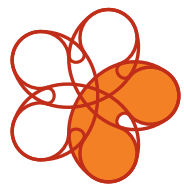
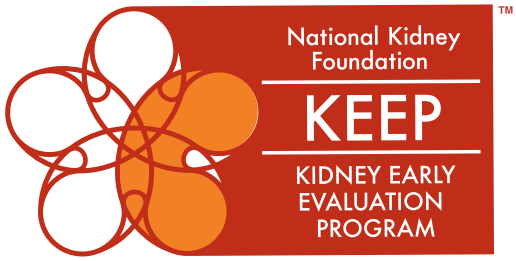
Kidney Early Evaluation Program

KEEP™

Annual Data Report



National Kidney Foundation™



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Executive summary

"Thank you so much for the free screening. The results have been helpful to me and my doctor. As a result, my doctor knew what other things we needed to look at and do further testing on. Thanks again! I would recommend everyone with diabetes or hypertension be tested."

KEEP participant: Screening date, October 2005

The emergence of chronic kidney disease (CKD) as a major public health problem has placed increased pressure on the health care system to address this condition. There is little doubt now that CKD and its staging provide valuable predictive information on likely complications from cardiovascular disease and on increased mortality, and CKD appears to be a potent risk multiplier in those with diabetes and hypertension. The fact that an individual with CKD is 20–50 times more likely to die than to reach end-stage renal disease (ESRD, requiring dialysis or a kidney transplant) places this condition in a unique perspective.

The public health implications of CKD were recently highlighted with the first World Kidney Day, on March 9, 2006. The second annual event, on March 8, 2007, will draw further attention to the disease as a worldwide public health problem. In the United States, the ever-growing number of ESRD patients and the pressure they place on the health care delivery system has led to a number of public health initiatives to address the feeder population. As one of these initiatives, the National Kidney Foundation's Kidney Early Evaluation Program (NKF KEEP), like any strong public health program, includes surveillance and detection components to assess the burden of disease and to promote early identification and intervention. KEEP addresses community awareness of CKD, using simple tests to define

the population and to demonstrate both the high burden of complicating conditions and the lack of implementation of available and effective treatments. The program's educational materials, sent to each participant and his or her physician provider, have a dual purpose—to improve the care of individual participants, and to encourage providers to address similar patients in their practices, thereby expanding the program's impact.

Concern about the public health issues related to CKD has reached into the Centers for Disease Control and Prevention, which recently awarded a grant to the NKF and researchers from the University of Minnesota to develop a state-level CKD detection program modeled after the KEEP system. The CDC also awarded researchers at the University of Michigan and Johns Hopkins, grants to develop a national CKD surveillance program. These efforts, along with the new ICD-9-CM diagnosis codes—incorporating the NKF CKD staging system—will help providers, health plans, and Medicare determine the disease prevalence and degree of care found in this vulnerable population.

To augment these public health initiatives, this annual report on the KEEP program provides a summary of important findings from a large-scale CKD detection effort. This year's report summarizes program activity through December 31, 2005, when 55,220 individuals had met the criteria of having self-reported diabetes or hypertension or a family history of diabetes, hypertension, or kidney disease. The program has expanded across the entire country, with the eastern and southeastern portions of the country contributing the greatest percentage of individuals.

Compared to the general population, KEEP participants are older, more likely to be female (68%), and three times more likely to be African American. They are, as expected, more likely to have diabetes (26% versus 6% in the general population) and hypertension (53% versus 25%). Individuals coming to the program are within the high-risk group for kidney disease, and their burden of CKD is far higher than that found in the general population (29% versus 13%). Most revealing is the fact that only 2% know they have evidence of kidney disease, yet results of urine microalbuminuria testing and findings of an eGFR less than 60 ml/min/1.73 m^2 identify the disease in 29% of participants. This is quite remarkable, and demonstrates the value of using simple tests to identify kidney disease in those with existing diabetes and hypertension.

Also remarkable is the finding that those factors placing individuals at risk for cardiovascular disease and mortality are very common and very treatable. Obesity, for example, is far more widespread in KEEP participants than in the general population—unsurprising, to some extent, as the targeted group has a high burden of diabetes and hypertension. As expected, the prevalence of these diseases increases with BMI. While this lifestyle issue clearly demands more attention, and is not a new finding, the degree of obesity is quite revealing. In addition, blood pressure control is far less than optimal, with only one in four participants with diabetes or CKD meeting the target of less than 130/80. And in participants with diabetes, glycemic control is a further problem. Fewer than half have a blood sugar level below the target set by the American Diabetes Association.

In this year's report we have added new information on the degree of kidney disease, using two different definitions: the more basic one of a positive urinary albumin level greater than 20 mg/L, and the more comprehensive definition of a urinary albumin to creatinine ratio greater than 30 mg/gm. In providing this measure we have calibrated the serum creatinine to the Cleveland Clinic Laboratory standard to validate the utilization of the MDRD estimating equation for GFR. Based on the first definition, 57.4 % of KEEP participants have evidence of kidney damage. Using the more stringent criterion, that number drops to 29%. While lower, this is still six times greater than the number identified using only a simple serum creatinine test, demonstrating the value—both for individual patients and on the level of public health—of more comprehensive assessment.

Other important new findings include the degree of hyperparathyroidism in KEEP participants with an eGFR less than 60 ml/min/1.73 m^2. There appears to be a stepwise increase in PTH levels as eGFR falls below 60, confirming findings from other investigators that hyperparathyroidism is common and begins in the early stages of CKD. Interestingly, the degree of anemia also correlates with the degree of secondary hyperparathyroidism, suggesting a potential interaction of these complicating conditions in people with CKD. Some investigators have suggested that there may be a link between the inflammatory cytokine abnormalities noted in secondary hyperparathyroidism and the degree of anemia, which may also be mediated through bone marrow resistance to erythropoietin. It is interesting to see that findings of anemia, hyperparathyroidism, and inflammation appear very early in CKD, showing that they are more common than previously appreciated. In Stage 3 CKD, anemia itself, as previously

reported, is twice as common in those with a diagnosis of diabetes as in those without. In those with Stage 4 CKD the prevalence approaches 60%, with the same differential in the diabetic and non-diabetic populations.

In 2007 the KEEP effort will enter a new phase, as a follow-up system is created for field operations and more comprehensive assessments are developed of cohort outcomes related to access to care. Additional tests are also being considered: hemoglobin A1c, to assess glycemic control; direct LDL and HDL cholesterol levels, to assess risk factors for cardiovascular disease; and tests of other inflammatory markers, such as white blood cell counts.

This report marks a transition in the KEEP Steering Committee. Members have served more than four years, guiding the program through its growth and development and overseeing its publications. The new committee will be installed by January, 2007, and will lead the program's focus on CVD and diabetes and on major populations with CKD. The follow-up phase will receive extensive review as it is implemented.

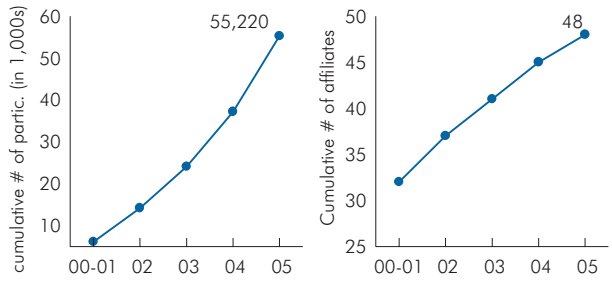
This year's World Kidney Day is a perfect time to advance the awareness of CKD and its implications for those with diabetes and hypertension. Detection programs are needed worldwide, as are the kind of surveillance programs already existing for diseases such as diabetes and cardiovascular disease. The KEEP effort is now developing in other countries, with the first collaborative detection program—between the U.S. KEEP program and the International Kidney Evaluation Association of Japan (IKEAJ)—starting in June, 2006. We look forward to working with other countries as they begin their own detection and surveillance programs to address CKD and to reduce its high comorbidity and mortality.

	2000+2001	2002	2003	2004	2005	All
Age						
18-30	568	644	1,004	1,085	1,389	4,690
31-45	1,491	1,977	2,393	2,940	3,980	12,781
46-60	2,097	2,652	3,422	4,691	6,401	19,263
61-75	1,502	2,029	2,381	3,327	4,737	13,976
>75	424	743	721	1,081	1,541	4,510
Gender						
Male	1,959	2,570	2,944	4,144	5,851	17,468
Female	4,123	5,474	6,975	8,979	12,124	37,675
Missing	.	1	2	1	73	77
Race						
White	2,284	3,104	4,301	5,791	9,005	24,485
Black	2,652	3,393	3,430	4,279	5,221	18,975
Other	967	1,358	1,850	2,973	3,403	10,551
Unknown/missing	179	190	340	81	419	1,209
Ethnicity						
Non-Hispanic	5,464	7,333	8,805	11,233	15,642	48,477
Hispanic	618	712	1,116	1,891	2,406	6,743
Education Level						
< 6 years	362	406	499	814	1,044	3,125
<12 years	586	871	921	1,189	1,774	5,341
12 years	1,585	2,193	2,590	3,490	4,597	14,455
>12 years	1,629	2,155	2,775	3,461	4,663	14,683
16 years	1,143	1,463	1,913	2,530	3,607	10,656
>16 years	688	862	1,132	1,470	2,133	6,285
Missing	89	95	91	170	230	675
Health Insurance Status						
Yes	4,948	6,429	7,892	10,154	15,279	46,869
No	652	874	1,554	1,701	2,353	6,804
Missing	251	382	370	475	810	2,288
All	6,082	8,045	9,921	13,124	18,048	55,220

e.a

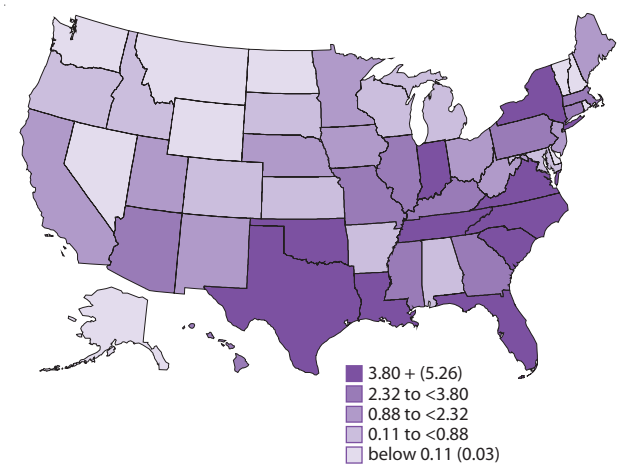
Total eligible KEEP participants

KEEP N= 55,220.



e.1

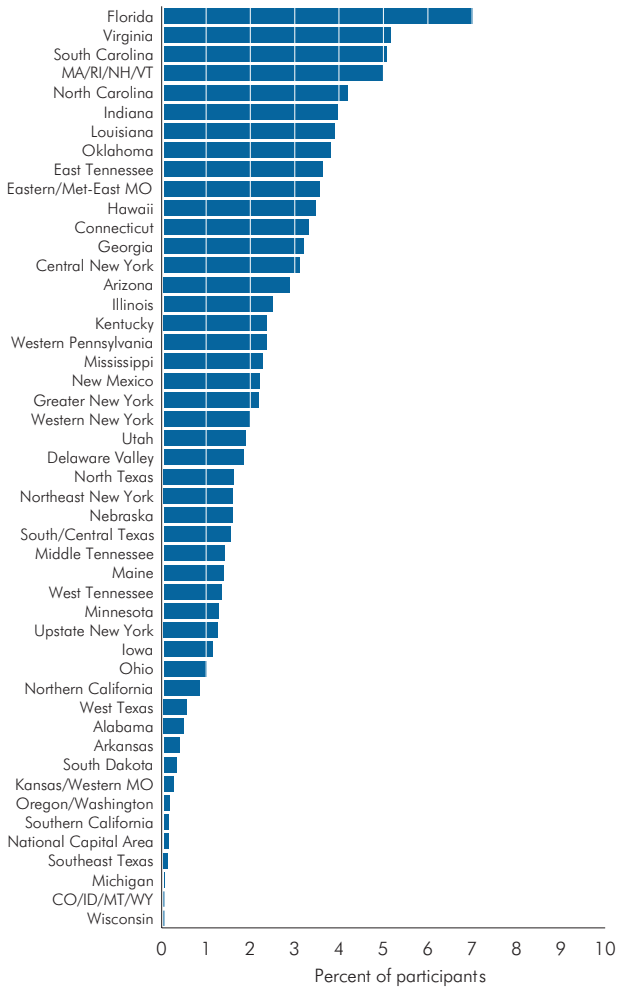
Cumulative number of KEEP participants & affiliates, by year



e.2

Geographic variations in the percent of KEEP participants, by state

KEEP N=55,200



e .3

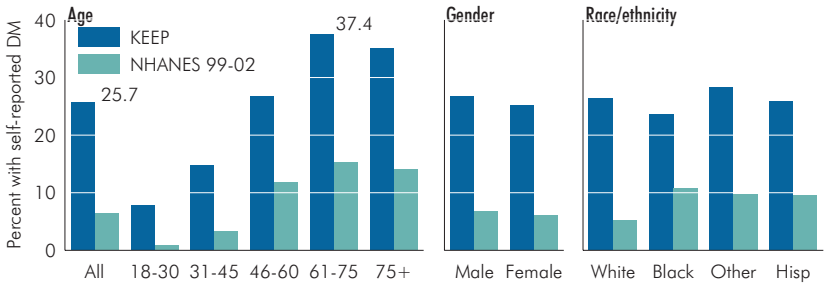
Percentage of KEEP participants, by affiliate (rank order)

KEEP N=55,220

The KEEP program is designed to identify individuals with a history of diabetes or hypertension and those with a family history of diabetes, hypertension, or kidney disease. As of December 31, 2005, the program had screened 55,220 participants. The greatest proportion of these participants are age 46–60.

Twice as many women compared to men have been screened by the KEEP program. And over 24,000 whites have taken part in the screening, compared to nearly 19,000 blacks and 11,000 Hispanics.

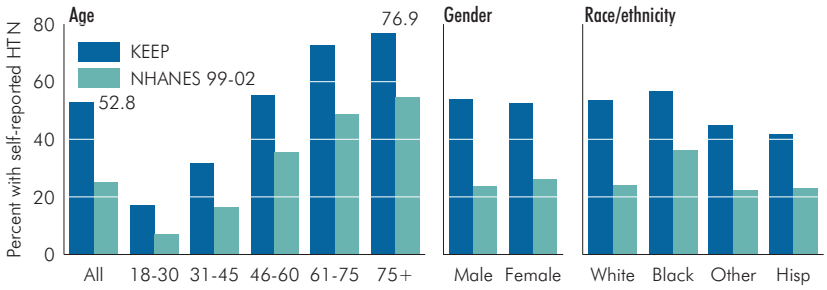
In 2005, screening programs were conducted by 48 affiliates, the majority located in the southern portions of the U.S. Seven percent of participants reside in Florida and 5% in Virginia, South Carolina, or New England.



e.4

Self-reported diabetes in KEEP & NHANES participants, by age, gender, & race/ethnicity

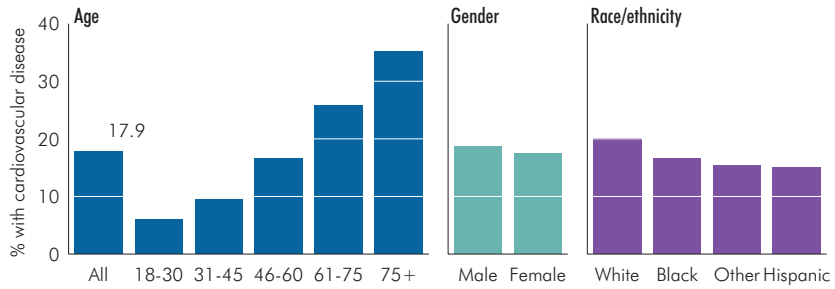
KEEP N= 55,220, age & Hispanics; 55,143, gender; 54,011, race. NHANES N= 11,432.



e.5

Self-reported hypertension in KEEP & NHANES participants, by age, gender, & race/ethnicity

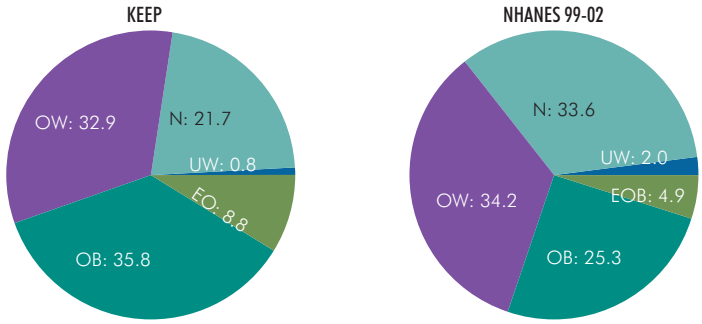
KEEP N= 54,506, age & Hispanics; 54,433, gender; 53,353, race. NHANES N= 11,271.



e.6

Cardiovascular disease in KEEP participants, by age, gender, & race/ethnicity

KEEP N= 54,173, age; 54,111, gender; 53,030, race.



e.7

Percent distribution of KEEP & NHANES participants, by BMI category

KEEP N= 54,466. NHANES N= 10,132.

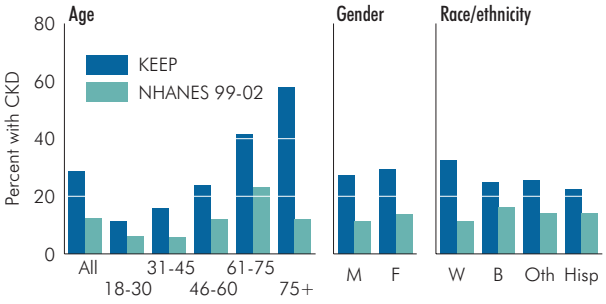
Over 25% of KEEP participants report having diabetes. Rates of diabetes increase with age up to age 61–75 and reach 37.4% in this age group. Equal proportions of men and women report having diabetes. By race and ethnicity diabetes is reported by 26.3, 24, 28.2, and 25.9%, respectively, of whites, blacks, people of other races, and Hispanics.

Self-reported hypertension is far more common in the KEEP population compared to the general population. Overall, 52.8% of KEEP participants report having hypertension compared to 25% of the NHANES population. The proportion of participants reporting hypertension increases with age, and reaches 76.9% in KEEP participants age 75 and older. Rates of hypertension are similar by gender, and in both the KEEP and NHANES populations are highest in blacks at 56.5 and 36%, respectively.

Not surprisingly, rates of cardiovascular disease (CVD) in KEEP participants increase with age. CVD is evident in 16.6% of participants age 46–60, while 25.9% of those age 61–75 and 35.2% of those age 75 and older are afflicted with the disease. By, gender, CVD is found in 18.7% of males and 17.5% of females. Twenty percent of white participants have CVD compared to 17% of blacks and to 15.5 and 15.1%, respectively, of people of other races and Hispanics.

Nearly a third of KEEP participants are classified as being overweight, while 35.8% are obese, and 8.8% are extremely obese.

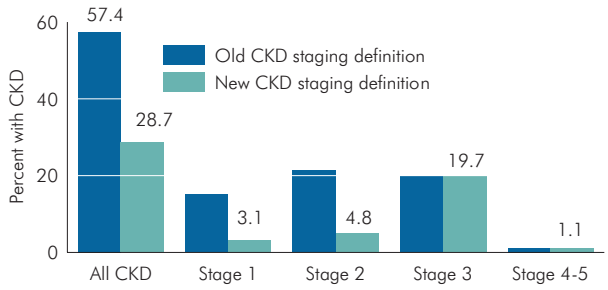
PREVALENCE OF CKD



e.8

CKD in KEEP & NHANES participants, by age, gender, & race ethnicity

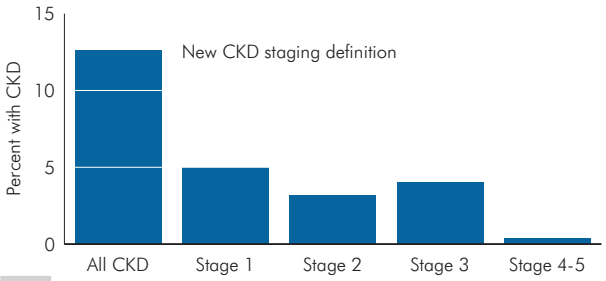
KEEP N= 45,311, age & gender; 44,400, race. NHANES N= 9,718.



e.9

CKD in KEEP participants, by CKD stage & CKD definition

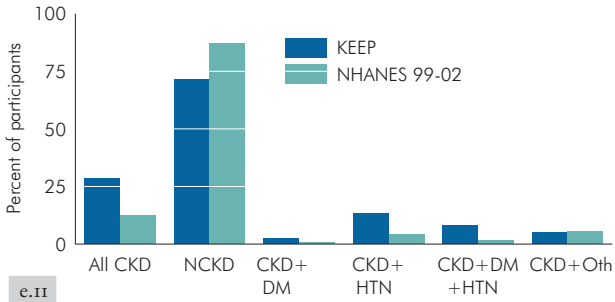
KEEP N= 45,311.



e.10

CKD in NHANES participants, by CKD stage & CKD definition

NHANES N= 45,311.



e.11

Interactions of CKD, diabetes, & hypertension in KEEP & NHANES participants

KEEP N= 44,925. NHANES N= 9,599.

Some form of chronic kidney disease (CKD) is known to exist in nearly 13,000 of the over 45,000 (28.7%) eligible KEEP participants for whom data on estimated glomerular filtration rates are available. Stage 3 CKD (eGFR 30–59) is most apparent among these individuals, at 19.7%, with Stage 1 and Stage 2 accounting for 3.0 and 4.8% of participants, respectively.

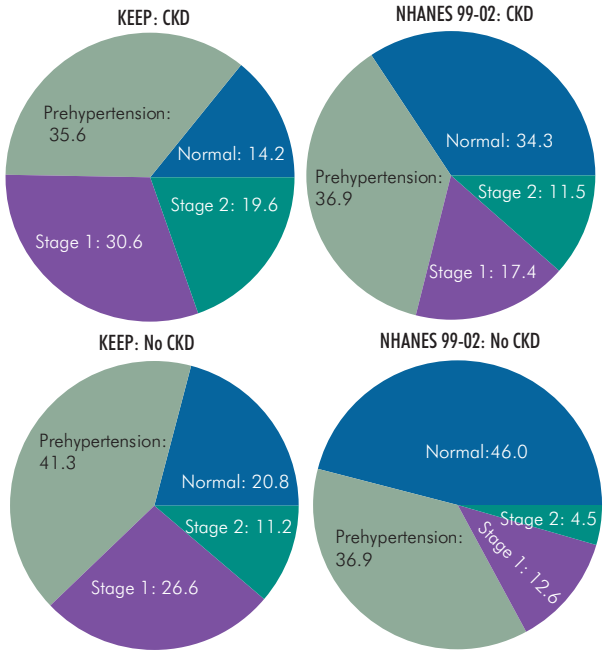
Evidence of CKD increases with age, reaching 41% in KEEP participants age 61–75 and 58% in those age 75 and older. Twenty-seven percent of men have some form of CKD compared to 29.3% of women. By race/ethnicity, CKD is present in 32.4% of whites, 25% of blacks, and 25.6% of individuals of other races; the disease affects 22.5% of eligible Hispanic KEEP participants.

	Non-CKD	Stage 1& Abnormal ACR	Stage 2& Abnormal ACR	Stage 3	Stages 4-5	Missing	All
Age							
18-30	3,239	208	96	110	6	1,031	4,690
31-45	8,535	393	403	787	21	2,642	12,781
46-60	11,913	533	718	2,405	101	3,593	19,263
61-75	6,951	212	670	3,792	228	2,123	13,976
>75	1,679	37	280	1,836	158	520	4,510
Gender							
Male	10,335	400	736	2,526	199	3,272	17,468
Female	21,982	983	1,431	6,404	315	6,560	37,675
Missing	.	.	.	.	.	77	77
Race							
White	14,184	366	917	5,243	263	3,512	24,485
Black	10,898	611	740	2,145	134	4,447	18,975
Other	6,618	370	468	1,338	105	1,652	10,551
Unknown/missing	617	36	42	204	12	298	1,209
Ethnicity							
Non-Hispanic	28,013	1,180	1,911	8,144	477	8,752	48,477
Hispanic	4,304	203	256	786	37	1,157	6,743
U.S. Census Region							
Northeast	7,651	318	516	2,166	119	2,073	12,843
Midwest	5,429	250	371	1,400	96	1,262	8,808
South	15,524	644	1,031	4,325	237	5,478	27,239
West	3,707	171	249	1,034	62	1,087	6,310
Missing	6	.	.	5	.	9	20
U.S. Census Division							
New England	2,732	89	192	1,049	42	1,205	5,309
Middle Atlantic	4,919	229	324	1,117	77	868	7,534
East North Central	3,114	152	224	704	54	395	4,643
West North Central	2,315	98	147	696	42	867	4,165
South Atlantic	7,497	288	488	2,395	113	3,298	14,079
East South Central	4,109	160	258	912	50	902	6,391
West South Central	3,918	196	285	1,018	74	1,278	6,769
Mountain	2,271	109	140	692	22	520	3,754
Pacific	1,436	62	109	342	40	567	2,556
Missing	6	.	.	5	.	9	20
Smoking							
Yes	12,744	606	951	3,735	242	3,989	22,267
No	17,728	687	1,096	4,714	236	5,258	29,719
Missing	1,845	90	120	481	36	662	3,234
Education Level							
≤ 6 years	1,656	94	157	653	57	508	3,125
<12 years	2,826	162	270	1,024	71	988	5,341
12 years	8,168	395	584	2,576	172	2,560	14,455
>12 years	8,792	376	554	2,163	108	2,690	14,683
16 years	6,725	232	352	1,398	52	1,897	10,656
>16 years	3,810	108	211	983	48	1,125	6,285
Missing	340	16	39	133	6	141	675
Health Insurance Status							
Yes	25,017	933	1,672	7,526	440	7,835	43,423
No	5,996	381	396	1,012	48	1,676	9,509
Missing	1,304	69	99	392	26	398	2,288
Doctor Status							
Yes	26,951	1,129	1,871	8,100	472	8,346	46,869
No	4,481	208	242	595	24	1,254	6,804
Missing	885	46	54	235	18	309	1,547
All	32,317	1,383	2,167	8,930	514	9,909	55,220

e.b

Total eligible KEEP participants with chronic kidney disease, by CKD stage

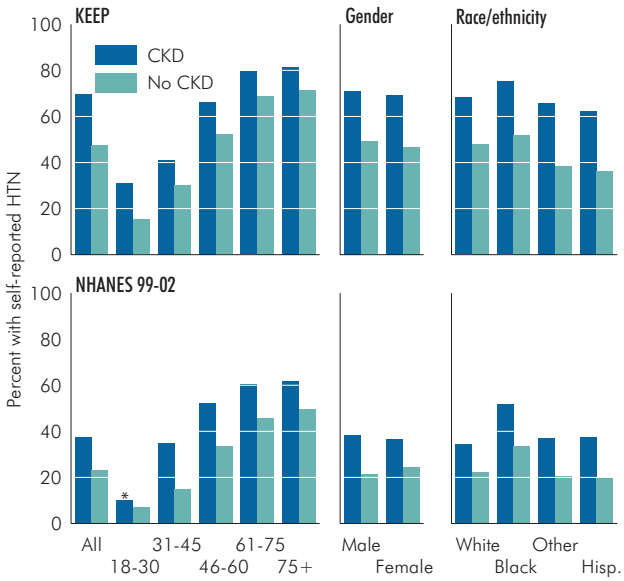
"All" includes participants with missing or unknown values for data fields.



e.12

Percent distribution by hypertension stage (JNC 7) in KEEP & NHANES participants with or without CKD

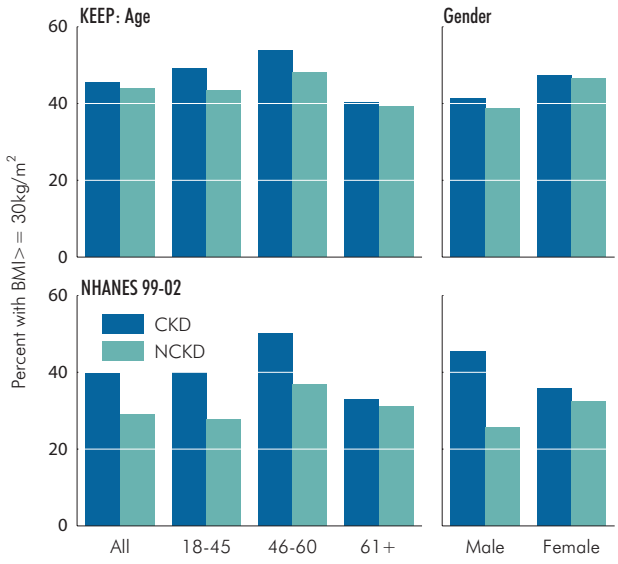
KEEP N= 44,673. NHANES N= 9,400.



e.13

Self-reported diabetes in KEEP & NHANES participants with or without CKD, by age, gender, & race/ethnicity

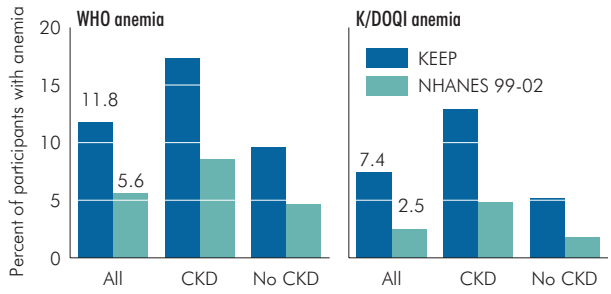
KEEP N= 44,925 age & gender; 44,041, race/ethnicity. NHANES N= 9,714.
**Sample size less than 30 or coefficient of variation not less than 30%.*



e.14

BMI ≥30 kg/m² in KEEP & NHANES participants with & without CKD, by age

KEEP N= 44,711. NHANES N= 9,459.



e.15

Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by CKD status

KEEP N= 44,723. NHANES N= 10,018, all, 9,712 CKD.

Under blood pressure criteria established by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7), 14.2% of KEEP participants with CKD have normal blood pressure levels, 35.6% have prehypertension, and 30.6 and 19.6%, respectively, have a hypertension classification of Stage 1 or Stage 2.

Nearly 70% of eligible KEEP participants with CKD report having diabetes. Diabetes affects older participants to a greater degree—approximately 80% of participants older than 60 report having diabetes, compared to 31% of those age 18–30 and 41% of those age 31–45. Rates of self-reported diabetes are similar in males and females, at 71 and 69%, while 75% of blacks report the disease, compared to 68, 66, and 63%, respectively of whites, individuals of other races, and Hispanics.

The percent of KEEP participants classified as obese is similar in those with and without CKD. In KEEP participants with CKD, those age 46–60 are the most prone to obesity, followed by those age 18–45. Females are more likely than males to be obese, regardless of CKD status.

Using the WHO and K/DOQI definitions of anemia, 11 and 7.4% of KEEP participants are classified as anemic. In those with CKD, proportions reach 17.3% when using WHO criteria, and 12.9% when the K/DOQI definition is applied. In participants not carrying a CKD diagnosis, rates are 9.6 and 5.2%, respectively.

Table e.a
As of 2005, 55,220 individuals have participated in the KEEP screening program. By race, 24,485 whites have participated compared to 18,975 blacks and 10,551 of other races.

Figure e.4
Over one-quarter of eligible KEEP participants report having diabetes or diabetic retinopathy. Rates are highest in older participants and in people of races other than white or black.

Figure e.5
The proportion of KEEP and NHANES participants who report being hypertensive increases with age, is comparable in males and females, and is slightly higher in blacks compared to whites, individuals of other races, and Hispanics.

Figure e.6
Over 17% of KEEP participants report a history of cardiovascular disease. Rates are most pronounced in older participants, reaching 35% in those age 75 and older. Rates are slightly higher in whites compared to those of other racial and ethnic groups.

Figure e.8
Twenty-nine percent of KEEP participants have CKD compared to 13% of the NHANES population. CKD is evenly distributed between males and females in both populations, and occurs most often in whites.

Figure e.9
Using the new CKD definition, the percent of KEEP participants with CKD is 28.7%, compared to 57.4% under the old definition.

Figure e.12
Among KEEP participants with or without CKD, 35.6 and 41% are pre-hypertensive, respectively, while in the NHANES population, 36.9% have this condition.

Figure e.13
In both the KEEP and NHANES populations, self-reported diabetes is more prominent in those with CKD—at 36.1% and 15.7% respectively—compared to those without the diagnosis.

JNC 7 HYPERTENSION

NORMAL
systolic <120 mmHg & diastolic <80 mmHg

PREHYPERTENSION
systolic 120-139 mmHg or diastolic 80-89 mmHg

STAGE 1
systolic 140-159 mmHg or diastolic 90-99 mmHg

STAGE 2
systolic ≥160 mmHg or diastolic ≥100 mmHg

DIABETES
Self-reported diabetes
Elevated blood sugar

GLUCOSE GREATER THAN THE NORMAL LIMIT
Fasting: >126 mg/dl
Non-fasting: >139 mg/dl

CVD DEFINITION: KEEP
Participant reporting any of the following cardiac events: heart attack, heart by-pass surgery, heart angioplasty, stroke, heart failure, stroke, PVD, or arrhythmia

CVD DEFINITION (NHANES)
Participant reporting any of the following cardiac diseases: congestive heart failure, coronary heart disease, angina/angina pectoris, heart attack, or stroke

CKD DEFINITION
If eGFR by K/DOQI MDRD <60 ml/min/1.73 m^2 or eGFR ≥60 ml/min/1.73 m^2 and abnormal albumin/creatinine ratio (ACR ≥30mg/g)

CKD STAGES
Stage 1: eGFR ≥90, ACR ≥30 mg/g
Stage 2: eGFR 60–89, ACR ≥30 mg/g
Stage 3: eGFR 30–59
Stage 4: eGFR 15–29
Stage 5: eGFR <15 or dialysis

BODY MASS INDEX CATEGORIES
UW: underweight, BMI <18.5
N: normal, BMI 18.5–24.9
OW: overweight, BMI 25–29.9
OB: obese, BMI 30–39.9
EOB: extremely obese, BMI ≥40

ANEMIA DEFINITIONS

WHO
Male: hemoglobin <13 g/dl
Female: <12g/dl

K/DOQI
Males: hemoglobin <12g/dl
Women age >50: <12g/dl
Women age ≤50: <11 g/dl