KEEP Data Report 2005

Chapter 6:
Anemia & chronic kidney disease
Figure 6.1
Percent distribution of KEEP & NHANES participants with anemia, by CKD stage

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

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
Figure 6.2
Anemia (WHO & K/DOQI anemia definitions) in KEEP & NHANES participants, by age

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

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
Figure 6.3
Anemia (WHO & K/DOQI anemia definitions) in KEEP & NHANES participants, by race/ethnicity

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

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Figure 6.4
Anemia (WHO definition) in KEEP & NHANES participants, by age, race, education, & insurance status

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

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Figure 6.5
Anemia (K/DOQI definition) in KEEP & NHANES participants, by age, race, education, & insurance status

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

Education & insurance
<HS&NInc: Less than a high school education, & no insurance
<HS&Inc: Less than a high school education, & insurance
HS+&NInc: High school education or greater, & no insurance
HS+&Inc: High school education or greater, & insurance
Figure 6.6
Microalbuminuria in KEEP & NHANES participants with anemia (WHO & K/DOQI definitions)

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

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

KEEP Data Report, 2005
Anemia (WHO & K/DOQI anemia definitions) in KEEP & NHANES participants, by gender & CKD status

**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 m² or;
If eGFR by K/DOQI MDRD ≥ 60 ml/min/1.73 m² and microalbuminuria +

KEEP N=34,783,
NHANES N=10,018.
Excludes participants with missing values for hemoglobin or CKD status.
Figure 6.9
Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by race & CKD status

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

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 m² or;
If eGFR by K/DOQI MDRD ≥ 60 ml/min/1.73 m² and microalbuminuria +
Figure 6.10
Anemia (WHO & K/DOQI definitions) in KEEP & NHANES participants, by CKD stage & self-reported diabetic status

**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

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

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

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

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

Anemia Definitions
WHO
Males: hemoglobin <13 g/dl
Females: hemoglobin < 12 g/dl
K/DOQI
Males: hemoglobin ≤12 g/dl
Women & age >50: <12 g/dl
Women & age ≤50: <11 g/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=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.
KEEP Data Report, 2005
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.
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
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 6.15

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
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.

KEEP Data Report, 2005
Figure 6.16
Odds of anemia (WHO & K/DOQI anemia definitions) in KEEP participants, by race & risk factor

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.

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
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
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.a

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

<table>
<thead>
<tr>
<th>WHO anemia</th>
<th>K/DOQI anemia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td>Age (ref: 46-60)</td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>1.28</td>
</tr>
<tr>
<td>31-45</td>
<td>1.47</td>
</tr>
<tr>
<td>61-75</td>
<td>1.13</td>
</tr>
<tr>
<td>76+</td>
<td>2.33</td>
</tr>
<tr>
<td>Male (ref: female)</td>
<td>0.68</td>
</tr>
<tr>
<td>Smoking &amp; used to smoke</td>
<td>0.94</td>
</tr>
<tr>
<td>Self-reported HTN</td>
<td>1.12</td>
</tr>
<tr>
<td>Family history of DM</td>
<td>1.00</td>
</tr>
<tr>
<td>Family history of HTN</td>
<td>0.97</td>
</tr>
<tr>
<td>BMI 30+</td>
<td>1.03</td>
</tr>
<tr>
<td>GFR (ref: 90+)</td>
<td></td>
</tr>
<tr>
<td>60-&lt;90</td>
<td>0.91</td>
</tr>
<tr>
<td>&lt;=60</td>
<td>2.04</td>
</tr>
<tr>
<td>Race &amp; diabetic status (ref: White/NDM)</td>
<td></td>
</tr>
<tr>
<td>White/DM</td>
<td>2.05</td>
</tr>
<tr>
<td>Black/NDM</td>
<td>3.38</td>
</tr>
<tr>
<td>Black/DM</td>
<td>5.02</td>
</tr>
<tr>
<td>Other/NDM</td>
<td>1.61</td>
</tr>
<tr>
<td>Other/DM</td>
<td>2.68</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>NHANES</th>
<th>WHO Anemia OR (CI p-value)</th>
<th>K/DOQI Anemia OR (CI p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (ref: 46-60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30</td>
<td>1.04 (0.69-1.55) 0.85</td>
<td>0.37 (0.23-0.6) 0.00</td>
</tr>
<tr>
<td>31-45</td>
<td>1.11 (0.81-1.53) 0.50</td>
<td>0.55 (0.33-0.9) 0.02</td>
</tr>
<tr>
<td>61-75</td>
<td>1.14 (0.76-1.7) 0.51</td>
<td>1.11 (0.69-1.8) 0.65</td>
</tr>
<tr>
<td>≥76</td>
<td>1.97 (1.29-2.99) 0.00</td>
<td>2.17 (1.28-3.67) 0.01</td>
</tr>
<tr>
<td>Male (ref: female)</td>
<td>0.38 (0.31-0.48) 0.00</td>
<td>0.26 (0.18-0.37) 0.00</td>
</tr>
<tr>
<td>Smoking &amp; used to smoke</td>
<td>0.85 (0.68-1.05) 0.13</td>
<td>0.97 (0.71-1.34) 0.85</td>
</tr>
<tr>
<td>Self-reported HTN</td>
<td>0.86 (0.67-1.11) 0.23</td>
<td>0.96 (0.65-1.44) 0.8571</td>
</tr>
<tr>
<td>GFR (ref: 90+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-&lt;90</td>
<td>0.8 (0.59-1.08) 0.1437</td>
<td>1.15 (0.72-1.84) 0.5455</td>
</tr>
<tr>
<td>&lt;60</td>
<td>3.25 (2.17-4.86) 0</td>
<td>4.85 (3.06-7.67) 0</td>
</tr>
<tr>
<td>Race &amp; diabetic status (ref: White/NDM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/DM</td>
<td>2.29 (1.44-3.63) 0.00</td>
<td>2.1 (1.27-3.47) 0.0051</td>
</tr>
<tr>
<td>Black/NDM</td>
<td>5.91 (4.53-7.72) 0.00</td>
<td>6.92 (4.94-9.69) 0</td>
</tr>
<tr>
<td>Black/DM</td>
<td>10.42 (6.17-17.6) 0.00</td>
<td>10 (5.76-17.36) 0</td>
</tr>
<tr>
<td>Other/NDM</td>
<td>2.17 (1.49-3.15) 0.00</td>
<td>3.28 (1.82-5.89) &lt;.0001</td>
</tr>
<tr>
<td>Other/DM</td>
<td>4.19 (2.2-7.98) 0.00</td>
<td>5.47 (2.29-13.09) &lt;.0001</td>
</tr>
</tbody>
</table>

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: < 11 g/dl

KEEP: N = 34,975,
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