

6

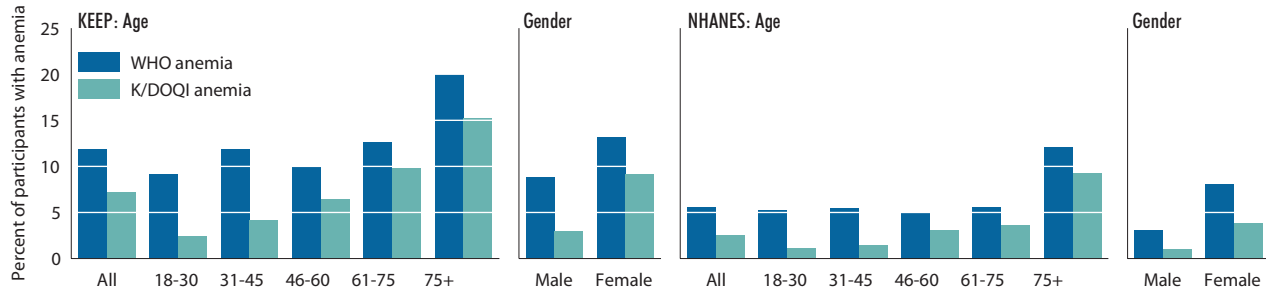
Anemia & CKD

“I felt everyone there was well informed and friendly. Everything was conducted very professionally. My results were explained in good detail and when I saw my doctor, I was informed enough to ask her for the tests I needed to address my concerns. Since the screening, I have kept an eye on my iron and have a lot more energy. I even lost about 15 lbs since the screening. One of my resolutions is to start taking better care of myself. Thank you for this program!”

KE&P Participant: Screening date, August, 2005

general anemia
anemia & CKD
odds of anemia

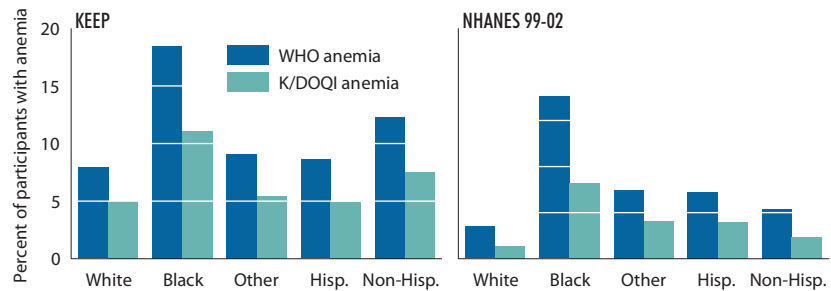
GENERAL ANEMIA



6.1

Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by age & gender

KEEP N= 52,317. NHANES N= 10,018.



6.2

Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by race/ethnicity

KEEP N= 51,207. NHANES N= 10,018.

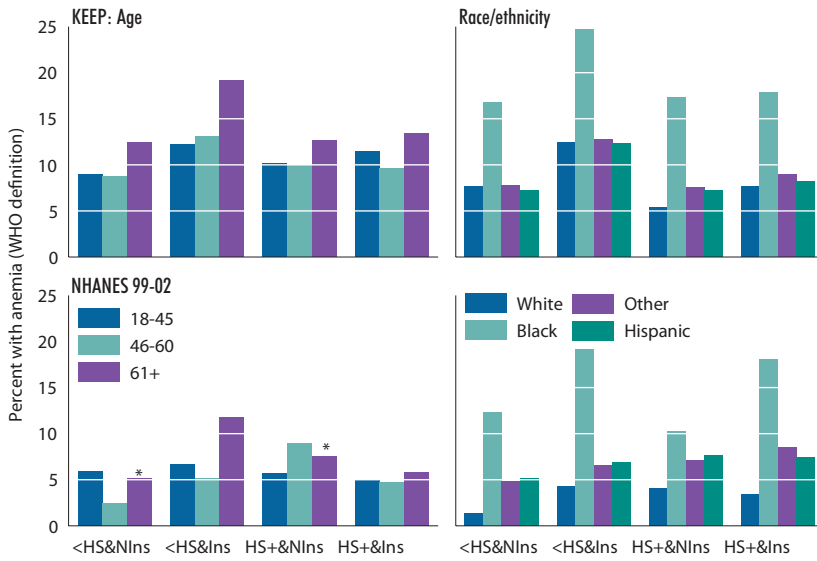
The percentage of KEEP and NHANES participants with WHO and K/DOQI anemia increases with age, reaching 20 and 15%, respectively, in participants age 75 and older. For both definitions, anemia is more prominent in females compared to males—13.2 versus 8.8%, respectively, using the WHO anemia definition and 9.1 versus 3%, respectively using the K/DOQI definition.

Blacks exhibit the highest rates of anemia in both populations. In black KEEP participants, and using the WHO and

K/DOQI anemia definitions, rates reach 18.5 and 11.1%, respectively, compared to 7.9 and 5% in whites.

By age and education status, older KEEP and NHANES participants generally have the highest percentages of WHO and K/DOQI anemia; anemia is most prominent in black participants.

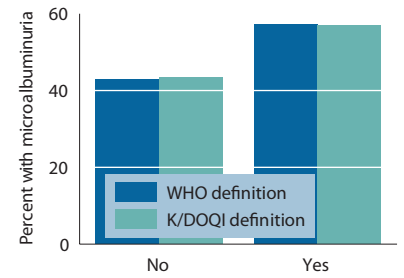
KEEP participants who are anemic are more likely to have a positive urinary microalbumin, higher microalbumin levels, and a greater likelihood of an abnormal ACR (≥ 30 mg/g).



6.3

Anemia (WHO definition) in KEEP & NHANES participants, by education & insurance status, age, & race/ethnicity

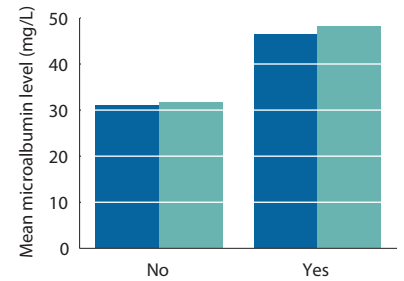
KEEP N= 49,694, age: 48,749, race. NHANES N= 9,856.
 *Sample size less than 30 or coefficient of variation not less than 30%.



6.4

Anemia (K/DOQI definition) in KEEP & NHANES participants, by age, race/ethnicity, education, & insurance status

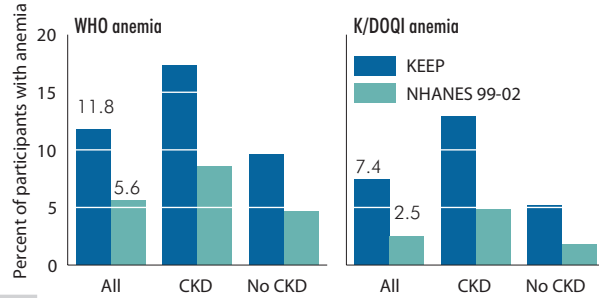
KEEP N= 49,694, age: 48,749, race. NHANES N= 9,856.
 *Sample size less than 30 or coefficient of variation not less than 30%.



6.5

Microalbuminuria & ACR in KEEP participants with anemia (WHO & K/DOQI definitions)

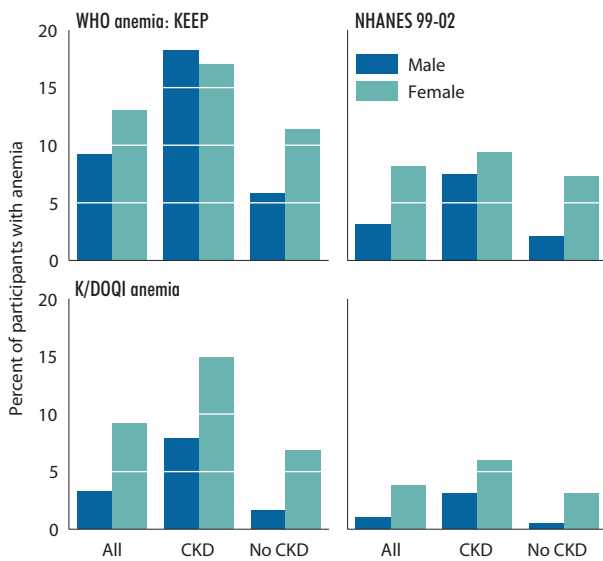
KEEP N= 52,317, microalbumin; 47,612, microalbumin level; 43,580, ACR. Positive microalbumin >20mg/L



6.6

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

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



6.7

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

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

6.8

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

KEEP N= 43,823. NHANES N= 10,018, all, 9,712, CKD.

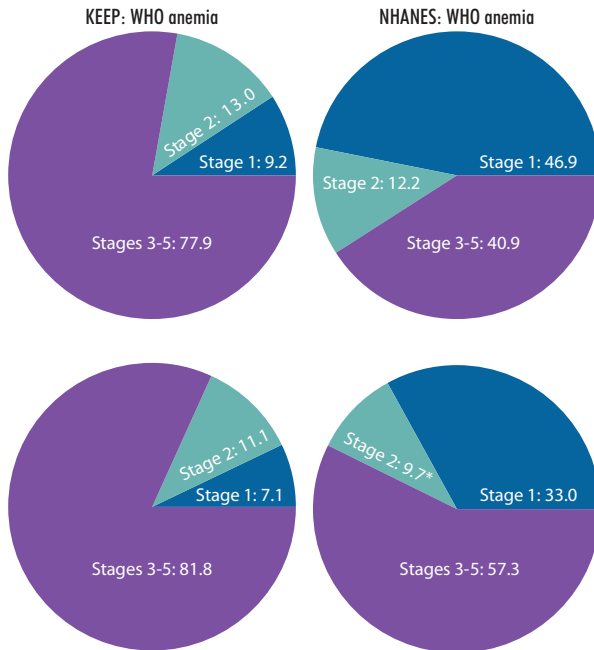
U

nder WHO and K/DOQI anemia definitions, 17.3 and 12.9% of KEEP participants with CKD are classified as anemic, and female participants are generally most likely to have anemia regardless of CKD status. By race, black participants are most likely to have anemia. In KEEP and NHANES participants with CKD, for example, 26 and 24%, respectively, are anemic using the WHO anemia definition and 19.6 and 11.2% are classified as anemic when using the K/DOQI definition.

Of KEEP and NHANES participants with WHO or K/DOQI anemia, 77.9 and 81.8% in KEEP are classified as having Stage 3–5 CKD compared to 40.9 and 57.3% in the NHANES population.

KEEP participants in the later stages of CKD are most likely to have anemia. Within all stages of CKD, black KEEP participants are the most likely to have anemia.

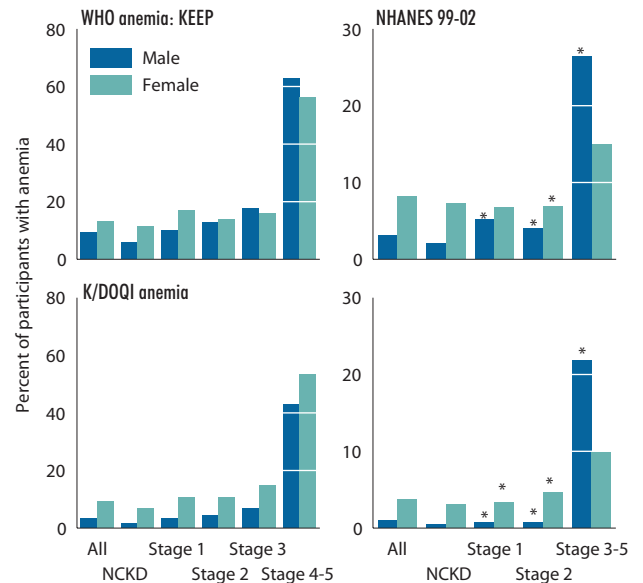
KEEP participants with diabetes are generally the most likely to be classified as anemic, when using the WHO and K/DOQI anemia definitions.



6.9

Percent distribution of KEEP & NHANES participants with WHO & K/DOQI anemia, by CKD stage

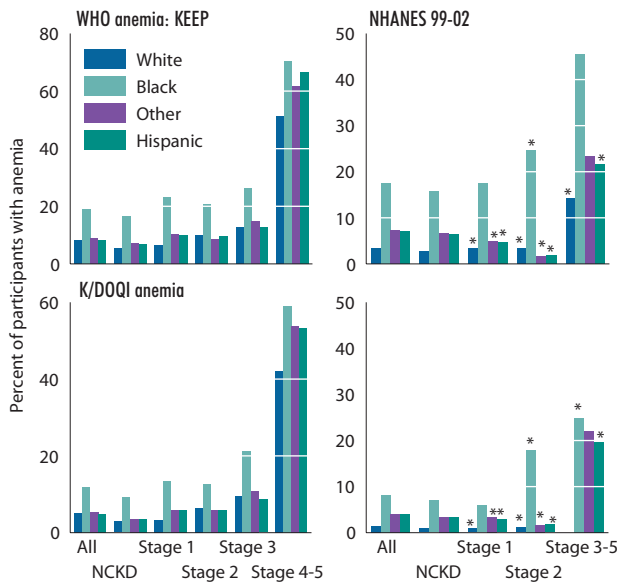
KEEP N= 2,217, WHO anemia; 1,645, K/DOQI anemia. NHANES N= 1,504.
*Sample size less than 30 or coefficient of variation not less than 30%.



6.10

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

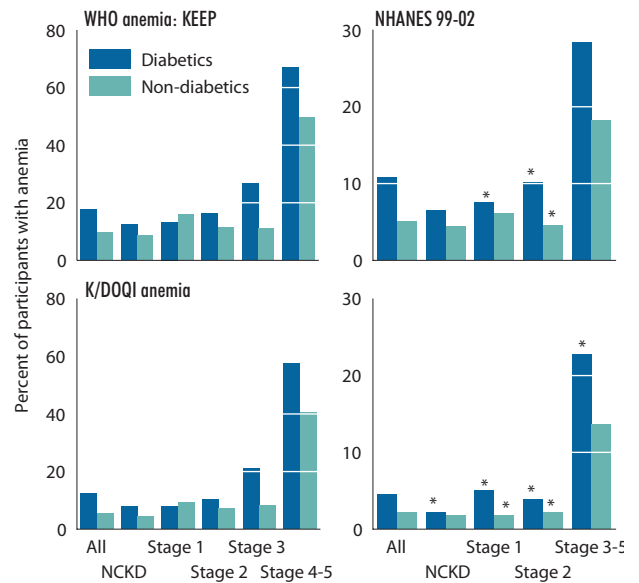
KEEP N= 44,723, NHANES N= 10,018, all; 9,712, CKD.
*Sample size less than 30 or coefficient of variation not less than 30%.



6.11

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

KEEP N= 43,823, NHANES N= 10,018, all.
*Sample size less than 30 or coefficient of variation not less than 30%.

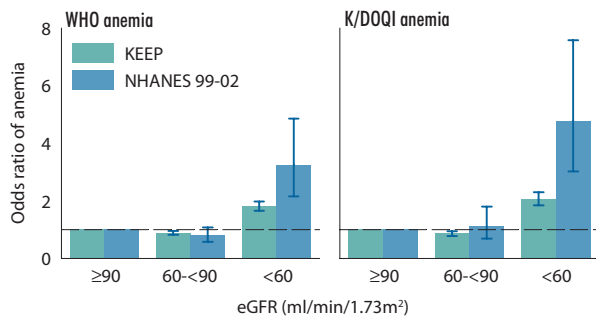


6.12

Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by CKD stage & self-reported diabetic status

KEEP N= 44,342, NHANES N= 10,013.
*Sample size less than 30 or coefficient of variation not less than 30%.

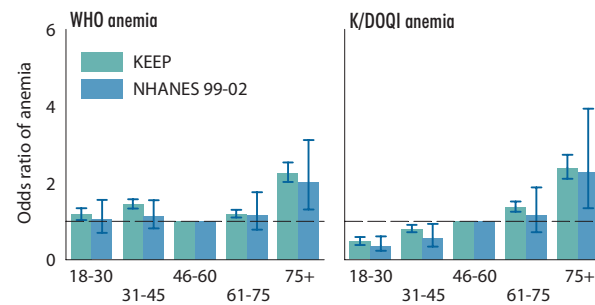
ODDS OF ANEMIA



6.13

Odds ratio of anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by eGFR

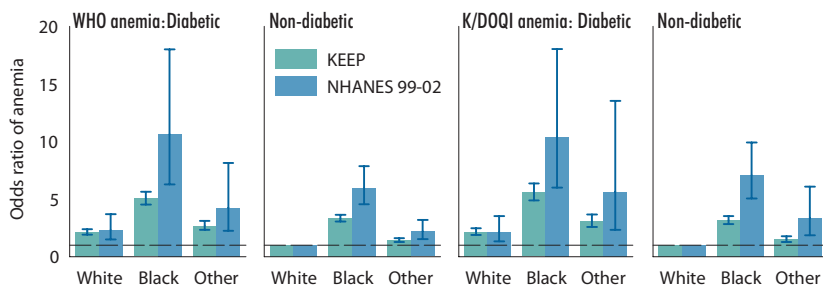
KEEP N= 44,075. NHANES N=8,707, participants age 20 and older.



6.14

Odds ratio of anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by age

KEEP N= 44,075, NHANES N=8,707, participants age 20 and older.



6.15

Odds ratio of anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by race & self-reported diabetic status

KEEP N= 44,075. NHANES N= 8,707, participants age 20 and older.

The odds of having anemia are greatest in participants with eGFRs of less than 60 ml/min/1.73 m². In the KEEP population, for example, the odds of anemia in participants with eGFRs of less than 60 ml/min/1.73 m², are 80% (WHO) and 100% (K/DOQI) higher when compared to those with an eGFR equal to or greater than 90 ml/min/1.73 m².

KEEP participants age 75 and older are more than two times as likely to have anemia compared to those age 46–60. By either the WHO or K/DOQI anemia

definition, both black diabetic and non-diabetic KEEP participants are 3–5 times more likely to be anemic compared to white non-diabetics.

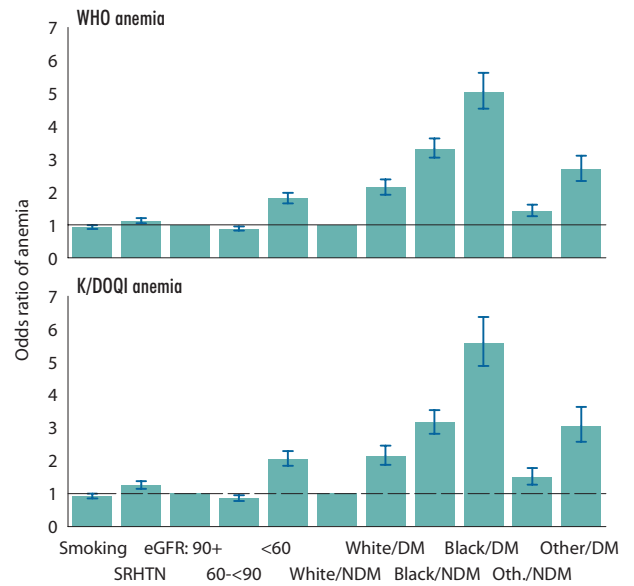
KEEP and NHANES participants age 75 and older are more than twice as likely to be anemic compared to participants age 46–60. Diabetes is a significant risk factor for anemia. Black diabetics, for example, are five to ten times more likely to be anemic compared to white non-diabetics. Participants with eGFRs <60 are 2–4 times more likely to be anemic compared to those with eGFRs of 90+.

	WHO anemia			K/DOQI anemia		
	OR	CI	P-value	OR	CI	P-value
Age (ref: 46-60)						
18-30	1.18	(1.03-1.34)	0.0147	0.47	(0.38-0.59)	<.0001
31-45	1.45	(1.33-1.57)	<.0001	0.81	(0.72-0.91)	0.0005
61-75	1.19	(1.10-1.30)	<.0001	1.37	(1.25-1.52)	<.0001
>75	2.26	(2.02-2.53)	<.0001	2.40	(2.11-2.73)	<.0001
Male (ref: female)	0.65	(0.61-0.70)	<.0001	0.31	(0.28-0.35)	<.0001
Smoking & used to smoke						
	0.93	(0.88-0.99)	0.0243	0.92	(0.85-1.00)	0.0372
Self-reported HTN	1.12	(1.05-1.20)	0.0011	1.26	(1.15-1.37)	<.0001
Family history DM						
	0.99	(0.93-1.06)	0.8233	0.99	(0.91-1.08)	0.7629
Family history EBP						
	0.98	(0.91-1.06)	0.6815	0.94	(0.85-1.04)	0.2384
BMI 30+	1.03	(0.96-1.09)	0.4214	1.02	(0.94-1.10)	0.6458
eGFR (ref 90+)						
<60	1.81	(1.65-1.98)	<.0001	2.06	(1.85-2.30)	<.0001
60-<90	0.88	(0.82-0.95)	0.0006	0.86	(0.78-0.95)	0.0020
Race & diabetic status (ref: White/NDM)						
White/DM	2.13	(1.91-2.38)	<.0001	2.14	(1.87-2.45)	<.0001
Black/NDM	3.32	(3.04-3.62)	<.0001	3.15	(2.81-3.53)	<.0001
Black/DM	5.04	(4.52-5.62)	<.0001	5.57	(4.88-6.36)	<.0001
Other/NDM	1.42	(1.26-1.61)	<.0001	1.51	(1.28-1.78)	<.0001
Other/DM	2.69	(2.33-3.10)	<.0001	3.06	(2.57-3.64)	<.0001

6.a

Odds ratio of anemia (WHO & K/DOQI definitions) in KEEP participants, by patient characteristics

KEEP N= 44,075.



6.16

Odds ratio of anemia (WHO & K/DOQI definitions) in KEEP participants, by race & risk factor

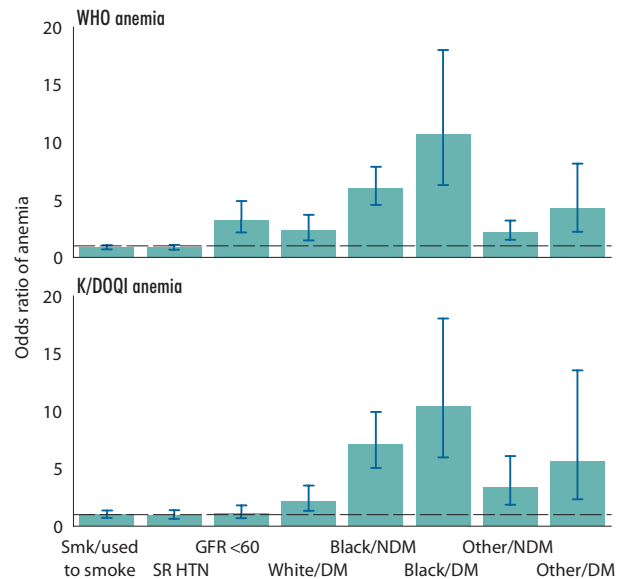
KEEP N= 44,075.

	WHO anemia			K/DOQI anemia		
	OR	CI	P-value	OR	CI	P-value
Age (ref: 46-60)						
20-30	1.05	(0.70-1.56)	0.814	0.37	(0.23-0.61)	0.000
31-45	1.13	(0.82-1.55)	0.449	0.56	(0.34-0.93)	0.027
61-75	1.17	(0.78-1.76)	0.436	1.16	(0.72-1.88)	0.535
>75	2.02	(1.31-3.12)	0.002	2.29	(1.34-3.93)	0.004
Male (ref: female)	0.39	(0.31-0.48)	0.0001	0.26	(0.18-0.38)	0.0001
Smoking & used to smoke						
	0.85	(0.69-1.06)	0.146	0.99	(0.72-1.36)	0.949
Self-reported HTN	0.85	(0.66-1.08)	0.179	0.93	(0.63-1.39)	0.728
GFR (ref: 90+)						
<60	3.24	(2.16-4.87)	0.0001	4.78	(3.02-7.58)	0.0001
60-<90	0.79	(0.58-1.07)	0.127	1.11	(0.69, 1.80)	0.652
Race & diabetic status (ref: White/NDM)						
White/DM	2.32	(1.47-3.67)	0.001	2.16	(1.32-3.53)	0.003
Black/NDM	5.98	(4.55-7.86)	0.0001	7.08	(5.05-9.91)	0.0001
Black/DM	10.62	(6.26-18.0)	0.0001	10.37	(5.97-18.0)	0.0001
Other/NDM	2.19	(1.51-3.18)	0.0001	3.35	(1.85-6.07)	0.0001
Other/DM	4.24	(2.22-8.12)	0.0001	5.62	(2.33-13.52)	0.0001

6.b

Odds ratio of anemia (WHO & K/DOQI definitions) in NHANES participants, by patient characteristics

NHANES N=8,707, participants age 20 and older.



6.17

Odds ratio of anemia (WHO & K/DOQI definitions) in NHANES participants, by race & risk factor

NHANES N= 8,707, participants age 20 and older.

Figure 6.1

The percentage of KEEP and NHANES participants with anemia increases with age, reaching 20 and 15%, respectively, in participants age 75 and older. Anemia is more prominent in females compared to males—13.2 versus 8.8% in the KEEP population.

Figure 6.6

Under WHO and K/DOQI anemia definitions, 17.3 and 12.9% of KEEP participants with CKD are classified as anemic.

Figure 6.9

Of KEEP and NHANES participants with WHO or K/DOQI anemia, 77.9 and 81.8% are classified as having Stage 3–5 CKD compared to 40.9 and 57.3% in the NHANES population.

Table 6.a

The odds of having anemia are greatest in participants with eGFRs of less than 60 ml/min/1.73 m². In the KEEP population, for example, the odds of anemia in participants with eGFRs of less than 60 ml/min/1.73 m² are 80–100% higher when compared to those with an eGFR equal to or greater than 90 ml/min/1.73 m².

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

CKD DEFINITION

If eGFR by K/DOQI MDRD <60 ml/min/1.73 m² or eGFR ≥60 ml/min/1.73 m² and abnormal albumin/creatinine ratio (ACR ≥30mg/g)

POSITIVE MICROALBUMIN

>20 mg/L

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

ABNORMAL ALBUMIN/CREATININE RATIO (ACR)

ACR ≥30 mg/g

EDUCATION & INSURANCE

<HS&NIns: Less than a high school education, & no insurance
<HS&Ins: Less than a high school education, & insurance
HS+&NIns: High school education or greater, & no insurance
HS+&Ins: High school education or greater, & insurance