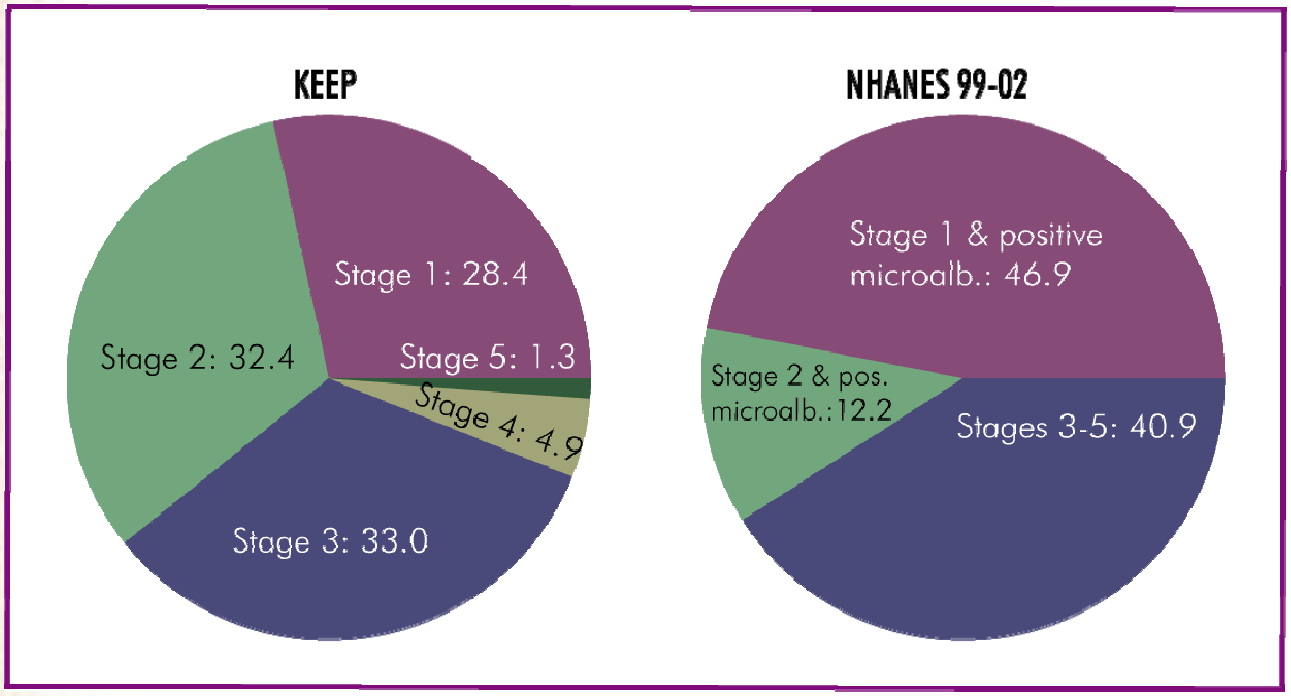
KEEP Data Report 2005

Chapter 6:
Anemia & chronic kidney disease

National Kidney Foundation
KEEP
KIDNEY EARLY EVALUATION PROGRAM

Figure 6.1

Percent distribution of KEEP & NHANES participants with anemia, by CKD stage



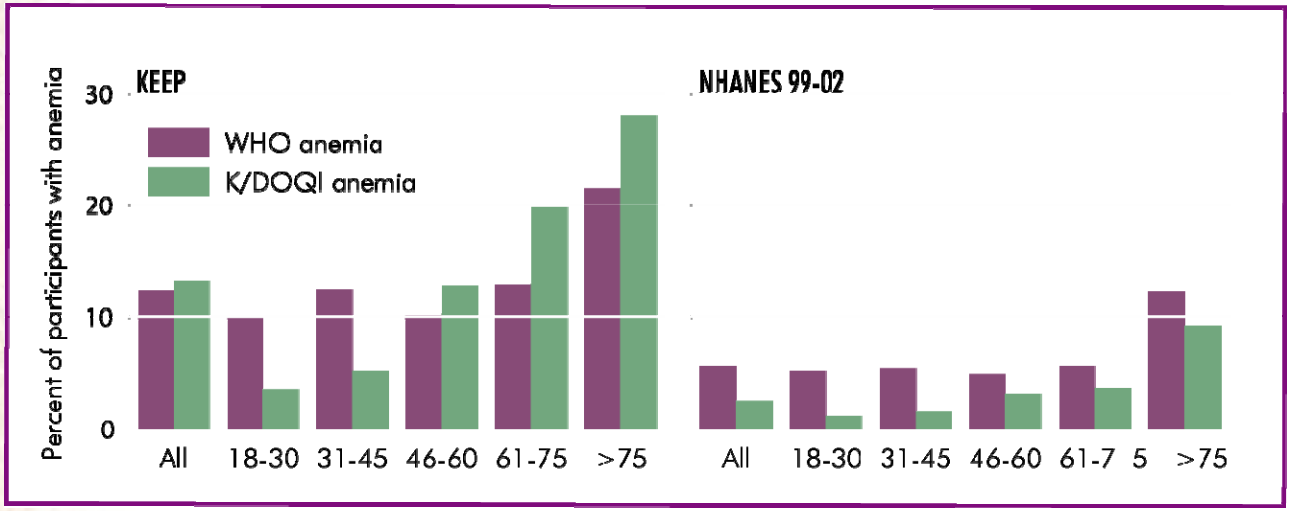
Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

CKD Stages
Stage 1: eGFR ≥ 90, microalbuminuria +
Stage 2: eGFR 60–89, microalbuminuria +
Stage 3: eGFR 30–59
Stage 4: eGFR 1–29
Stage 5: eGFR <15 or patient on dialysis

KEEP N=2,831, NHANES N=222.

Figure 6.2

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

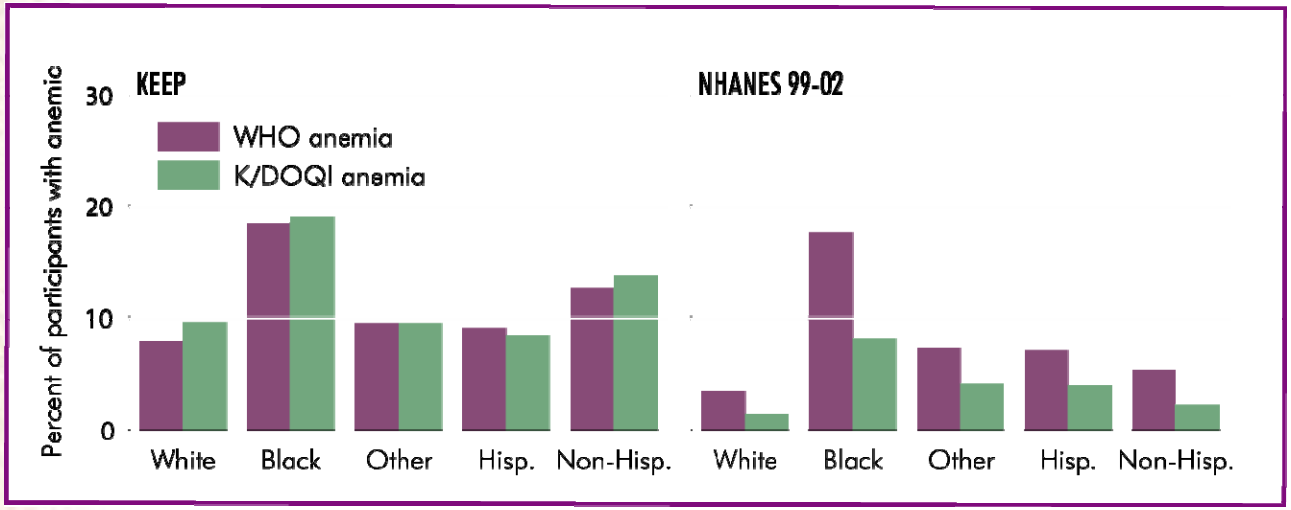


Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP N=34,975, NHANES N=10,018. Excludes participants with missing values for hemoglobin.

Figure 6.3

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

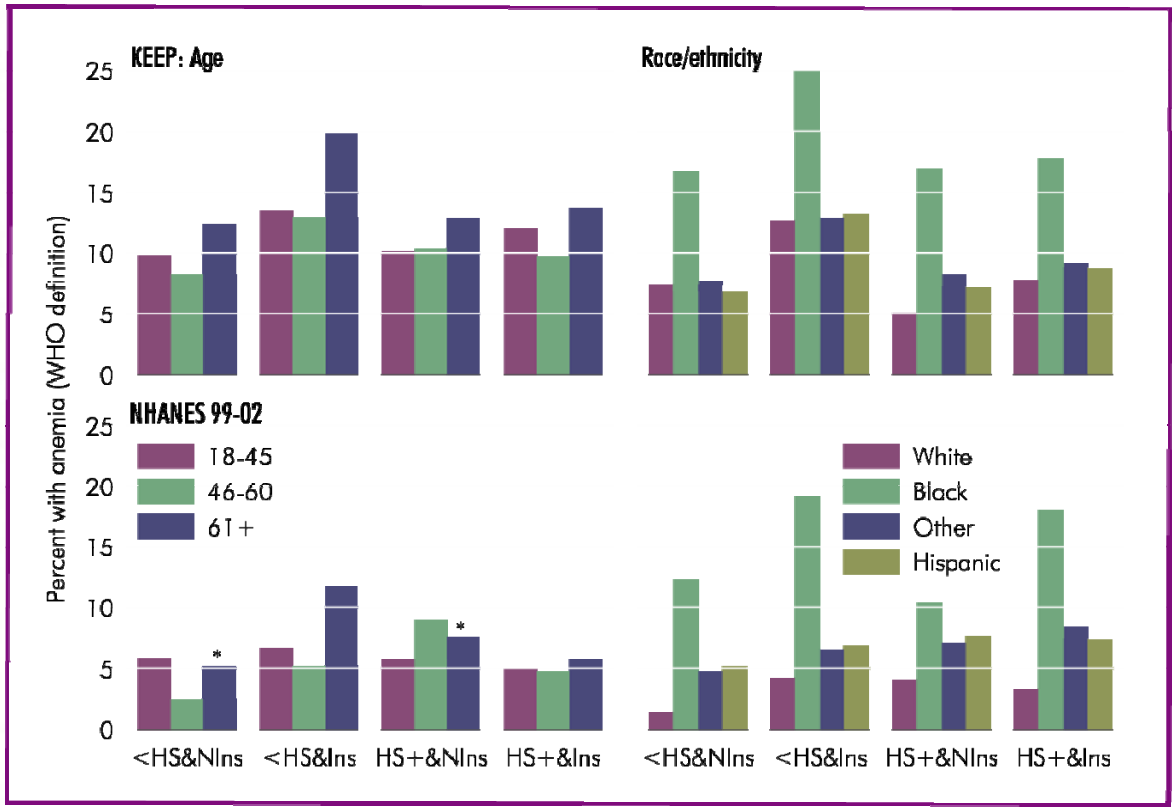


Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP N=34,975, NHANES N=10,018. Excludes participants with missing values for hemoglobin.

Figure 6.4

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

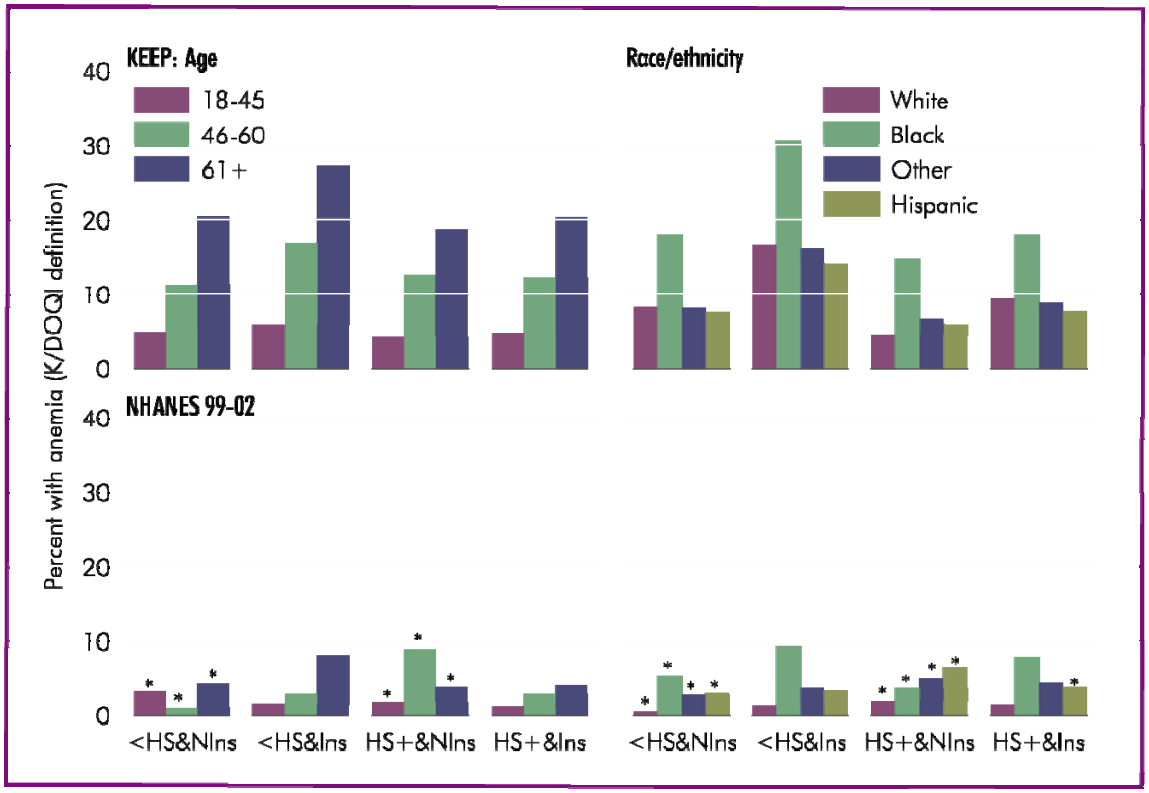


Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl

KEEP N=33,276, NHANES N=9,856. Excludes participants with missing values for hemoglobin, education, & insurance.

Figure 6.5

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



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

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

KEEP N=33,276, NHANES N=9,856. Excludes participants with missing values for hemoglobin, education, & insurance. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

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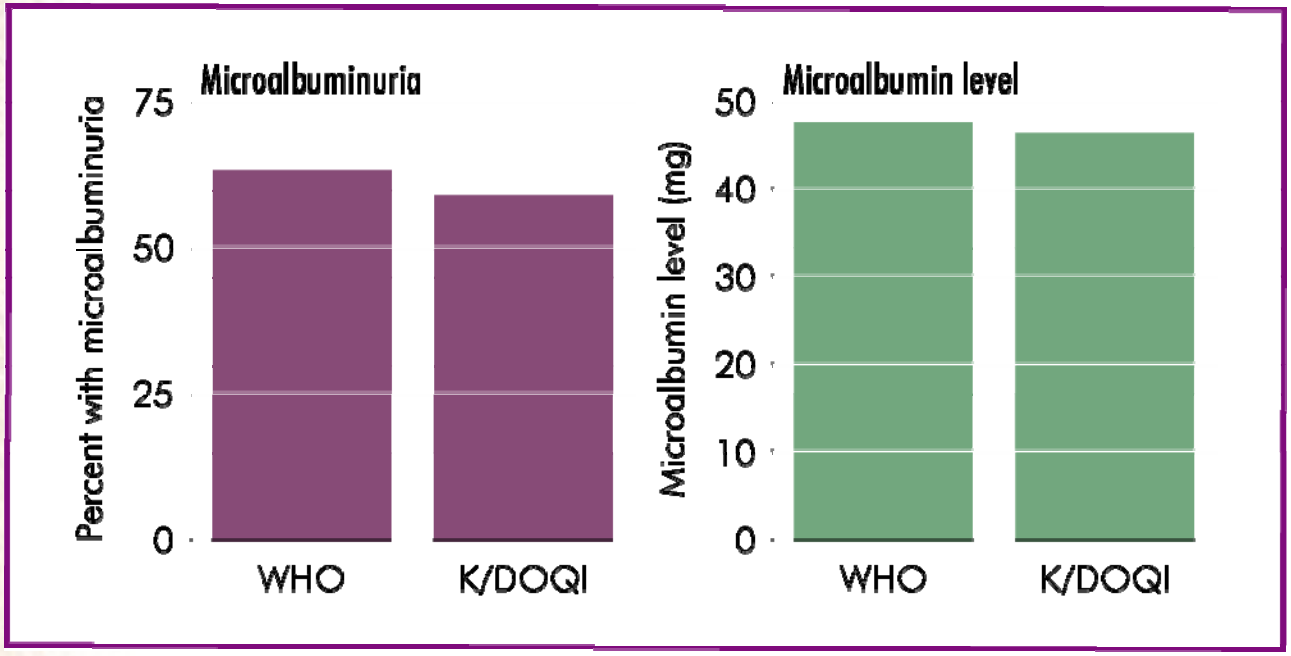
Figure 6.6

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

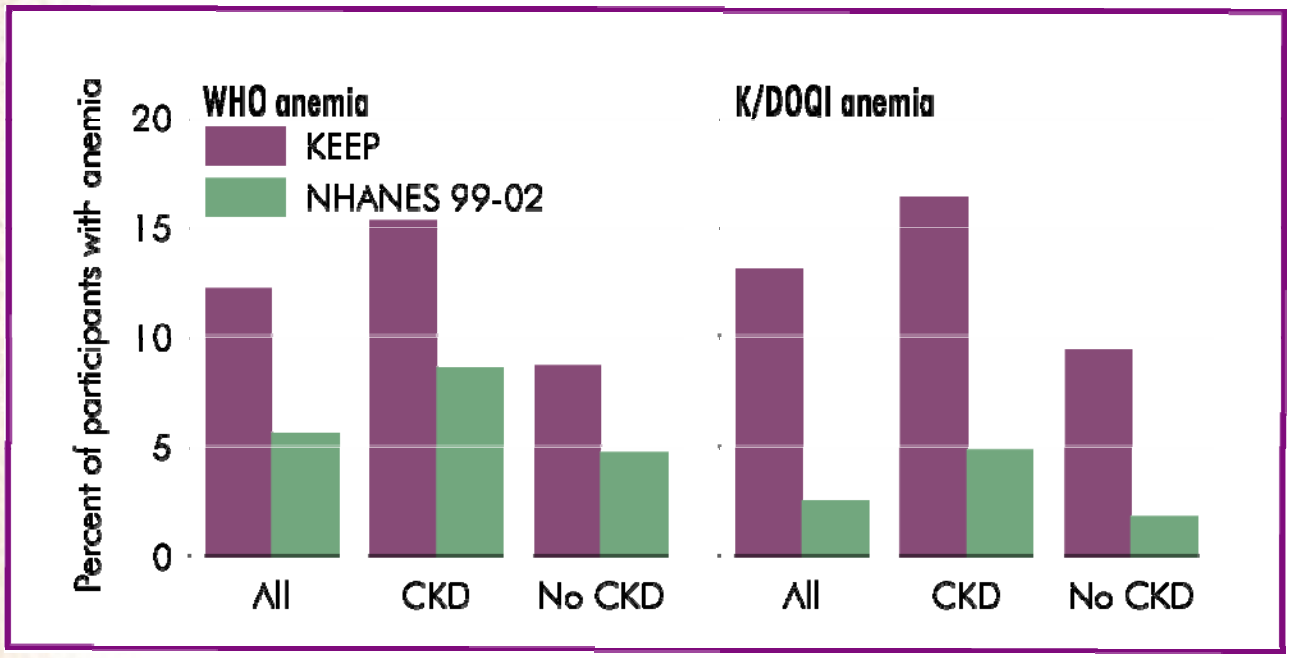


Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP N=3,739 WHO anemia; 4,041 K/DOQI definition. Excludes participants with missing values for hemoglobin or microalbuminuria.

Figure 6.7

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



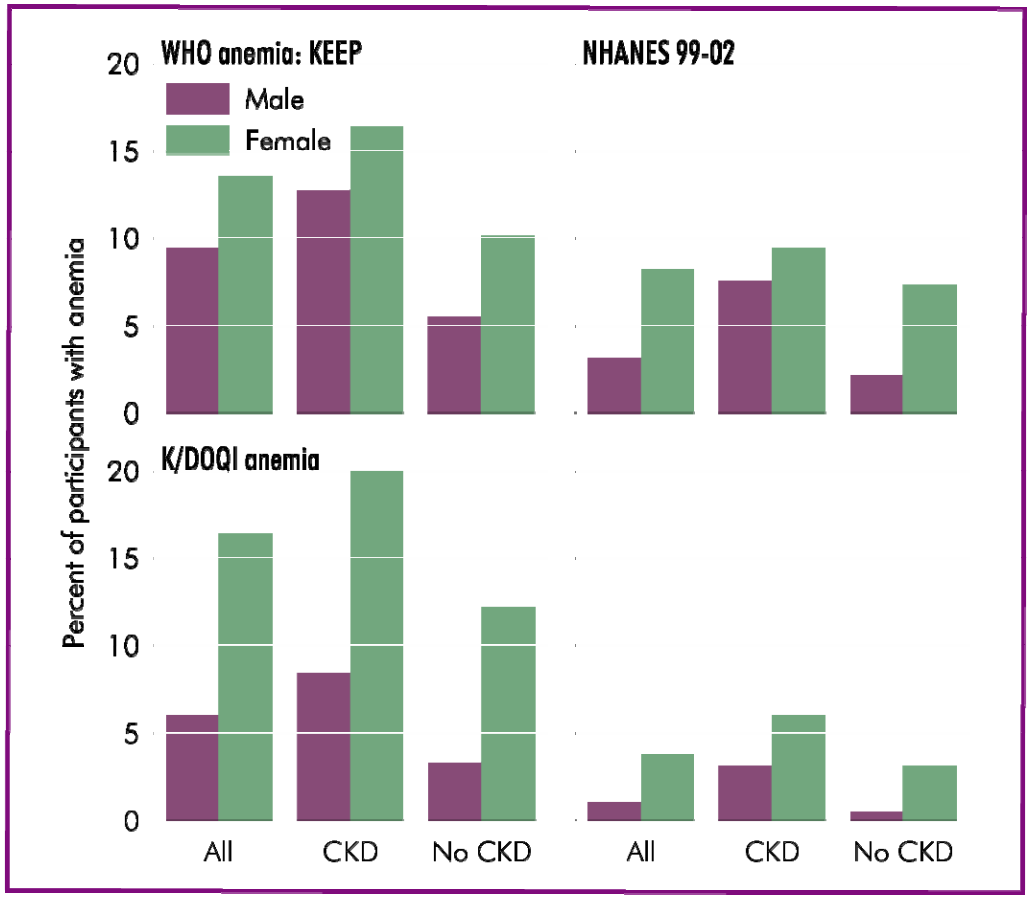
Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

CKD Definition
If eGFR by K/DOQI MDRD <60 ml/min/1.73 m^2 or;
If eGFR by K/DOQI MDRD ≥ 60 ml/min/1.73 m^2 and microalbuminuria +

KEEP N=34,783, NHANES N=10,018. Excludes participants with missing values for hemoglobin or CKD status.

Figure 6.8

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

CKD Definition
If eGFR by K/DOQI MDRD <60 ml/min/1.73 m^2 or;
If eGFR by K/DOQI MDRD ≥ 60 ml/min/1.73 m^2 and microalbuminuria +

KEEP N=34,783, NHANES N=10,018. Excludes participants with missing values for hemoglobin or CKD status.

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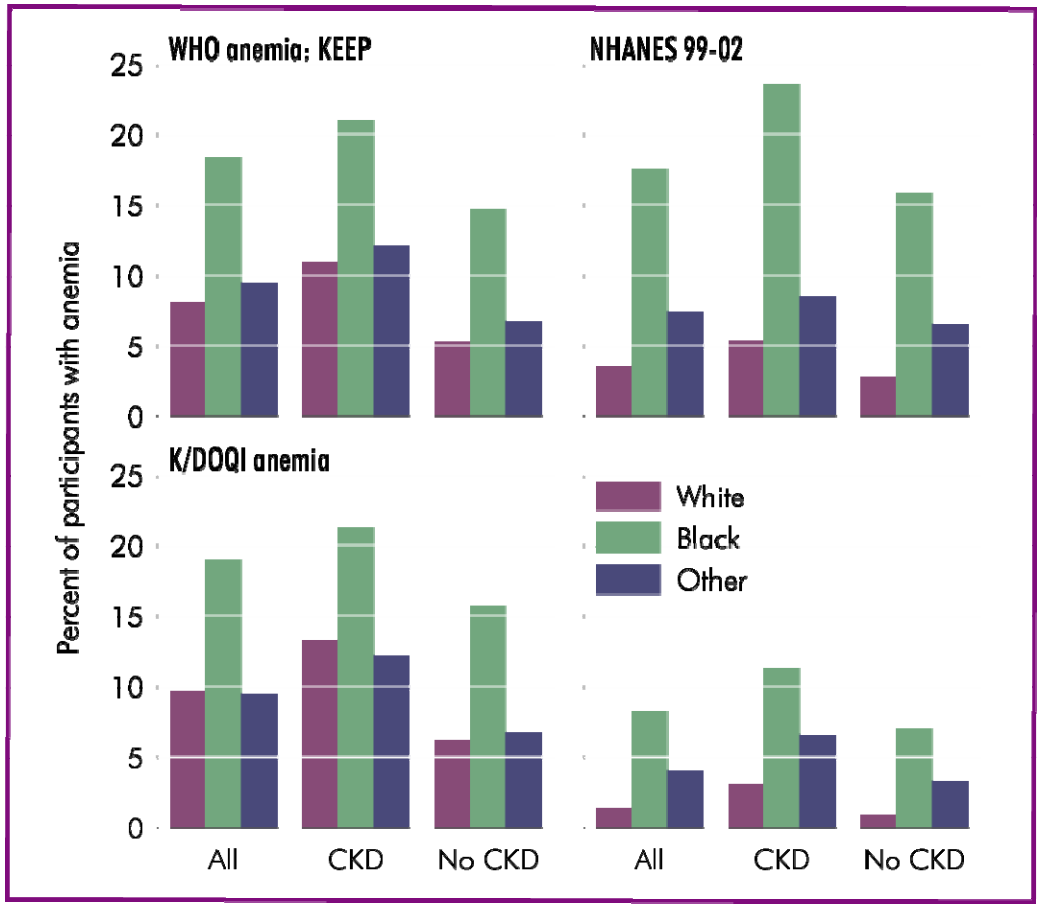
Figure 6.9

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



Anemia Definitions
WHO
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K/DOQI
Males: hemoglobin<12g/dl
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CKD Definition
If eGFR by K/DOQI MDRD <60 ml/min/1.73 m^2 or;
If eGFR by K/DOQI MDRD ≥ 60 ml/min/1.73 m^2 and microalbuminuria +

KEEP N=34,032, NHANES N=10,018. Excludes participants with missing values for hemoglobin, CKD status, or race.

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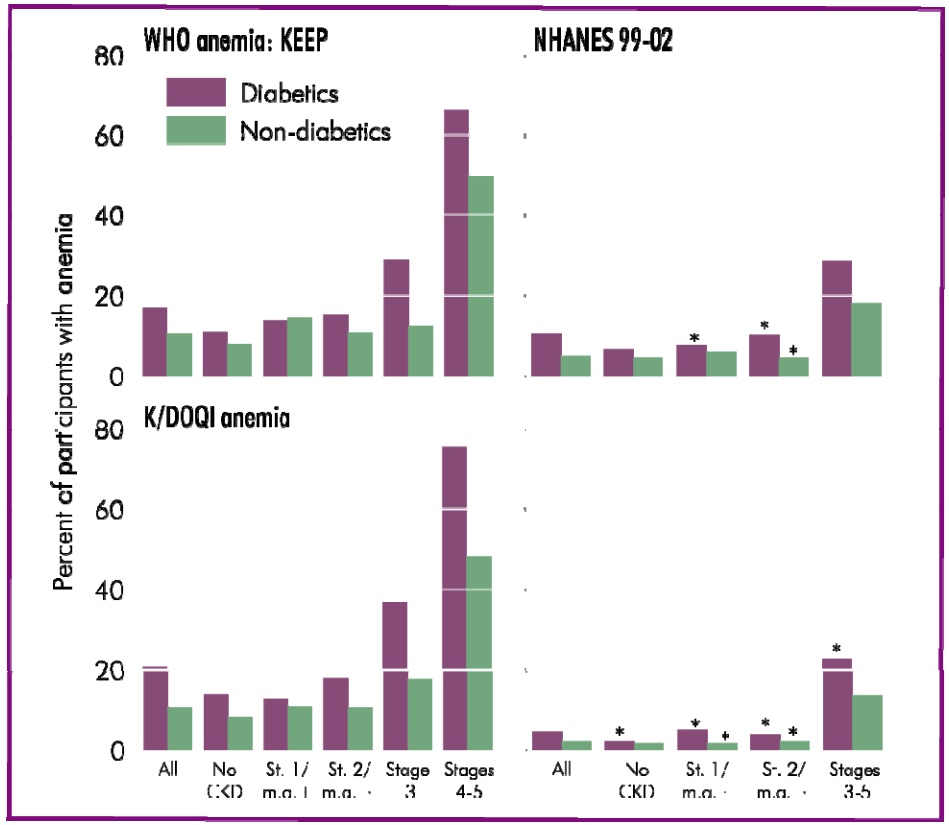
Figure 6.10

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



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WHO
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K/DOQI
Males: hemoglobin<12g/dl
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CKD Stages
Stage 1: eGFR ≥ 90, microalbuminuria +
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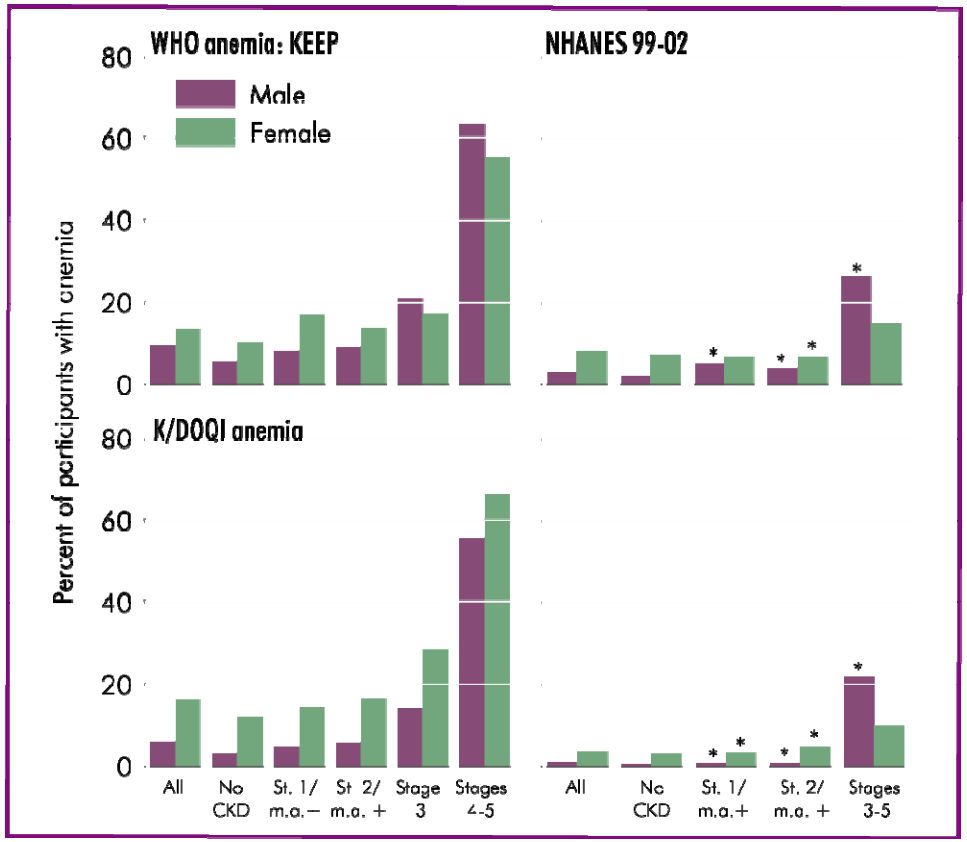
Stage 3: eGFR 30–59
Stage 4: eGFR 1–29
Stage 5: eGFR <15 or patient on dialysis

KEEP N=34,390, NHANES N=10,013. Excludes participants with missing values for hemoglobin, CKD status, or self-reported diabetic status.

Figure 6.11

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



Anemia Definitions
WHO
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K/DOQI
Males: hemoglobin<12g/dl
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Stage 4: eGFR 1–29
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KEEP N=34,783, NHANES N=10,018. Excludes participants with missing values for hemoglobin or CKD status. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

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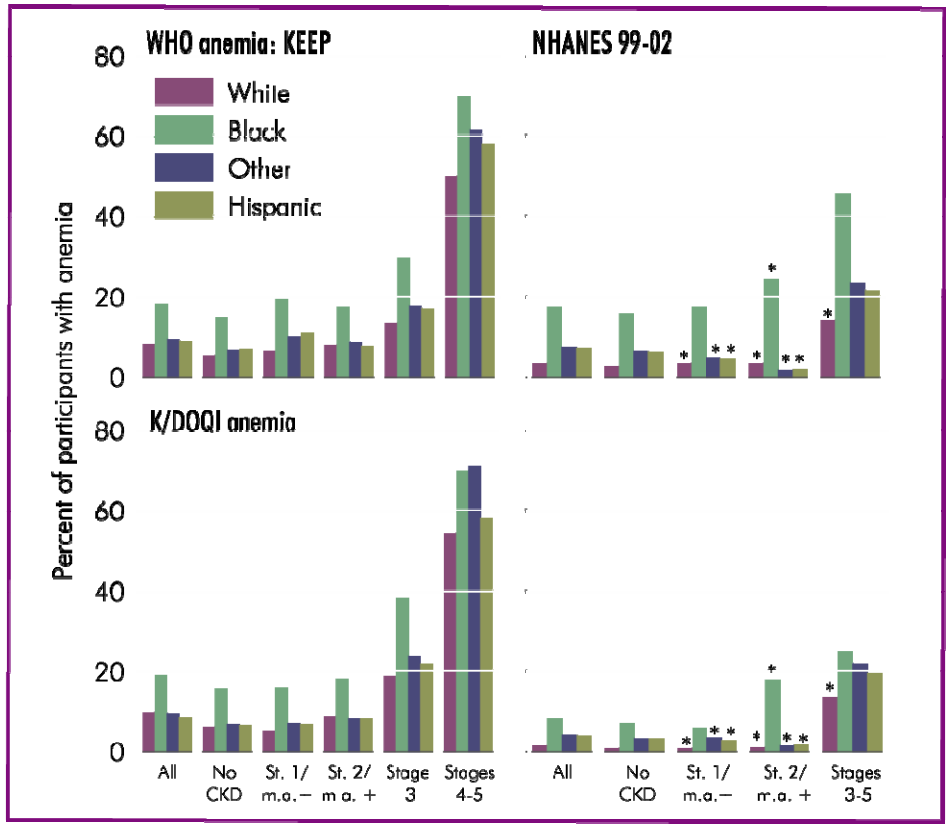
Figure 6.12

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



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WHO
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K/DOQI
Males: hemoglobin<12g/dl
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KEEP N=34,783, NHANES N=10,018. Excludes participants with missing values for hemoglobin or CKD status. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

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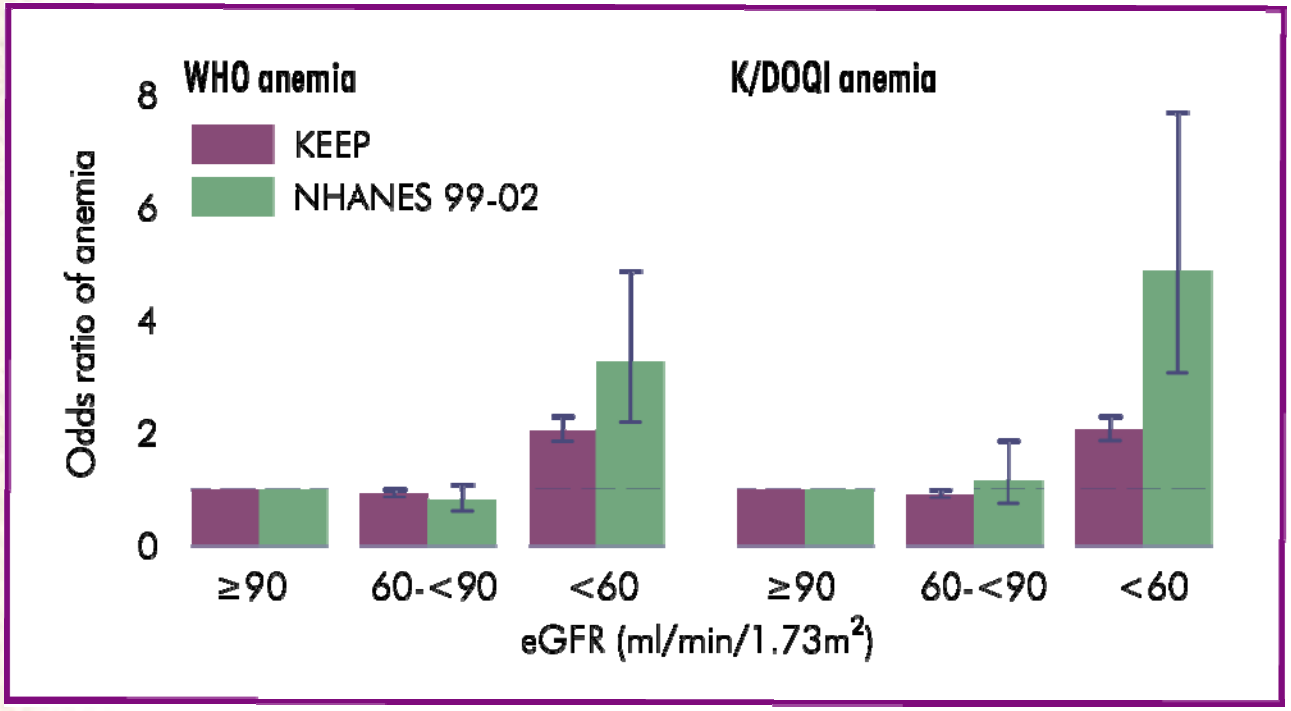
Figure 6.13

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP: N= 34,975, NHANES N=8,707, excludes participants with missing values for race, smoking, BMI, serum creatinine, self-reported diabetes, self-reported hypertension, family history of diabetes or hypertension, or census region.

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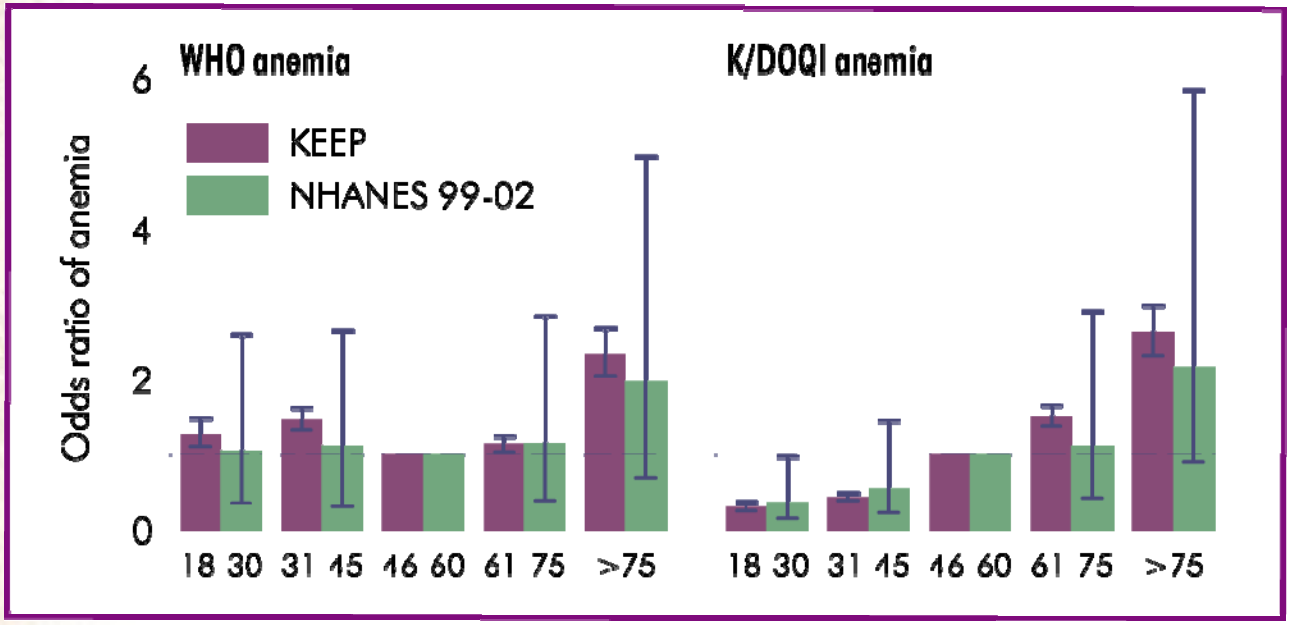
Figure 6.14

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
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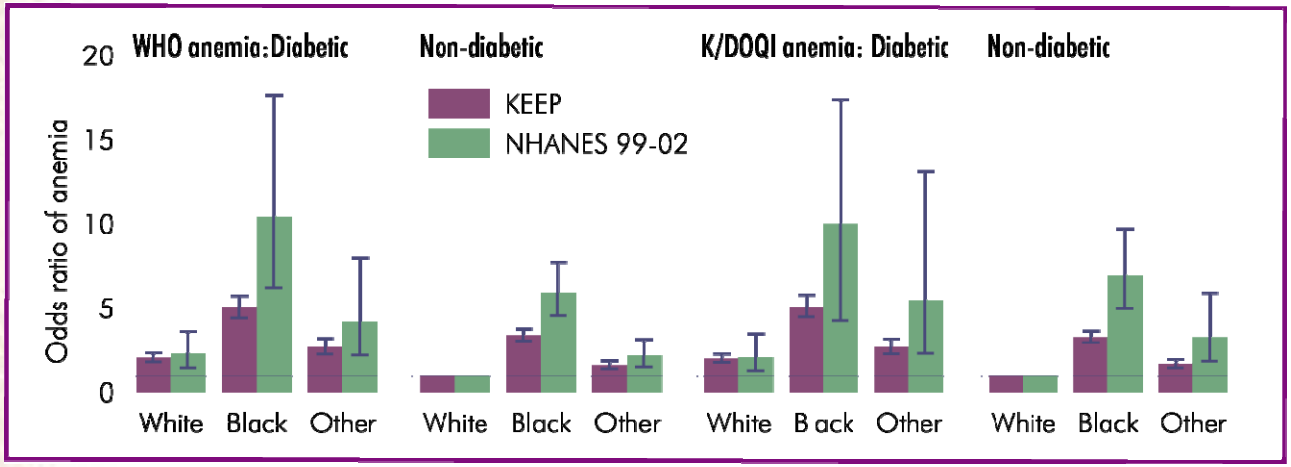
Figure 6.15

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
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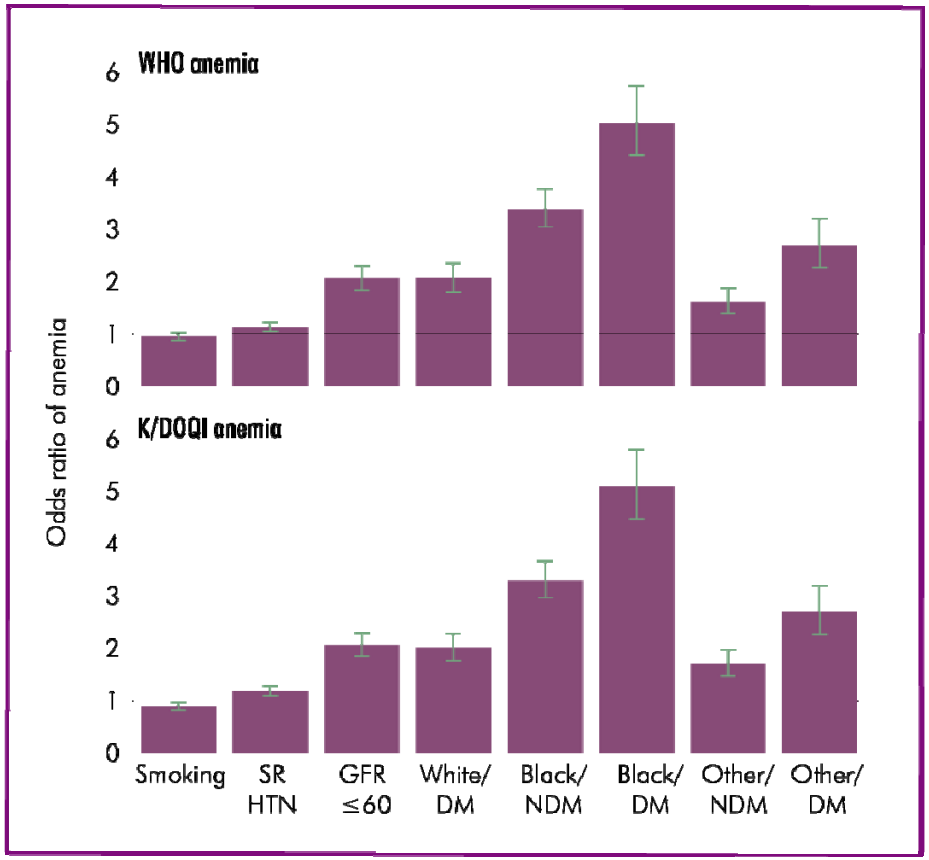
Figure 6.16

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP: N= 34,975, NHANES N=8,707, excludes participants with missing values for race, smoking, BMI, serum creatinine, self-reported diabetes, self-reported hypertension, family history of diabetes or hypertension, or census region.

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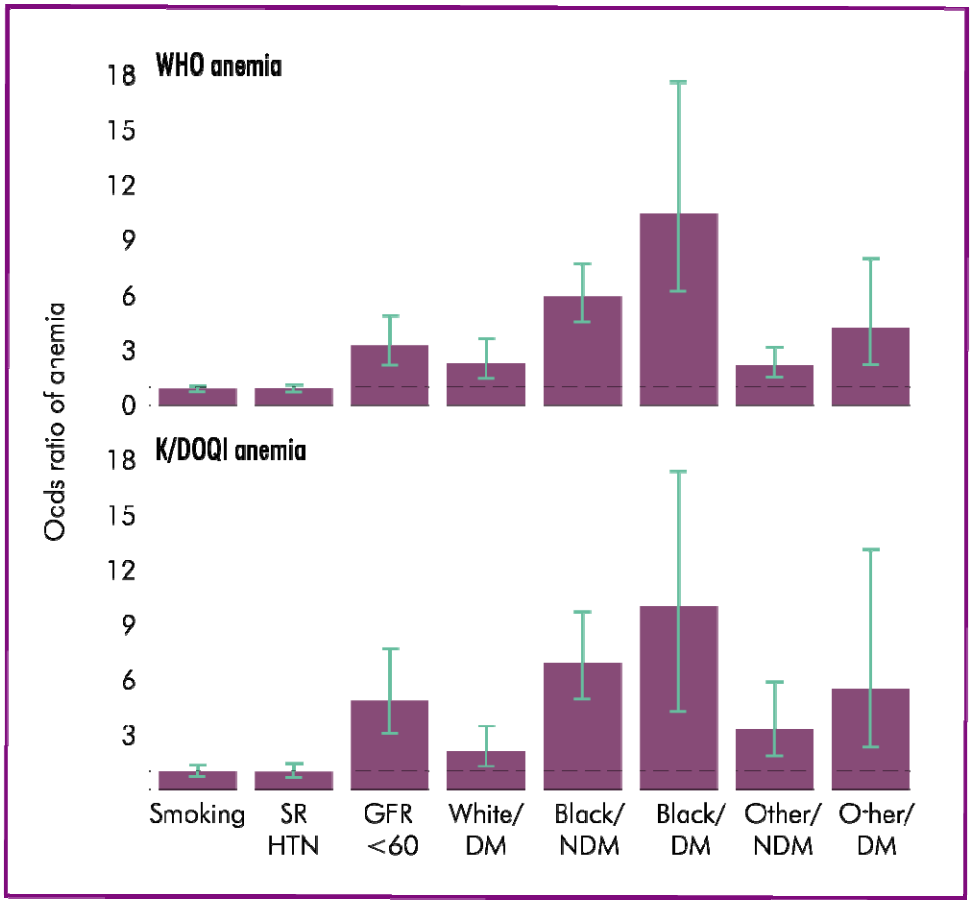
Figure 6.17

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



Anemia Definitions
WHO
Males: hemoglobin <13g/dl
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K/DOQI
Males: hemoglobin<12g/dl
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Women & age ≤50: <11g/dl

KEEP: N= 34,975, NHANES N=8,707, excludes participants with missing values for race, smoking, BMI, serum creatinine, self-reported diabetes, self-reported hypertension, family history of diabetes or hypertension, or census region.

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Table 6.a

Odds ratios of anemia (WHO & K/DOQI anemia definitions) in KEEP participants

	WHO anemia			K/DOQI anemia		
	OR	CI	p-value	OR	CI	p-value
Age (ref: 46-60)						
18-30	1.28	(1.09-1.49)	0.002	0.30	(0.24-0.37)	<.0001
31-45	1.47	(1.33-1.62)	<.0001	0.43	(0.38-0.49)	<.0001
61-75	1.13	(1.02-1.25)	0.021	1.50	(1.37-1.65)	<.0001
76+	2.33	(2.04-2.67)	<.0001	2.62	(2.31-2.98)	<.0001
Male (ref: female)	0.68	(0.62-0.74)	<.0001	0.31	(0.28-0.35)	<.0001
Smoking & used to smoke	0.94	(0.87-1.01)	0.108	0.88	(0.81-0.95)	0.001
Self-reported HTN	1.12	(1.03-1.22)	0.007	1.17	(1.07-1.27)	0.000
Family history of DM	1.00	(0.93-1.09)	0.933	1	(0.9-1.06)	0.533
Family history of HTN	0.97	(0.88-1.07)	0.519	1.03	(0.94-1.14)	0.551
BMI 30+	1.03	(0.96-1.12)	0.389	0.99	(0.91-1.07)	0.7305
GFR (ref: 90+)						
60-<90	0.91	(0.84-1)	0.040	0.91	(0.83-0.99)	0.032
<=60	2.04	(1.83-2.29)	<.0001	2.05	(1.83-2.29)	<.0001
Race & diabetic status (ref: White/NDM)						
White/DM	2.05	(1.79-2.35)	<.0001	2.00	(1.76-2.28)	<.0001
Black/NDM	3.38	(3.04-3.75)	<.0001	3.28	(2.95-3.65)	<.0001
Black/DM	5.02	(4.4-5.73)	<.0001	5.08	(4.46-5.78)	<.0001
Other/NDM	1.61	(1.39-1.87)	<.0001	1.69	(1.45-1.96)	<.0001
Other/DM	2.68	(2.25-3.19)	<.0001	2.68	(2.26-3.18)	<.0001

Anemia Definitions
WHO
Males: hemoglobin <13g/dl
Females: hemoglobin < 12g/dl
K/DOQI
Males: hemoglobin<12g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11g/dl

KEEP: N= 34,975, NHANES N=8,707, excludes participants with missing values for race, smoking, BMI, serum creatinine, self-reported diabetes, self-reported hypertension, family history of diabetes or hypertension, or census region.

Table 6.b

Odds ratios of anemia (WHO & K/DOQI anemia definitions) in NHANES participants

	WHO Anemia			K/DOQI Anemia		
NHANES	OR	CI	p-value	OR	CI	p-value
Age (ref: 46-60)						
20-30	1.04	(0.69-1.55)	0.85	0.37	(0.23-0.6)	0.00
31-45	1.11	(0.81-1.53)	0.50	0.55	(0.33-0.9)	0.02
61-75	1.14	(0.76-1.7)	0.51	1.11	(0.69-1.8)	0.65
>=76	1.97	(1.29-2.99)	0.00	2.17	(1.28-3.67)	0.01
Male (ref: female)	0.38	(0.31-0.48)	0.00	0.26	(0.18-0.37)	0.00
Smoking & used to smoke	0.85	(0.68-1.05)	0.13	0.97	(0.7-1.34)	0.85
Self-reported HTN	0.86	(0.67-1.11)	0.23	0.96	(0.65-1.44)	0.8571
GFR (ref: 90+)						
60-<90	0.8	(0.59-1.08)	0.1437	1.15	(0.72-1.84)	0.5455
<60	3.25	(2.17-4.86)	0	4.85	(3.06-7.67)	0
Race & diabetic status (ref: White/NDM)						
White/DM	2.29	(1.44-3.63)	0.00	2.1	(1.27-3.47)	0.0051
Black/NDM	5.91	(4.53-7.72)	0.00	6.92	(4.94-9.69)	0
Black/DM	10.42	(6.17-17.6)	0.00	10	(5.76-17.36)	0
Other/NDM	2.17	(1.49-3.15)	0.00	3.28	(1.82-5.89)	<.0001
Other/DM	4.19	(2.2-7.98)	0.00	5.47	(2.29-13.09)	<.0001

Anemia Definitions

WHO

Males: hemoglobin <13g/dl

Females: hemoglobin < 12g/dl

K/DOQI

Males: hemoglobin<12g/dl

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Women & age ≤50: <11g/dl

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