (0.5 – 0.8)	0.8 (0.6 – 0.9)
Leisure-time physical activity	Active (Ref)	2.0 (0.1)	1.0 (Ref)	1.0 (Ref)
	Inactive	3.8 (0.1)***	1.6 (1.5 – 1.7)	1.1 (1.0 – 1.2)
BMI, kg/m^2	<18.5	2.3 (0.3)	1.2 (0.9 – 1.6)	0.9 (0.7 – 1.2)
	18.5 – 24.9 (Ref)	1.9 (0.1)	1.0 (Ref)	1.0 (Ref)
	25.0 – 29.9	2.5 (0.1)***	1.1 (1.0 – 1.3)	1.0 (0.9 – 1.1)
	30.0 – 34.5	2.8 (0.1)***	1.3 (1.2 – 1.4)	0.8 (0.7 – 0.9)
	35.0 – 39.9	3.3 (0.2)***	1.6 (1.4 – 1.8)	0.8 (0.7 – 0.9)
	≥40	4.7 (0.3)***	2.4 (2.1 – 2.8)	0.9 (0.8 – 1.1)
High BP	No (Ref)	1.3 (0.1)	1.0 (Ref)	1.0 (Ref)
	Yes	5.1 (0.1)***	2.9 (2.7 – 3.2)	1.9 (1.7 – 2.1)

Characteristic		Unadjusted prevalence	Prevalence ratio	
			model 1	model 2
Diabetes	No (Ref)	1.9 (0.1)	1.0 (Ref)	1.0 (Ref)
	Yes	8.2 (0.3)***	3.1 (2.8 – 3.3)	1.7 (1.5 – 1.8)
CVD	No (Ref)	1.9 (0.1)	1.0 (Ref)	1.0 (Ref)
	Yes	8.8 (0.3)***	2.9 (2.7 – 3.2)	1.5 (1.4 – 1.6)
Cancer	No (Ref)	2.1 (0.1)	1.0 (Ref)	1.0 (Ref)
	Yes	5.8 (0.2)***	1.7 (1.6 – 1.9)	1.5 (1.3 – 1.6)
Self-reported health status	Excellent (Ref)	0.8 (0.1)	1.0 (Ref)	1.0 (Ref)
	Very good	1.2 (0.1)***	1.5 (1.2 – 1.9)	1.3 (1.1 – 1.7)
	Good	2.2 (0.1)***	2.5 (2.0 – 3.1)	2.0 (1.6 – 2.5)
	Fair	5.7 (0.2)***	5.7 (4.7 – 7.1)	3.7 (3.0 – 4.6)
	Poor	12.2 (0.5)***	11.2 (9.1 – 13.8)	5.7 (4.5 – 7.2)

Values in parentheses represent standard errors or 95% CIs, as appropriate. Prevalence ratios were obtained using log-linear regression models with a robust variance estimator. In model 1, prevalence ratios were adjusted for age (centered at grand mean) and age squared. In model 2, prevalence ratios were adjusted for age, age squared and all other covariates listed in the table.

** $p < 0.01$,

*** $p < 0.001$ (two-sample t tests were used to test for equality in the prevalence of self-reported kidney disease between the designated group and the referent group). BP = Blood pressure; CVD = cardiovascular disease, including coronary heart disease, myocardial infarction or stroke; Ref = referent group.

[1] Including adults who were unemployed, homemakers, students or unable to work.