**Supplemental Table 1.** Serum creatinine calibration in different NHANES survey periods

|  |  |  |
| --- | --- | --- |
| **Years**  | **Serum Creatinine Calibration Equation** | **Reference** |
| **1988-1994** | Standard Creatinine = 0.960\*(measured creatinine) – 0.184 | <http://www.cdc.gov/nchs/data/nhanes/nhanes_03_04/general_%20note_for_serum_creatinine.pdf>\* |
| **1999-2000** | Standard Creatinine = 1.013\*(measured creatinine) + 0.147 | [https://wwwn.cdc.gov/ Nchs/Nhanes/1999-2000/LAB18.htm](https://wwwn.cdc.gov/%20Nchs/Nhanes/1999-2000/LAB18.htm) \* |
| **2001-2002** | None  | [https://wwwn.cdc.gov/ Nchs/Nhanes/2001-2002/L40\_B.htm](https://wwwn.cdc.gov/%20Nchs/Nhanes/2001-2002/L40_B.htm)\* |
| **2003-2004** | None  | [https://wwwn.cdc.gov/ Nchs/Nhanes/2003-2004/L40\_C.htm](https://wwwn.cdc.gov/%20Nchs/Nhanes/2003-2004/L40_C.htm) \* |
| **2005-2006** | Standard creatinine = 0.978\*(measured creatinine) – 0.016 | http://www.cdc.gov /nchs/nhanes/nhanes2005-2006/BIOPRO\_D.htm |
| **2007-2008** | None  | [http://www.cdc.gov/ nchs/data/nhanes/nhanes\_07\_08/CRE\_biopro\_E\_met\_DXC800.pdf](http://www.cdc.gov/%20nchs/data/nhanes/nhanes_07_08/CRE_biopro_E_met_DXC800.pdf) |
| **2009-2010** | None  | [http://www.cdc.gov/ NCHS/data/nhanes/nhanes\_09\_10/BIOPRO\_F\_met\_creatinine.pdf](http://www.cdc.gov/%20NCHS/data/nhanes/nhanes_09_10/BIOPRO_F_met_creatinine.pdf) |
| **2011-2012** | None  | [http://www.cdc.gov/ nchs/data/nhanes/nhanes\_11\_12/BIOPRO\_G\_met\_creatinine.pdf](http://www.cdc.gov/%20nchs/data/nhanes/nhanes_11_12/BIOPRO_G_met_creatinine.pdf) |

\* see also Selvin E, Manzi J, Stevens LA, Van Lente F, Lacher DA, Levey AS, Coresh J: Calibration of serum creatinine in the National Health and Nutrition Examination Surveys (NHANES) 1988-1994, 1999-2004. Am J Kidney Dis 2007; 50 (6) 918-926.

**Supplemental Table 2. Sampled number of NHANES participants with CKD stages 3-4 (eGFR 15-59 ml/min/1.73m2 by CKD-EPI equation) in U.S. adults by demographic and diabetic categories, NHANES 1988-1994 through 2011-2012**

|  |
| --- |
| **Years** |
|  | **1988-1994** | **1999-2000** | **2001-2002** | **2003-2004** | **2005-2006** | **2007-2008** | **2009-2010** | **2011-2012** |
| **Total**  | 1089 | 351 | 436 | 483 | 401 | 477 | 488 | 404 |
| **Age** |  |  |  |  |  |  |  |  |
| 20-39 years | 9 | 5 | 4 | 2 | 3 | 3 | 2 | 5 |
| 40-64 years | 115 | 35 | 59 | 54 | 59 | 78 | 78 | 78 |
| 65-79 years | 491 | 160 | 180 | 203 | 167 | 238 | 223 | 178 |
| ≥80 years | 474 | 151 | 193 | 224 | 172 | 158 | 185 | 143 |
| **Sex** |  |  |  |  |  |  |  |  |
| Male | 517 | 164 | 210 | 215 | 205 | 209 | 231 | 194 |
| Female | 572 | 187 | 226 | 268 | 196 | 268 | 257 | 210 |
| **Race/ethnicity** |  |  |  |  |  |  |  |  |
| Non-Hispanic white | 762 | 210 | 323 | 339 | 290 | 315 | 318 | 210 |
| Non-Hispanic black | 202 | 72 | 64 | 58 | 74 | 84 | 85 | 107 |
| Other race/ethnicity | 125 | 69 | 49 | 86 | 37 | 78 | 85 | 87 |
| **Diabetes status** |  |  |  |  |  |  |  |  |
| With diabetes mellitus | 278 | 92 | 104 | 140 | 121 | 159 | 186 | 162 |
| Without diabetes mellitus | 811 | 259 | 332 | 343 | 280 | 318 | 302 | 242 |

CKD=chronic kidney disease

CKD-EPI = Chronic Kidney Disease-Epidemiology Collaboration

eGFR = estimated glomerular filtration rate

NHANES = National Health and Nutritional Examination Survey

**Supplemental Table 3. Sampled number of NHANES participants with (by CKD-EPI equation) with expanded definition which includes albuminuria ≥30 mg/g regardless of eGFR level in U.S. adults by demographic and diabetic categories, NHANES 1988-1994 through 2011-2012**

|  |
| --- |
| **Years** |
|  | **1988-1994** | **1999-2000** | **2001-2002** | **2003-2004** | **2005-2006** | **2007-2008** | **2009-2010** | **2011-2012** |
| **Total**  | 2517 | 748 | 866 | 867 | 799 | 1015 | 936 | 861 |
| **Age** |  |  |  |  |  |  |  |  |
| 20-39 years | 367 | 89 | 104 | 76 | 112 | 105 | 102 | 113 |
| 40-64 years | 658 | 192 | 238 | 203 | 226 | 328 | 272 | 293 |
| 65-79 years | 867 | 280 | 286 | 319 | 245 | 374 | 337 | 268 |
| ≥80 years | 625 | 187 | 238 | 269 | 216 | 208 | 225 | 187 |
| **Sex** |  |  |  |  |  |  |  |  |
| Male | 1120 | 345 | 409 | 413 | 384 | 466 | 447 | 419 |
| Female | 1397 | 403 | 457 | 454 | 415 | 549 | 489 | 442 |
| **Race/ethnicity** |  |  |  |  |  |  |  |  |
| Non-Hispanic white | 1264 | 356 | 511 | 508 | 446 | 541 | 495 | 352 |
| Non-Hispanic black | 643 | 155 | 158 | 142 | 182 | 201 | 170 | 250 |
| Other race/ethnicity | 610 | 237 | 197 | 217 | 171 | 273 | 271 | 259 |
| **Diabetes status** |  |  |  |  |  |  |  |  |
| With diabetes mellitus | 725 | 218 | 246 | 265 | 251 | 363 | 348 | 317 |
| Without diabetes mellitus | 1792 | 530 | 620 | 602 | 548 | 652 | 588 | 544 |

**Supplemental Table 4. Prevalence (percentage) of CKD stages 3-4 (eGFR 15-59 ml/min/1.73m2 by MDRD equation) in U.S. adults by demographic and diabetic categories, NHANES 1988-1994 through 2011-2012;** CI is 95% confidence interval of prevalence (as percentage) are shown in parentheses; N represents the population number in 100,000's (number of significant digits varies by number of sampled NHANES participants in each cell)

|  |
| --- |
| **Years**  |
|  | **1988-1994** | **1999-2000** | **2001-2002** | **2003-2004** | **2005-2006** | **2007-2008** | **2009-2010** | **2011-2012** |
| **Total Population** | **5.6%(5.1-6.2%)****N = 94.44** | **7.0%(5.9-8.1%)****N = 125** | **8.1%(6.8-9.4%)****N = 153** | **7.8%(6.6-9.1%)****N = 152** | **8.1%(6.3-9.9%)****N = 159** | **8.3%(6.7-9.9%)****N = 167** | **7.8%(6.8-8.9%)****N = 162** | **8.4%(7.0-9.8%)****N = 177** |
| **Age** |  |  |  |  |  |  |  |  |
| 20-39 years \* | 0.3%(0.1-0.4%) | 1.2%(0.6-1.8%) | 0.6%(0.1-1.1%) | 0.3%(0.0-0.7%) | 0.2%(0.0-0.5%) | 0.7%(0.0-1.5%) | 0.7%(0.1-1.3%) | 1.1%(0.3-1.9%) |
| 40-64 years | 4.0%(3.3-4.8%) | 5.1%(3.7-6.5%) | 6.3%(3.7-8.9%) | 4.8%(3.2-6.4%) | 5.7%(3.8-7.5%) | 5.5%(3.4-7.7%) | 4.8%(3.8-5.7%) | 6.0%(4.5-7.6%) |
| 65-79 years | 20.2%(17.9-22.6%) | 22.8%(19.1-26.6%) | 25.3%(22.1-28.5%) | 26.1%(21.9-30.3%) | 24.8%(21.4-28.3%) | 27.4%(22.8-31.9%) | 25.0%(22.8-27.2%) | 23.5%(19.6-27.4%) |
| ≥80 years | 38.4%(34.5-42.3%) | 49.9%(39.8-59.9%) | 59.2%(51.8-66.6%) | 55.3%(50.4-60.1%) | 52.0%(45.8-58.3%) | 47.1%(39.8-54.5%) | 48.7%(44.4-53.1%) | 49.8%(42.7-57.0%) |
| **Sex** |  |  |  |  |  |  |  |  |
| Male | 4.3%(3.6-4.9%) | 5.4%(4.5-6.3%) | 6.7%(5.3-8.2%) | 6.2%(5.3-7.1%) | 6.2%(4.7-7.8%) | 6.7%(4.8-8.6%) | 6.1%(4.9-7.3%) | 6.8%(5.3-8.3%) |
| Female | 6.9%(6.0-7.8%) | 8.4%(6.7-10.2%) | 9.4%(8.0-10.8%) | 9.4%(7.7-11.1%) | 9.8%(7.4-12.2%) | 9.7%(7.8-11.6%) | 9.5%(8.2-10.8%) | 9.9%(8.2-11.6%) |
| **Race/ethnicity** |  |  |  |  |  |  |  |  |
| Non-Hispanic white | 6.4%(5.6-7.1%) | 7.8%(6.5-9.2%) | 9.8%(8.4-11.3%) | 9.1%(7.8-10.3%) | 9.7%(7.7-11.6%) | 10.0%(8.0-12.1%) | 9.3%(8.1-10.5%) | 10.0%(8.1-11.9%) |
| Non-Hispanic black | 3.6%(3.1-4.2%) | 5.1%(3.7-6.6%) | 5.1%(3.6-6.6%) | 4.9%(3.7-6.1%) | 5.0%(3.4-6.6%) | 5.3%(3.8-6.8%) | 6.3%(5.0-7.7%) | 6.5%(5.1-8.0%) |
| Other race/ethnicity  | 2.8%(1.4-4.1%) | 4.7%(2.7-6.8%) | 2.9%(1.0-4.8%) | 4.5%(2.9-6.0%) | 3.2%(1.6-4.7%) | 3.4%(2.2-4.7%) | 3.8%(2.8-4.8%) | 4.5%(3.6-5.5%) |
| **Diabetes status** |  |  |  |  |  |  |  |  |
| With diabetes mellitus | 16.2%(14.0-18.5%) | 16.3%(12.9-19.6%) | 19.2%(13.9-24.5%) | 21.9%(17.0-26.8%) | 20.2%(15.7-24.8%) | 18.3%(14.6-22.1%) | 22.3%(18.9-25.7%) | 20.2%(16.9-23.5%) |
| Without diabetes mellitus | 4.8%(4.3-5.3%) | 6.2%(5.1-7.3%) | 7.1%(5.7-8.5%) | 6.3%(5.1-7.5%) | 6.8%(4.9-8.7%) | 7.0%(5.4-8.6%) | 6.1%(5.2-6.9%) | 6.9%(5.3-8.5%) |

 \*estimates in this row have large relative standard error (RSE) and thus may be less reliable

**Supplemental Table 5. Prevalence (percentage) of CKD (by MDRD equation) with expanded definition which includes albuminuria ≥30 mg/g regardless of eGFR level by demographic and diabetic categories, NHANES 1988-1994 through 2011-2012;** 95% confidence interval of prevalence (as percentage) are shown in parentheses; N represents the population number in 100,000's (number of significant digits varies by number of sampled NHANES participants in each cell)

|  |
| --- |
| **Years**  |
|  | **1988-1994** | **1999-2000** | **2001-2002** | **2003-2004** | **2005-2006** | **2007-2008** | **2009-2010** | **2011-2012** |
| **Total Population** | **12.5%(11.6-13.3%)****N = 209.2** | **14.6%(13.0-16.2%)****N = 262** | **15.2%(13.6-16.8%)****N = 286** | **14.7%(13.0-16.4%)****N = 287** | **15.4%(13.0-17.7%)****N = 303** | **15.9%(14.2-17.5%)****N = 320.5** | **13.8%(12.7-15.0%)****N = 286** | **15.6%(13.8-17.4%)****N = 327** |
| **Age** |  |  |  |  |  |  |  |  |
| 20-39 | 5.0%(4.3-5.8%) | 7.1%(4.9-9.3%) | 5.5%(3.9-7.1%) | 5.2%(3.6-6.8%) | 6.2%(5.2-7.1%) | 6.4%( 4.9-7.8%) | 5.3%(4.2-6.3%) | 6.9%(5.5-8.3%) |
| 40-64 | 11.2%(10.0-12.4%) | 12.8%(10.8-14.8%) | 14.0%(11.3-16.6%) | 11.6%(9.6-13.6%) | 13.0%(10.0-16.1%) | 12.8%(10.7-15.0%) | 10.6%(9.3-11.8%) | 12.8%(10.5-15.2%) |
| 65-79 | 31.3%(28.1-34.4%) | 34.5%(31.4-37.6%) | 37.4%(33.0-41.9%) | 37.6%(32.4-42.7%) | 34.1%(30.5-37.7%) | 39.7%(36.7-42.6%) | 34.2%(30.9-37.5%) | 33.3%(30.1-36.5%) |
| ≥80 | 52.3%(48.2-56.5%) | 65.5%(58.1-73.0%) | 68.5%(61.7-75.3%) | 66.4%(62.3-70.6%) | 65.2%(59.7-70.8%) | 60.8%(51.1-70.5%) | 59.3%(54.0-64.6%) | 64.2%(57.3-71.1%) |
| **Sex** |  |  |  |  |  |  |  |  |
| Male | 10.0%(8.7-11.3%) | 12.0%(10.3-13.7%) | 13.5%(11.7-15.4%) | 13.3%(11.5-15.1%) | 12.4%(9.7-15.0%) | 13.5%(11.4-15.6%) | 11.9%(10.8-13.0%) | 13.8%(11.0-16.6%) |
| Female | 14.7%(13.5-16.0%) | 17.0%(14.9-19.1%) | 16.8%(15.1-18.5%) | 16.1%(14.1-18.1%) | 18.1%(15.4-20.9%) | 18.1%(16.1-20.1%) | 15.7%(13.9-17.5%) | 17.2%(15.3-19.1%) |
| **Race/ethnicity** |  |  |  |  |  |  |  |  |
| Non-Hispanic white | 12.6%(11.4-13.8%) | 14.6%(12.9-16.3%) | 16.1%(14.5-17.8%) | 14.8%(12.9-16.6%) | 15.8%(13.1-18.4%) | 16.9%(14.8-19.0%) | 14.6%(13.2-15.9%) | 15.9%(13.7-18.2%) |
| Non-Hispanic black | 13.6%(12.7-14.6%) | 14.2%(11.9-16.5%) | 14.9%(11.9-17.9%) | 14.4%(11.3-17.6%) | 15.3%(12.6-18.1%) | 15.2%(12.3-18.1%) | 14.3%(11.9-16.6%) | 17.5%(15.5-19.4%) |
| Other race/ethnicities | 10.6%(8.2-13.0%) | 14.8%(11.7-17.9%) | 11.7%( 9.3-14.1%) | 14.7%(11.6-17.9%) | 13.7%(11.0-16.4%) | 12.4%(10.3-14.5%) | 11.2%(9.0-13.3%) | 13.5%(10.9-16.2%) |
| **Diabetes status** |  |  |  |  |  |  |  |  |
| With diabetes mellitus | 39.3%(36.1-42.4%) | 36.8%(31.8-41.8%) | 44.2%(38.7-49.7%) | 42.0%(37.0-47.0%) | 40.0%(33.7-46.3%) | 39.0%(35.9-42.2%) | 37.3%(32.4-42.2%) | 37.4%(33.6-41.2%) |
| Without diabetes mellitus | 10.3%(9.6-11.0%) | 12.8%(11.2-14.4%) | 12.6%(10.7-14.5%) | 11.8%(9.8-13.7%) | 12.8%(10.3-15.2%) | 12.9%(11.2-14.7%) | 11.0%(9.9-12.1%) | 12.8%(11.1-14.4%) |

**Supplemental Table 6. Temporal trends in the U.S. population prevalence of chronic kidney disease derived from the National Health and Nutrition Examination Surveys from prior peer-reviewed publications (adapted from Hsu RK, Hsu CY. Am J Kidney Dis 2013; 62:214-6)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study** | **CKD definition** | **Disease prevalence during time period**  | **Change in prevalence per year** | **GFR estimating equation** | **Filtration marker calibration and alignment**  |
|  |  | **1976-1980** | **1988-1994** | **1999-2004** |  |  |  |
| Hsu Annals 20041 | eGFRcr <60 | 2.0%a | 2.5%a |  | +1.7% per yearb | 4-variable MDRD Study Equation6 | For both time periods, Cleveland Clinic calibrated Cr = Cr - 0.23 |
| Coresh JASN 2005[2](#_ENREF_3) | CKD stages 1-4 (eGFRcr and ACR) |  | 8.8%  | 9.4% (1999-2000) | +0.8% per year | 4-variable MDRD Study Equation6 | 1988-1994: Cleveland Clinic calibrated Cr = Cr - 0.23; 1999-2000: Cleveland Clinic calibrated Cr = Cr + 0.13  |
| eGFRcr <60 | 4.4% | 3.8%(1999-2000) | -1.7% per year |
| Coresh JAMA 2007[3](#_ENREF_4) | CKD stages 1-4 (eGFRcr and ACR) | 10.0% | 13.1% | +2.6% per yearb | IDMS-traceable MDRD Study Equation7 | 1998-1994: standardized Cr = -0.184 + 0.960\*Cr; 1999-2000: standardized Cr = 0.147+1.013\*Cr; 2000-4:no calibrationConservative trend analysis added 0.04mg/dl to 1988-1994 creatinine values |
| eGFRcr <60*(primary analysis)* | 5.6% | 8.1% | +3.5% per yearb |  |
| eGFRcr <60*(conservative trend analysis)* | data not shown | data not shown | +1.4% per yearb |  |
| Foley CJASN 2009[4](#_ENREF_5) | CKD stages 1-5 (eGFRcyc and ACR) | 15.1% | 14.9%(1999-2002) | -0.1% per year | CKD-EPI cystatin C 20088 | No calibration performed for cystatin C. |
| eGFRcys <60 | 6.4% | 6.9%(1999-2002) | +0.8% per year |
| Grams AJKD 2013[5](#_ENREF_1) | eGFRcys <60 | 5.5% | 8.7%(1999-2002) | +4.9% per yearb | CKD-EPI Cystatin C 20129 | 1988-1994: standardized cystatin C = 1.12\*[0.022+0.80\*(cystatin C)];  1999-2002: standardized cystatin C = 1.12\*[cystatin C-0.12] |
| eGFRcr-cys <60 | 4.4% | 7.1%(1999-2002) | +5.0% per yearb | CKD-EPI Cr-cystatin C 20129 |

Abbeviations: eGFRcr, creatinine-based estimated glomerular filtration rate (ml/min/1.73m2); ACR, albumin-to-creatinine ratio; eGFRcys, cystatin

C-based estimated glomerular filtration rate (ml/min/1.73m2); eGFRcr-cys, creatinine and cystatin C-based estimated glomerular filtration rate (ml/min/1.73m2); MDRD, Modification of Diet in Renal Disease; IDMS, isotope dilution mass spectrometry; CKD-EPI, Chronic Kidney Disease Epidemiology Collaboration; Cr, creatinine (mg/dL)

afor age 20-74 blacks and whites only

brepresents statistically significant change in the original study

1. Hsu CY, Vittinghoff E, Lin F, Shlipak MG. The incidence of end-stage renal disease is increasing faster than the prevalence of chronic renal insufficiency. Ann Intern Med. 2004;141(2):95-101.

2. Coresh J, Byrd-Holt D, Astor BC, et al. Chronic kidney disease awareness, prevalence, and trends among US adults, 1999 to 2000. J Am Soc Nephrol. 2005;16(1):180-188.

3. Coresh J, Selvin E, Stevens L, et al. Prevalence of chronic kidney disease in the United States. JAMA. 2007;298(17):2038-2047.

4. Foley RN, Wang C, Snyder JJ, Collins AJ. Cystatin C levels in US adults, 1988-1994 versus 1999-2002: NHANES. Clin J Am Soc Nephrol. 2009;4(5):965-972.

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9. Inker LA, Schmid CH, Tighiouart H, et al. Estimating glomerular filtration rate from serum creatinine and cystatin C. N Engl J Med. 2012;367(1):20-29.

**Supplemental Figure 1. Adjusted prevalence (as percentage) of CKD (by CKD-EPI equation) with expanded definition which includes albuminuria ≥30 mg/g regardless of eGFR level by age (1A), sex (1B), race/ethnicity (1C), and presence or absence of diabetes mellitus (1D), National Health and Nutritional Examination Survey (NHANES) 1988-1994 through 2011-2012**

****

Each subgroup is adjusted for the other three subgroup variables (e.g. 1A is adjusted for sex, race/ethnicity, and diabetes status).

**Supplemental Figure 2. Adjusted prevalence (as percentage) of chronic kidney disease (CKD) stages 3-4 (by Modification of Diet in Renal Disease study [MDRD] equation) in U.S. adults by age (2A), sex (2B), race/ethnicity (2C) and presence or absence of diabetes mellitus (2D)**

****

Each subgroup is adjusted for the other three subgroup variables (e.g. 2A is adjusted for sex, race/ethnicity, and diabetes status).

**Supplemental Figure 3. Adjusted prevalence (as percentage) of CKD (by MDRD equation) with expanded definition which includes albuminuria ≥30 mg/g regardless of estimated glomerular filtration rate (eGFR) level by age (3A), sex (3B), race/ethnicity (3C), and presence or absence of diabetes mellitus (3D)**





Each subgroup is adjusted for the other three subgroup variables (e.g. 3A is adjusted for sex, race/ethnicity, and diabetes status).