Chapter 5: Chronic kidney disease
Figure 5.1
Elevated serum creatinine levels in KEEP participants, overall & by age, gender, & race

KEEP N=35,490. Excludes participants with missing values for serum creatinine.
Figure 5.2
CKD in KEEP & NHANES participants, by age, gender, & race/ethnicity

KEEP N=35,490, NHANES N=9,720. Excludes participants with missing values for serum creatinine.
Figure 5.3
CKD in KEEP & NHANES participants, by CKD stage

KEEP N=35,490, NHANES N=9,720. Excludes participants with missing values for serum creatinine.

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Figure 5.4
KEEP & NHANES participants with CKD, by age, race/ethnicity, education, & insurance status

KEEP N=33,760. Excludes participants with missing values for serum creatinine, education, or insurance.
Figure 5.5
Family history of kidney disease in KEEP participants with CKD, overall & by gender

KEEP N=18,877. Excludes participants with missing values for family history of kidney disease.

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 +
Family history of kidney disease in KEEP participants with CKD, by race

KEEP N=18,877. Excludes participants with missing values for family history of kidney disease.

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 5.7
Family history of kidney disease in KEEP participants with CKD, by Hispanic ethnicity

KEEP N=18,877. Excludes participants with missing values for family history of kidney disease.

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Figure 5.8
Percent distribution of hypertension stage (JNC 7) in KEEP & NHANES participants with or without CKD

KEEP N=35,214, NHANES N=9,402. Excludes participants with missing values for CKD or blood pressure.
Self-reported hypertension in KEEP & NHANES participants with CKD, by age, gender, & race/ethnicity

KEEP N=35,152, NHANES N=9,603. Excludes participants with missing values for CKD or self-reported hypertension. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005
Figure 5.10
Blood pressure parameters in KEEP & NHANES participants, by CKD stage

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

Mean blood pressure
(Systolic – Diastolic)/3 + Diastolic

KEEP N=35,180,
NHANES N=9,402.
Excludes participants with missing values for CKD or blood pressure.
Figure 5.11
Elevated blood pressure (JNC 7) in KEEP & NHANES participants with CKD, by CKD stage

KEEP N=18,751 CKD, 16,473 NCKD, NHANES N=9,423. Excludes participants with missing values for blood pressure.

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Figure 5.12

KEEP participants meeting target blood pressure (JNC 7), by CKD stage

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

Target blood pressure (JNC 7)
- DM or CKD:
  - Systolic: <130 mmHg or
  - Diastolic: <80 mmHg
- No DM or CKD:
  - Systolic: <140 mmHg or
  - Diastolic: <90 mm Hg

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=18,751 CKD, 16,473 NCKD, NHANES N=9,423.
Excludes participants with missing values for blood pressure.

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Figure 5.13
Elevated BP (JNC 7) in KEEP & NHANES participants with or without CKD, by age, race, & Hispanic ethnicity

KEEP Data Report, 2005

KEEP N=18,751 CKD, 16,473 NCKD, NHANES N=1,265 CKD, N=7,894 NCKD. Excludes participants with missing values for blood pressure. Race & Hispanic ethnicity are not mutually exclusive.

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 +

Target blood pressure (JNC 7)
- DM or CKD:
  - Systolic: <130 mmHg or
  - Diastolic: <80 mmHg
- No DM or CKD:
  - Systolic: <140 mmHg or
  - Diastolic: <90 mmHg
Figure 5.14
Self-reported diabetes in KEEP & NHANES participants with or without CKD, by age, gender, & race/ethnicity

KEEP N=35,088, NHANES N=9,716. Excludes participants with missing values for self-reported diabetes or CKD. Race & Hispanic ethnicity are not mutually exclusive. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005
Figure 5.15
Self-reported diabetes in KEEP & NHANES participants with or without CKD, by BMI category & gender

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 +

Body Mass Index Categories
UW: underweight: BMI < 18.5
N: normal: BMI 18.5–24.9
OW: overweight: BMI 25–29.9
OB: obese: 30–39.9
EOB: extremely obese: BMI ≥ 40

KEEP N=34,777, NHANES N=9,716. Excludes participants with missing values for self-reported diabetes, BMI, or CKD.

KEEP Data Report, 2005
Figure 5.16
Self-reported diabetes in KEEP & NHANES participants, by CKD stage

KEEP N=35,088, NHANES N=11,432. Excludes participants with missing values for self-reported diabetes or CKD.

KEEP Data Report, 2005
Figure 5.17

BMI in KEEP & NHANES participants, by CKD stage

KEEP N=35,165, NHANES N=10,132. Excludes participants with missing values for CKD or BMI. *Sample size less than 30 or coefficient of variation is not less than 30%.

KEEP Data Report, 2005
Figure 5.18
BMI in KEEP participants with or without CKD, by age & gender

KEEP N=35,165. Excludes participants with missing values for CKD or BMI.

KEEP Data Report, 2005
Figure 5.18 (continued)

BMI in NHANES participants with or without CKD, by age & gender

NHANES N=9,461. Excludes participants with missing values for CKD or BMI. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

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 +

Body Mass Index Categories
UW: underweight: BMI<18.5
N: normal: BMI 18.5–24.9
OW: overweight: BMI 25–29.9
OB: obese: 30–39.9
EOB: extremely obese: BMI ≥ 40
Figure 5.19
BMI in KEEP & NHANES participants with or without CKD, by self-reported hypertension or diabetes

KEEP N=34,475, NHANES N=9,461. Excludes participants with missing values for self-reported diabetes or hypertension, CKD, or BMI. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005
Figure 5.20
Obesity (BMI $\geq 30$ kg/m$^2$) in KEEP participants with or without CKD, by gender & Hispanic ethnicity

KEEP N=35,165. Excludes participants with missing values for CKD or BMI.

CKD Definition
- If eGFR by K/DOQI MDRD <60 ml/min/1.73 m$^2$ or;
- If eGFR by K/DOQI MDRD $\geq 60$ ml/min/1.73 m$^2$ and microalbuminuria +
Figure 5.21
BMI in KEEP & NHANES participants with or without CKD, by race/ethnicity

KEEP N= 35,165, NHANES N=9,461. Excludes participants with missing values for CKD or BMI.
*Sample size less than 30 or coefficient of variation is not less than 30 percent.
Figure 5.22
Smoking status in KEEP & NHANES participants with or without CKD, by age & gender

KEEP N=33,196, NHANES N=8,702. Excludes participants with missing values for smoking or CKD.

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 5.23

Elevated blood pressure (JNC 7) in KEEP & NHANES participants, by CKD stage & smoking status

KEEP N=32,610, NHANES N=8,406. Excludes participants with missing values for smoking, CKD, or blood pressure.

KEEP Data Report, 2005
KEEP Data Report, 2005

Figure 5.24

Smoking status in KEEP & NHANES participants with or without CKD, by race/ethnicity

KEEP N=33,196, NHANES N=8,702. Excludes participants with missing values for smoking or CKD

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 5.25
Anemia (WHO definition) in KEEP & NHANES with or without CKD, by age & gender

KEEP N=34,783, NHANES N=9,714. Excludes participants with missing values for CKD or hemoglobin.

WHO anemia definition
Male: Hemoglobin <13 g/dl
Female: Hemoglobin <12 g/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 5.26
Anemia (WHO definition) in KEEP & NHANES with or without CKD, by CKD stage & self-reported diabetic status

KEEP N=34,390, NHANES N=10,013. Excludes participants with missing values for self-reported diabetes, CKD, or hemoglobin. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005
Figure 5.27
Anemia (WHO anemia definition) in KEEP & NHANES participants with CKD, by age, race, & Hispanic ethnicity

KEEP N=34,783, NHANES N=9,714. Excludes participants with missing values for CKD or hemoglobin.

WHO anemia definition
Male: Hemoglobin <13 g/dl
Female: Hemoglobin <12 g/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 5.28
Percent distribution of KEEP & NHANES participants with CKD, by number of risk factors for CKD

KEEP N=18,877, NHANES N=1,129.

Risk factors for CKD
Self-reported diabetes
BMI ≥25 kg/m²
Smoking history
Anemia (WHO definition)
Hypertension (JNC 7)

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 5.29
Elevated blood pressure (JNC 7*) in KEEP & NHANES participants with CKD, by BMI category & self-reported diabetic status

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 +

Body Mass Index Categories
UW: underweight: BMI<18.5
N: normal: BMI 18.5–24.9
OW: overweight: BMI 25–29.9
OB: obese: 30–39.9
EOB: extremely obese: BMI ≥ 40

Elevated blood pressure (JNC 7)
DM or CKD:
Systolic: ≥130 mmHg or
Diastolic: ≥80 mmHg
No DM or CKD:
Systolic: ≥140 mmHg or
Diastolic: ≥90 mm Hg

KEEP N=18,487, NHANES N=1,265. Excludes participants with missing values for BMI or self-reported diabetes.
Figure 5.30
Elevated blood pressure (JNC 7*) in KEEP & NHANES participants with CKD, by BMI & smoking status

KEEP N=17,481, NHANES N=1,208. Excludes participants with missing values for BMI or smoking.

Body Mass Index Categories
UW: underweight: BMI<18.5
N: normal: BMI 18.5–24.9
OW: overweight: BMI 25–29.9
OB: obese: 30–39.9
EOB: extremely obese: BMI ≥ 40

Elevated blood pressure (JNC 7)
DM or CKD:
Systolic: ≥130 mmHg or
Diastolic: ≥80 mmHg
No DM or CKD:
Systolic: ≥140 mmHg or
Diastolic: ≥90 mm Hg

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 5.31
Elevated blood pressure (JNC 7) in KEEP & NHANES participants with CKD, by BMI category & anemia (WHO anemia definition) status

KEEP N=18,363, NHANES N=1,264. Excludes participants with missing values for BMI or hemoglobin.
Figure 5.32
Number of risk factors for cardiovascular disease in KEEP & NHANES participants, by CKD stage

- **KEEP N=34,147, NHANES N=9,230. Excludes participants with missing values for CKD, blood pressure, or hemoglobin. *Sample size less than 30 or coefficient of variation is not less than 30 percent.**

**Risk factors for CV disease**
- **BMI ≥25 kg/m²**
- Self-reported diabetes
- History of smoking
- Anemia (WHO definition)
- Elevated blood pressure (JNC 7)

**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 +

**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 5.33
Microalbuminururia & albumin/creatinine ratio in KEEP & NHANES participants, by creatinine clearance level (KEEP MDRD)

Creatinine clearance level (KEEP MDRD)
Normal: Male 100-125, Female 90-110
Abnormal: Male <100, Female <90
Hyperfiltration: Male >125, Female >110

KEEP N=31,020, KEEP N=26,711 for ACR calculations, NHANES N=10,257. Excludes participants with missing values for microalbumin or serum creatinine.
Figure 5.34

Microalbuminuria & albumin/creatinine ratio in KEEP & NHANES participants, by CKD stage (K/DOQI MDRD)

CKD Stages (K/DOQI MDRD)
- Stage 1: eGFR ≥90, microalbumin +
- Stage 2: eGFR 60–89, microalbumin +
- Stage 3: eGFR 30–59
- Stage 4: eGFR 15–29
- Stage 5: eGFR <15 or dialysis

KEEP N=31,020, KEEP N= 26,711 for ACR calculations, NHANES N=10,257. Excludes participants with missing values for microalbumin or serum creatinine.

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Figure 5.35
Microalbuminuria & serum creatinine level in KEEP & NHANES participants, by CKD stage & diabetic status

KEEP N=30,717 KEEP N=26,459 for ACR calculations, NHANES N=10,252. Excludes participants with missing values for microalbumin, self-reported diabetes, or serum creatinine.
*Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005
Figure 5.36
Microalbuminuria & albumin/creatinine ratio in KEEP & NHANES participants, by CKD stage & JNC 7 blood pressure stage

**KEEP N=30,839, KEEP N= 26,573 for ACR calculations, NHANES N=9,332. Excludes participants with missing values for microalbumin, blood pressure, or serum creatinine.**

*Sample size less than 30 or coefficient of variation is not less than 30 percent.*

**KEEP Data Report, 2005**
Figure 5.37
Microalbuminuria & serum/creatinine ratio in KEEP & NHANES participants, by CKD stage & smoking history

KEEP N=29,017, KEEP N= 24,969 for ACR calculations, NHANES N=9,180. Excludes participants with missing values for microalbumin, smoking, or serum creatinine. *Sample size less than 30 or coefficient of variation is not less than 30 percent.

KEEP Data Report, 2005