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# Appendix 1. Data analysis overview and analytic notes for some of individual studies

**Overview:**

As previously described,1 the collaborating cohorts were asked to compile a dataset with approximately 40 variables (key exposures [serum creatinine to estimate GFR and albuminuria], covariates [e.g., age, sex, race/ethnicity, diabetes], and outcomes [laboratory tests and hypertension]). To be consistent across cohorts, the CKD-PC Data Coordinating Center sent definitions for those variables to participating cohorts. We instructed studies not to impute any variables.

For 42 of the 55 cohorts in this specific study, the Data Coordination Center at Johns Hopkins University conducted the analysis; the remainder ran the standard code written in STATA by the Data Coordinating Center and shared the output with the Data Coordinating Center. The standard code was designed to automatically save all estimates and variance-covariance matrices needed for the meta-analysis. Then, the Data Coordinating Center meta-analyzed the estimates across cohorts using STATA.

As detailed in our previous reports,2,3 each cohort was instructed to standardize their serum creatinine and report its method when available. The reported creatinine standardization allows grouping studies into studies that reported using a standard IDMS traceable method or conducted some serum creatinine standardization to IDMS traceable methods (ARIC, AusDiab, BIS, CanPREDDICT, CARE FOR HOMe, ESTHER, GCKD, Geisinger, Gonryo, Gubbio, Maccabi, MASTERPLAN, MMKD, NHANES, PREVEND, Rancho Bernardo, RCAV, REGARDS, RSIII, SCREAM, SEED, SRR-CKD, Takahata) and studies where the creatinine standardization was not done (AASK, ADVANCE, Aichi, BC CKD, Beijing, CCF, ChinaNS, CHS, CIRCS, CKD-JAC, CRIB, Framingham, IPHS, KHS, MDRD, MESA, MRC, NZDCS, Ohasama, Pima, RENAAL, Sunnybrook, Taiwan MJ, ULSAM, ZODIAC). For those cohorts without standardization, the creatinine levels were reduced by 5%, the calibration factor used to adjust non-standardized MDRD Study samples to IDMS.2,4 We did not adjust creatinine levels in those studies with unknown standardization status (JMS, Mt Sinai, NIPPON DATA80, NIPPON DATA90, NIPPON DATA2010, PSP-CKD and SMART).

We calculated eGFR using the CKD-EPI equation: eGFRCKD-EPI = 141 × (minimum of standardized serum creatinine [mg/dL]/κ or 1)α × (maximum of standardized serum creatinine [mg/dL]/κ or 1)-1.209 × 0.993age × (1.018 if female) × (1.159 if black), where κ is 0.7 if female and 0.9 if male and α is -0.329 if female and -0.411 if male.5 The selection of knots for eGFR and ACR was based on clinical thresholds.6

**Notes for individual studies:**

1. General population cohorts

ChinaNS: Anti-hypertensive medication use was not available.

2. High-risk cohorts

ADVANCE: This study is an intervention study which includes participants with diabetes only.

Geisinger: Due to the requirement of ACR measurement for analyses and the clinical indications that are associated with measurement in this health system dataset, this cohort was categorized as a high-risk cohort for all outcomes except phosphorus and PTH, and as a CKD cohort for outcomes phosphorus and PTH. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

Maccabi: Due to the requirement of ACR measurement for analyses and the clinical indications that are associated with measurement in this health system dataset, this cohort was categorized as a high-risk cohort. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

Mt Sinai BioMe: Due to the requirement of ACR measurement for analyses and the clinical indications that are associated with measurement in this health system dataset, this cohort was categorized as a high-risk cohort cohort for all outcomes except phosphorus and PTH, and as a CKD cohort for outcomes phosphorus and PTH. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

PIMA: History of CVD was not available.

SCREAM: This cohort does not have data on BMI, smoking and blood pressure. Due to the requirement of ACR measurement for analyses and the clinical indications that are associated with measurement in this health system dataset, this cohort was categorized as a high-risk cohort cohort for all outcomes except phosphorus and PTH, and as a CKD cohort for outcomes phosphorus and PTH.

ZODIAC: Anti-hypertensive medication use was not available.

3. CKD cohorts

AASK: Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

CanPREDDICT: This cohort does not have data on smoking. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

CRIB: History of heart failure was not available. Use of thiazide diuretics, loop diuretics or potassium sparing diuretics was combined. Individual use of each type of diuretics was not available.

Gonryo: This cohort does not have data on smoking.

MASTERPLAN: This study measured urine albumin-to-creatinine ratio in patients with albuminuria in the low range, urine protein-to-creatinine ratio in patients with overt proteinuria. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

MDRD: Anti-hypertensive medication use was not available. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

PSP-CKD: Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

RCAV: This cohort does not have data on smoking. Subset of eGFR<60 of this cohort was included in the analysis thus categorized as a CKD cohort.

RENAAL: History of CVD was not available.

SRR-CKD: This cohort does not have data on smoking. There may be some overlap with the SCREAM cohort, which would capture participants with advanced CKD in the region of Stockholm. Use of thiazide diuretics, loop diuretics or potassium sparing diuretics was combined. Individual use of each type of diuretics was not available.

Sunnybrook: This cohort includes patients seen in the nephrology clinics at Sunnybrook Hospital in Toronto, Ontario, Canada with CKD stage 3-5 or proteinuric CKD stage 1-2. Urine protein-to-creatinine ratio was converted to urine albumin-to-creatinine ratio by dividing by 2.655 for men and 1.7566 for women.

**Missing Covariates Table**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Region**  | N | BMI | Smoking | DM | History of CVD |
| **CKD Cohorts** |  |  |  |  |  |  |
| AASK | USA | 1094 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| BC CKD | Canada | 11880 | 5463 (46%) | 0 (0%) | 0 (0%) | 0 (0%) |
| CanPREDDICT | Canada | 2061 | 2025 (98%) | 2061 (100%) | 0 (0%) | 0 (0%) |
| CARE FOR HOMe | Germany | 369 | 348 (94%) | 24 (7%) | 229 (62%) | 0 (0%) |
| CCF | USA | 19249 | 2881 (15%) | 0 (0%) | 0 (0%) | 0 (0%) |
| CKD-JAC | Japan | 2679 | 254 (9%) | 342(13%) | 0 (0%) | 0 (0%) |
| CRIB | UK | 375 | N<5 | 0 (0%) | 0 (0%) | 0 (0%) |
| GCKD | Germany | 5159 | 52 (1%) | 14 (0%) | 0 (0%) | N<5 |
| Geisinger CKD† | USA | 24611 | 2549 (10%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Gonryo | Japan | 3009 | 1393 (46%) | 3009 (100%) | 937 (31%) | 0 (0%) |
| MASTERPLAN | Netherlands | 670 | 0 (0%) | 14 (2%) | N<5 | 9 (1%) |
| MDRD | USA | 1736 | N<5 | 5 (0%) | 10 (1%) | 0 (0%) |
| MMKD | Multi | 202 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Mt Sinai BioMe CKD† | USA | 3521 | 554 (16%) | 260 (7%) | 0 (0%) | 0 (0%) |
| PSP-CKD | UK | 9434 | 3768 (40%) | 0 (0%) | 0 (0%) | 0 (0%) |
| RCAV | USA | 127812 | 13342 (10%) | 127812 (100%) | 0 (0%) | 0 (0%) |
| RENAAL | Multi | 1512 | 1512 (100%) | N<5 | 0 (0%) | 1512 (100%) |
| SCREAM CKD† | Sweden | 33232 | 33232 (100%) | 33232 (100%) | 0 (0%) | 0 (0%) |
| SRR-CKD | Sweden | 3051 | 544 (18%) | 3051 (100%) | 0 (0%) | 0 (0%) |
| Sunnybrook | Canada | 3010 | 1838 (61%) | 0 (0%) | 0 (0%) | 0 (0%) |
| **General Population Cohorts** |
| Aichi | Japan | 4987 | 0 (0%) | 89 (2%) | 0 (0%) | 0 (0%) |
| ARIC\* | USA | 11889 | 34 (0%) | 436 (4%) | 17 (0%) | 281 (2%) |
| AusDiab\* | Australia | 11198 | 170 (2%) | 178 (2%) | 69 (1%) | 32 (0%) |
| Beijing | China | 1533 | 0 (0%) | N<5 | 61 (4%) | N<5 |
| BIS | Germany | 2055 | N<5 | 0 (0%) | 0 (0%) | 0 (0%) |
| ChinaNS\* | China | 46810 | 228 (0%) | 35 (0%) | 44 (0%) | 4766 (10%) |
| CHS\* | USA | 2984 | 48 (2%) | 55 (2%) | 0 (0%) | 0 (0%) |
| CIRCS | Japan | 11916 | N<5 | 8 (0%) | 0 (0%) | 0 (0%) |
| ESTHER\* | Germany | 9744 | 10 (0%) | 284 (3%) | 0 (0%) | 10 (0%) |
| Framingham\* | USA | 2956 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Gubbio | Italy | 1684 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| IPHS | Japan | 97769 | 437 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| JMS | Japan | 5124 | 6 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| KHS | Korean | 243779 | 12080 (1%) | 0 (0%) | 0 (0%) | 0 (0%) |
| MESA\* | USA | 6796 | 0 (0%) | 34 (1%) | 0 (0%) | 0 (0%) |
| MRC | UK | 12367 | 765 (6%) | 31 (0%) | 0 (0%) | 96 (1%) |
| NHANES | USA | 56017 | 540 (1%) | 2741 (5%) | 69 (0%) | 3343 (6%) |
| NIPPON DATA80\* | Japan | 10382 | N<5 | 15 (0%) | N<5 | 0 (0%) |
| NIPPON DATA90 | Japan | 7612 | N<5 | 0 (0%) | 0 (0%) | 0 (0%) |
| NIPPON DATA2010 | Japan | 2749 | N<5 | 8 (0%) | 6 (0%) | 0 (0%) |
| Ohasama | Japan | 3300 | 46 (1%) | 641 (19%) | 89 (3%) | 0 (0%) |
| PREVEND | Netherlands | 8060 | 74 (1%) | 0 (0%) | 274 (3%) | 0 (0%) |
| Rancho Bernardo | USA | 1484 | 7 (0%) | 8 (1%) | 0 (0%) | 0 (0%) |
| REGARDS | USA | 27727 | 79 (0%) | 101 (0%) | 137 (0%) | 8 (0%) |
| RSIII | Netherlands | 3519 | 67 (2%) | 10 (0%) | 0 (0%) | 0 (0%) |
| SEED\* | Singapore | 7028 | 7 (0%) | N<5 | 51 (1%) | 5 (0%) |
| Taiwan MJ | Taiwan | 501704 | 149 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Takahata | Japan | 3524 | 0 (0%) | N<5 | 115 (3%) | 0 (0%) |
| ULSAM | Sweden | 1123 | N<5 | 32 (3%) | 0 (0%) | 0 (0%) |
| **High Risk Cohorts** |
| ADVANCE | Multi | 11033 | 22 (0%) | 13 (0%) | 0 (0%) | 0 (0%) |
| Geisinger | USA | 65051 | 10497 (16%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Maccabi | Israel | 264255 | 125292 (47%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Mt Sinai BioMe | USA | 8109 | 1642 (20%) | 540 (7%) | 7 (0%) | 7 (0%) |
| NZDCS\* | New Zealand | 31622 | 604 (2%) | 163 (1%) | 0 (0%) | 0 (0%) |
| Pima | USA | 5074 | 37 (1%) | 2119 (42%) | 0 (0%) | 5074 (100%) |
| SCREAM | Sweden | 260047 | 260047 (100%) | 260047 (100%) | 0 (0%) | 0 (0%) |
| SMART | Netherlands | 3691 | 6 (0%) | 34 (1%) | 0 (0%) | 0 (0%) |
| ZODIAC | Netherlands | 1632 | 3 (0%) | 18 (1%) | 0 (0%) | 0 (0%) |

#

# Appendix 2. Acronyms or abbreviations for studies included in the current report and their key references linked to the Web references

AASK: African American Study of Kidney Disease and Hypertension7

ADVANCE: The Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE) trial8

Aichi: Aichi Workers’ Cohort9

ARIC: Atherosclerosis Risk in Communities Study10

AusDiab: Australian Diabetes, Obesity, and Lifestyle Study14

BC CKD: British Columbia CKD Study11

Beijing: Beijing Cohort Study12

BIS: Berlin Initiative Study13

CanPREDDICT: Canadian Study of Prediction of Death, Dialysis and Interim Cardiovascular Events14

CARE FOR HOMe: The Cardiovascular and Renal Outcome in CKD 2-4 Patients—The Fourth Homburg evaluation

CCF: Cleveland Clinic CKD Registry Study15

ChinaNS: The China National Survey of Chronic Kidney Disease

CHS: Cardiovascular Health Study16

CIRCS: Circulatory Risk in Communities Study17

CKD-JAC: Chronic Kidney Disease Japan Cohort

CRIB: Chronic Renal Impairment in Birmingham18

ESTHER: ESTHER Study19

Framingham: Framingham Heart Study20

GCKD: German Chronic Kidney Disease Study21

Geisinger: Geisinger Health System22

Gonryo: Gonryo Study

Gubbio: Gubbio Study23

IPHS: Ibaraki Prefectural Health Study24

JMS: Jichi Medical School cohort

KHS: Korean Heart Study

Maccabi: Maccabi Health System25

MASTERPLAN: Multifactorial Approach and Superior Treatment Efficacy in Renal

Patients with the Aid of a Nurse Practitioner26

MDRD: Modification of Diet in Renal Disease Study27

MESA: Multi-Ethnic Study of Atherosclerosis28

MMKD: Mild to Moderate Kidney Disease Study29

MRC Older People: MRC Study of assessment of older people30

Mt Sinai BioMe: Mount Sinai BioMe Biobank Platform31

NHANES: US National Health and Nutrition Examination Survey, using both NHANES III and the continuous NHANES from 1999-201032

NIPPON DATA80: National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in Aged - 1980

NIPPON DATA90: National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in Aged - 1990

NIPPON DATA2010: National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in Aged - 2010

NZDCS: New Zealand Diabetes Cohort Study33

Ohasama: Ohasama Study34

Pima: Pima Indian Study35

PREVEND: Prevention of Renal and Vascular End-stage Disease Study36

PSP-CKD: Primary-Secondary Care Partnership to Prevent Adverse Outcomes in Chronic Kidney Disease

Rancho Bernardo: Rancho Bernardo Study37

RCAV: Racial and Cardiovascular Risk Anomalies in CKD Cohort38

REGARDS: Reasons for Geographic And Racial Differences in Stroke Study39

RENAAL: Reduction of Endpoints in Non-insulin Dependent Diabetes Mellitus with

the Angiotensin II Antagonist Losartan40

RSIII: Rotterdam Study Third Cohort41

SCREAM: Stockholm CREAtinine Measurements Cohort42

SEED: Singapore Epidemiology of Eye Diseases

SMART: Second Manifestations of ARTerial Disease Study

SRR-CKD: Swedish Renal Registry CKD Cohort43

Sunnybrook: Sunnybrook Cohort44

Taiwan MJ: Taiwan MJ Cohort Study45

Takahata: Takahata Study46

ULSAM: Uppsala Longitudinal Study of Adult Men31

ZODIAC: Zwolle Outpatient Diabetes project Integrating Available Care47

# Appendix 3. Acknowledgements and funding for collaborating cohorts

|  |  |
| --- | --- |
| **Study** | **List of sponsors** |
| AASK | AASK was supported by grants to each clinical center and the coordinating center from the National Institute of Diabetes and Digestive and Kidney Diseases. In addition, AASK was supported by the Office of Research in Minority Health (now the National Center on Minority Health and Health Disparities, NCMHD) and the following institutional grants from the National Institutes of Health: M01 RR-00080, M01 RR-00071, M0100032, P20-RR11145, M01 RR00827, M01 RR00052, 2P20 RR11104, RR029887, and DK 2818-02. King Pharmaceuticals provided monetary support and antihypertensive medications to each clinical center. Pfizer Inc, AstraZeneca Pharmaceuticals, Glaxo Smith Kline, Forest Laboratories, Pharmacia and Upjohn also donated antihypertensive medications. |
| ADVANCE | National Health and Medical Research Council (NHMRC)of Australia program grants 358395 and 571281 and project grant 211086 |
| Aichi | KAKENHI (09470112, 13470087, 17390185, 18590594, 20590641, 20790438, 22390133) |
| ARIC | The Atherosclerosis Risk in Communities study has been funded in whole or in part with Federal funds from the National Heart, Lung, and Blood Institute, National Institutes of Health, Department of Health and Human Services, under Contract nos. (HHSN268201700001I, HHSN268201700003I, HHSN268201700005I, HHSN268201700004I, HHSN2682017000021). The authors thank the staff and participants of the ARIC study for their important contributions. |
| AusDiab | The Baker IDI Heart and Diabetes Institute, Melbourne, Australia, their sponsors, and the National Health and Medical Research Council of Australia (NHMRC grant 233200), Amgen Australia, Kidney Health Australia and The Royal Prince Alfred Hospital, Sydney, Australia. |
| BC CKD | BC Provincial Renal Agency, an Agency of the Provincial Health Services Authority in collaboration with University of British Columbia. |
| Beijing | The research for this study was supported by the Program for New Century Excellent Talents in University (BMU2009131) from the Ministry of Education of the People’s Republic of China, and the grants for the Early Detection and Prevention of Non-communicable Chronic Diseases from the International Society of Nephrology Research Committee. |
| BIS | Foundation for Preventive Medicine of the KfH (Kuratorium für Heimdialyse und Nierentransplantation e.V. – Stiftung Präventivmedizin; [www.kfh-stiftung-praeventivmedizin.de](http://www.kfh-stiftung-praeventivmedizin.de)). Dr. Werner Jackstädt Foundation |
| CanPREDDICT |  |
| CARE FOR HOMe |  |
| CCF | Supported by an unrestricted educational grant from Amgen to the Department of Nephrology and Hypertension. |
| ChinaNS |  |
| CHS | This research was supported by contracts HHSN268201200036C, HHSN268200800007C, N01HC55222, N01HC85079, N01HC85080, N01HC85081, N01HC85082, N01HC85083, N01HC85086, and grants U01HL080295 and U01HL130114 from the National Heart, Lung, and Blood Institute (NHLBI), with additional contribution from the National Institute of Neurological Disorders and Stroke (NINDS). Additional support was provided by R01AG023629 from the National Institute on Aging (NIA). A full list of principal CHS investigators and institutions can be found at CHS-NHLBI.org. |
| CIRCS |  |
| CKD-JAC |  |
| CRIB | British Renal Society Project Grant AwardBritish Heart Foundation Project Grant Award. |
| ESTHER | Ministry of Research, Science and the Arts Baden-Württemberg (Stuttgart, Germany), Federal Ministry of Education and Research (Berlin, Germany), Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (Berlin, Germany), European Commission FP7 framework programme of DG-Research (CHANCES Project). Measurement of urinary albumin was funded by Dade-Behring, Marburg, Germany. |
| Framingham | NHLBI Framingham Heart Study (N01-HC-25195). |
| GCKD | The GCKD study is supported by grants from the Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung; www.bmbf.de), FKZ 01ER 0804, 01ER 0818, 01ER 0819, 01ER 0820 und 01ER 0821 and the Foundation for Preventive Medicine of the KfH (Kuratorium für Heimdialyse und Nierentransplantation e.V. – Stiftung Präventivmedizin; [www.kfh-stiftung-praeventivmedizin.de](http://www.kfh-stiftung-praeventivmedizin.de)) and corporate partners (for a list see [www.gckd.org](http://www.gckd.org)). The GCKD investigators gratefully acknowledge the expert support of all members of study staff, the dedicated contribution of all collaborating nephrologists (for a list of contributors and the 169 study sites, see www.gckd.org) and the support of patients participating in the study. |
| Geisinger | Geisinger Clinic  |
| Gonryo |  |
| Gubbio | Municipal and Health Authorities of Gubbio, Italy; Center of Gubbio Epidemiological Studies, Gubbio, Italy; University of Salerno, Salerno, Italy. |
| IPHS |  |
| JMS |  |
| KHS |  |
| Maccabi |  |
| MASTERPLAN | The MASTERPLAN study is a clinical trial with trial registration ISRCTN registry: 73187232. Sources of funding: The MASTERPLAN Study was supported by grants from the Dutch Kidney Foundation (Nierstichting Nederland, number PV 01), and the Netherlands Heart Foundation (Nederlandse Hartstichting, number 2003 B261). Unrestricted grants were provided by Amgen, Genzyme, Pfizer and Sanofi-Aventis. |
| MDRD | NIDDK UO1 DK35073 and K23 DK67303, K23 DK02904 |
| MESA | This research was supported by contracts HHSN268201500003I, N01-HC-95159, N01-HC-95160, N01-HC-95161, N01-HC-95162, N01-HC-95163, N01-HC-95164, N01-HC-95165, N01-HC-95166, N01-HC-95167, N01-HC-95168 and N01-HC-95169 from the National Heart, Lung, and Blood Institute and by grants UL1-TR-000040 and UL1-TR-001079 from NCRR. The authors thank the other investigators, the staff, and the participants of the MESA study for their valuable contributions. A full list of participating MESA investigators and institutions can be found at <http://www.mesa-nhlbi.org>. |
| MMKD | The MMKD study was funded by the Austrian Heart Fund and by the Innsbruck Medical University. |
| MRC Older People | UK Medical Research Council, Department of Health for England, Wales and the Scottish Office and Kidney Research UK |
| Mt Sinai BioMe |  |
| NHANES | United States Center for Disease Control |
| NIPPON DATA80 | Health and Labour Sciences Research Grants of the Ministry of Health, Labour and Welfare, Japan (Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus [H22-Junkankitou-Seishuu-Sitei-017, H25-Junkankitou-Seishuu-Sitei-022]) |
| NIPPON DATA90 | Health and Labour Sciences Research Grants of the Ministry of Health, Labour and Welfare, Japan (Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus [H22-Junkankitou-Seishuu-Sitei-017, H25-Junkankitou-Seishuu-Sitei-022]) |
| NIPPON DATA2010 | Health and Labour Sciences Research Grants of the Ministry of Health, Labour and Welfare, Japan (Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus [H22-Junkankitou-Seishuu-Sitei-017, H25-Junkankitou-Seishuu-Sitei-022]) |
| NZDCS | New Zealand Health Research Council, Auckland Medical Research Foundation and New Zealand Society for the Study of Diabetes |
| Ohasama | Grant-in-Aid(H20-22Junkankitou[Seishuu]-Ippan-009, 013 and H23-Junkankitou [Senshuu]-Ippan-005) from the Ministry of Health, Labor and Welfare, Health and Labor Sciences Research Grants, Japan; Japan Atherosclerosis Prevention Fund. |
| Pima | This work was supported by the Intramural Research Program of the National Institute of Diabetes and Digestive and Kidney Diseases. |
| PREVEND | The PREVEND study is supported by several grants from the Dutch Kidney Foundation, and grants from the Dutch Heart Foundation, the Dutch Government (NWO), the US National Institutes of Health (NIH) and the University Medical Center Groningen, The Netherlands (UMCG). Dade Behring, Marburg, Germany supplied equipment and reagents for nephelometric measurement of urinary albumin. |
| PSP-CKD | The PSP-CKD study was funded by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) East Midlands. Ongoing support for the study is funded by NIHR CLAHRC East Midlands and Kidney Research UK (Grant TF2/2015). |
| Rancho Bernardo | NIA AG07181 and AG028507 NIDDK DK31801 |
| RCAV | This study was supported by grant R01DK096920 from NIH-NIDDK and is the result of work supported with resources and the use of facilities at the Memphis VA Medical Center and the Long Beach VA Medical Center. Support for VA/CMS data is provided by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Health Services Research and Development, VA Information Resource Center (project numbers SDR 02-237 and 98-004). |
| REGARDS | This research project is supported by a cooperative agreement U01 NS041588 from the National Institute of Neurological Disorders and Stroke, National Institutes of Health, Department of Health and Human Service. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Neurological Disorders and Stroke or the National Institutes of Health. Representatives of the funding agency have been involved in the review of the manuscript but not directly involved in the collection, management, analysis or interpretation of the data. The authors thank the other investigators, the staff, and the participants of the REGARDS study for their valuable contributions.  A full list of participating REGARDS investigators and institutions can be found at [http://www.regardsstudy.org](http://www.regardsstudy.org/)Additional funding was provided by an investigator-initiated grant-in-aid from Amgen and an investigator-initiated National Heart, Lung, and Blood Institute (NHLBI) grant R01 HL080477. Representatives from Amgen or NHLBI did not have any role in the design and conduct of the study, the collection, management, analysis, and interpretation of the data, or the preparation or approval of the manuscript. |
| RENAAL | The RENAAL trial was supported by Merck and Company. |
| RSIII | The Rotterdam Study is funded by Erasmus Medical Center and Erasmus University, Rotterdam, Netherlands Organization for the Health Research and Development (ZonMw), the Research Institute for Diseases in the Elderly (RIDE), the Ministry of Education, Culture and Science, the Ministry for Health, Welfare and Sports, the European Commission (DG XII), and the Municipality of Rotterdam |
| SCREAM | This study was supported by Stockholm County Council and the Swedish Heart and Lung Foundation. |
| SEED |  |
| SMART | Funded by the University Medical Center Utrecht. |
| SRR-CKD | The SRR-CKD is a national health care quality register funded by The Swedish Association of Local Authorities and Regions, which is an organization that represents and advocates for local government in Sweden. All of Sweden's municipalities, county councils and regions are members. |
| Sunnybrook |  |
| Taiwan MJ | This study was supported by Taiwan Department of Health Clinical Trial and Research Centre of Excellence (DOH 101-TD-B-111-004) |
| Takahata | A Grant-in-Aid from the 21st Century Center of Excellence (COE) and Global COE program of the Japan Society for the Promotion of Science |
| ULSAM | The Swedish Research Council, the Swedish Heart-Lung Foundation, the Marianne and Marcus Wallenberg Foundation, Dalarna University, and Uppsala University. |
| ZODIAC |  |

# eTable 1. Proportion with anemia and mean value of hemoglobin and hematocrit, by cohort

|  |  |  |
| --- | --- | --- |
|   |  | Medication use availability |
| Study | N | % Anemia | Hemoglobin, mean (SD) | Hematocrit, mean (SD) | % Erythropoietin stimulating agent use | % IV iron supplement use | % oral iron supplement use |
| **CKD Cohorts** |  |  |  |  |  |  |  |
| BC CKD | 11655 | 6280 (54%) | 12 (2) | 37 (5) | NA | NA | NA |
| CanPREDDICT | 2045 | 1206 (59%) | 12 (2) | 36 (5) | 393 (19%) | 477 (23%) | 46 (2%) |
| CARE FOR HOMe | 371 | 71 (19%) | 14 (2) | 41 (4) | 7 (2%) | 4 (1%) | 6 (2%) |
| CCF | 12696 | 5307 (42%) | 13 (2) | 39 (5) | NA | NA | NA |
| CKD-JAC | 2639 | 1659 (63%) | 12 (2) | 36 (5) | 350 (13%) | 21 (1%) | 215 (8%) |
| CRIB | 364 | 218 (60%) | 12 (2) | NA | 35 (10%) | NA | NA |
| GCKD | 5127 | 1217 (24%) | 14 (2) | NA | 123 (2%) | NA | NA |
| Geisinger CKD† | 19008 | 7696 (40%) | 13 (2) | 33 (6) | 35 (0%) | 30 (0%) | 1293 (7%) |
| Gonryo | 3044 | 1113 (37%) | 13 (2) | 38 (6) | 200 (7%) | NA | NA |
| MASTERPLAN | 670 | 236 (35%) | 13 (2) | 39 (37) | 57 (9%) | NA | 2 (6%) |
| MDRD | 1719 | 602 (35%) | 13 (2) | 38 (4) | NA | NA | NA |
| MMKD | 202 | 58 (29%) | 13 (2) | 40 (6) | NA | NA | NA |
| Mt Sinai BioMe CKD† | 1931 | 1103 (57%) | 12 (2) | 36 (6) | 69 (4%) | 9 (0%) | 275 (14%) |
| RCAV | 108044 | 43385 (40%) | 13 (2) | NA | 421 (0%) | 20 (0%) | 4048 (4%) |
| RENAAL | 1510 | 791 (52%) | 13 (2) | 38 (6) | NA | NA | NA |
| SCREAM CKD† | 30209 | 10291 (34%) | 13 (2) | NA | 935 (3%) | 186 (1%) | 1407 (5%) |
| SRR-CKD | 3032 | 1841 (61%) | 12 (2) | NA | 623 (21%) | 105 (3%) | 346 (11%) |
| Sunnybrook | 2822 | 1048 (37%) | 13 (2) | NA | NA | NA | NA |
| **Subtotal** | **207088** | **84121 (41%)** | **13 (2)** | **36 (7)** | **3251 (2%)** | **853 (1%)** | **7638 (5%)** |
|  |  |  |  |  |  |  |  |
| **General Population** |  |  |  |  |  |  |  |
| Aichi | 4987 | 285 (6%) | 15 (1) | NA | NA | NA | NA |
| BIS | 1995 | 354 (18%) | 14 (1) | 41 (4) | 4 (0%) | 1 (0%) | 24 (1%) |
| CIRCS | 11475 | 1422 (12%) | 14 (2) | 41 (5) | NA | NA | NA |
| Gubbio | 1684 | 33 (2%) | 15 (1) | 43 (4) | 0 (0%) | 0 (0%) | 34 (2%) |
| IPHS | 97740 | 11378 (12%) | 14 (1) | 41 (4) | NA | NA | NA |
| JMS | 5091 | 689 (14%) | 14 (2) | 42 (4) | NA | NA | NA |
| KHS | 243716 | 16043 (7%) | 14 (2) | 43 (5) | NA | NA | NA |
| MRC | 12101 | 2372 (20%) | 13 (1) | NA | NA | NA | NA |
| NHANES | 51434 | 4928 (10%) | 14 (2) | 42 (4) | NA | NA | NA |
| NIPPON DATA90 | 7612 | 1048 (14%) | 14 (2) | 44 (5) | NA | NA | NA |
| NIPPON DATA2010 | 2730 | 338 (12%) | 14 (2) | 42 (4) | NA | NA | NA |
| Ohasama | 1926 | 389 (20%) | 13 (1) | 40 (4) | NA | NA | NA |
| REGARDS | 19070 | 2657 (14%) | 14 (1) | 40 (4) | NA | NA | NA |
| RSIII | 3525 | 160 (5%) | 14 (1) | 45 (4) | NA | NA | NA |
| Taiwan MJ | 501646 | 36932 (7%) | 14 (2) | 42 (4) | NA | NA | NA |
| Takahata | 3523 | 406 (12%) | 14 (1) | 41 (4) | NA | NA | NA |
| **Subtotal** | **970255** | **79434 (8%)** | **14 (2)** | **42 (5)** | **4 (0%)** | **1 (0%)** | **58 (2%)** |
|  |  |  |  |  |  |  |  |
| **High Risk Cohorts** |  |  |  |  |  |  |  |
| Geisinger | 46072 | 10189 (22%) | 14 (2) | 35 (6) | 41 (0%) | 37 (0%) | 1909 (4%) |
| Maccabi | 253333 | 33080 (13%) | 14 (1) | 42 (4) | 326 (0%) | 2 (0%) | 2828 (1%) |
| Mt Sinai BioMe | 4346 | 1764 (41%) | 13 (2) | 38 (5) | 72 (2%) | 8 (0%) | 462 (11%) |
| Pima | 5058 | 506 (10%) | NA | 42 (5) | NA | NA | NA |
| SCREAM | 232861 | 27342 (12%) | 14 (1) | NA | 999 (0%) | 264 (0%) | 3411 (1%) |
| SMART | 3684 | 378 (10%) | 14 (1) | 42 (4) | NA | NA | NA |
| **Subtotal** | **545354** | **73256 (13%)** | **14 (2)** | **41 (5)** | **1438 (0%)** | **311 (0%)** | **8610 (2%)** |
| **General population/ high risk subtotal** | **1515609** | **152690 (10%)** | **14 (2)** | **42 (5)** | **1442 (0%)** | **312 (0%)** | **8668 (2%)** |
|  |  |  |  |  |  |  |  |
| **Total†** | **1671549** |  |  |  |  |  |  |
| Anemia: Hemoglobin <13g/L for male, <12g/L for female; Hematocrit <39% for male, <36% for female† CKD population from three administrative high risk cohorts, not included in the total N |

# eTable 2. Proportion with hyperkalemia and hypokalemia and mean value of serum potassium, by cohort

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | N | % Hyperkalemia | % Hypokalemia | Potassiummean (SD) | % RAAS inhibitor use | % ACE inhibitor use | % ARB use | % Renin inhibitor use | % K sparing diurtics use | % Other diuretics use | % Loop diuretics use | % thiazide diuretics use | % Kayexalate use |
| **CKD Cohorts** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| AASK | 1066 | 91 (9%) | 92 (9%) | 4.2 (0.6) | 620 (59%) | 611 (58%) | 12 (1%) | NA | NA | NA | NA | NA | NA |
| BC CKD | 11785 | 2463 (21%) | 193 (2%) | 4.6 (0.6) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| CanPREDDICT | 2052 | 396 (19%) | 49 (2%) | 4.6 (0.6) | 1463 (71%) | 871 (42%) | 761 (37%) | 8 (0%) | 122 (6%) | 1394 (68%) | 917 (45%) | 621 (30%) | 113 (6%) |
| CCF | 17498 | 1917 (11%) | 621 (4%) | 4.4 (0.6) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| CKD-JAC | 2640 | 594 (22%) | 36 (1%) | 4.6 (0.6) | 2170 (82%) | 726 (28%) | 1967 (75%) | 0 (0%) | 156 (6%) | 749 (28%) | 638 (24%) | 211 (8%) | 14 (1%) |
| CRIB | 373 | 70 (19%) | 9 (2%) | 4.6 (0.6) | 133 (36%) | 117 (31%) | 16 (6%) | NA | NA | 151 (40%) | NA | NA | NA |
| Geisinger CKD† | 24417 | 2945 (12%) | 555 (2%) | 4.5 (0.5) | 12072 (49%) | 9084 (37%) | 3326 (14%) | 22 (0%) | 1771 (7%) | 11313 (46%) | 5886 (24%) | 6287 (26%) | 55 (0%) |
| MASTERPLAN | 670 | 89 (13%) | 23 (3%) | 4.4 (0.6) | 545 (81%) | 343 (51%) | 254 (38%) | NA | 24 (4%) | 331 (49%) | 119 (18%) | 216 (32%) | NA |
| MDRD | 830 | 85 (10%) | 40 (5%) | 4.4 (0.6) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Mt Sinai BioMe CKD† | 3518 | 454 (13%) | 128 (4%) | 4.4 (0.8) | 1740 (49%) | 1151 (33%) | 665 (19%) | 8 (0%) | 183 (5%) | 1284 (36%) | 493 (14%) | 841 (24%) | 144 (4%) |
| PSP-CKD | 9405 | 1718 (18%) | 105 (1%) | 4.6 (0.5) | 6064 (64%) | 4450 (47%) | 1844 (20%) | NA | 523 (6%) | 4197 (45%) | 2306 (25%) | 2013 (21%) | NA |
| RCAV | 124843 | 12778 (10%) | 3528 (3%) | 4.4 (0.5) | 56445 (45%) | 46162 (37%) | 11515 (9%) | 9 (0%) | 8051 (6%) | 41031 (33%) | 22212 (18%) | 20864 (17%) | 223 (0%) |
| RENAAL | 1513 | 386 (26%) | 22 (1%) | 4.7 (0.6) | 737 (49%) | 737 (49%) | NA | NA | 910 (60%) | NA | NA | NA |
| SCREAM CKD† | 29383 | 1639 (6%) | 1060 (4%) | 4.3 (0.5) | 13599 (46%) | 7630 (26%) | 6730 (23%) | NA | 2462 (8%) | 10426 (35%) | 8932 (30%) | 1702 (6%) | 322 (1%) |
| SRR-CKD | 2591 | 363 (14%) | 85 (3%) | 4.4 (0.6) | 1003 (39%) | 0 (0%) | 1002 (39%) | 1 (0%) | NA | 1801 (70%) | NA | NA | NA |
| Sunnybrook | 2965 | 361 (12%) | 99 (3%) | 4.4 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **Subtotal** | **235549** | **26348 (11%)** | **6645 (3%)** | **4.4 (0.5)** | **97256 (48%)** | **72906 (36%)** | **28129 (14%)** | **48 (0%)** | **13316 (7%)** | **73587 (37%)** | **41503 (21%)** | **32755 (17%)** | **871 (0%)** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **General Population** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Beijing | 1530 | 168 (11%) | 4 (0%) | 4.5 (0.5) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| CIRCS | 8034 | 146 (2%) | 66 (1%) | 4.2 (0.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Gubbio | 1684 | 20 (1%) | 36 (2%) | 4.2 (0.4) | 91 (5%) | 91 (5%) | NA | NA | 59 (4%) | 109 (6%) | 9 (1%) | 100 (6%) | NA |
| KHS | 108185 | 1047 (1%) | 653 (1%) | 4.2 (0.6) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| MRC | 11840 | 1081 (9%) | 328 (3%) | 4.4 (0.6) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| NHANES | 57208 | 405 (1%) | 2340 (4%) | 4.0 (0.3) | 5983 (10%) | 4325 (8%) | 1730 (4%) | 14 (0%) | 1347 (2%) | 5498 (10%) | 1548 (3%) | 4100 (7%) | NA |
| PREVEND | 7319 | 204 (3%) | 47 (1%) | 4.4 (0.7) | 334 (5%) | 289 (5%) | 47 (1%) | NA | 13 (0%) | 203 (3%) | 57 (1%) | 150 (2%) | NA |
| Rancho Bernardo | 1484 | 45 (3%) | 17 (1%) | 4.3 (0.4) | NA | NA | NA | NA | 4 (0%) | 256 (17%) | 57 (4%) | 203 (14%) | NA |
| TaiwanMJ | 159268 | 1077 (1%) | 2896 (2%) | 4.1 (0.3) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Takahata | 1923 | 102 (5%) | 23 (1%) | 4.3 (0.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **Subtotal** | **358475** | **4295 (1%)** | **6410 (2%)** | **4.1 (0.5)** | **6408 (10%)** | **4705 (7%)** | **1777 (4%)** | **14 (0%)** | **1423 (2%)** | **6066 (9%)** | **1671 (3%)** | **4553 (7%)** | **0 (0%)** |
| **High Risk Cohorts** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ADVANCE | 11033 | 843 (8%) | 183 (2%) | 4.4 (0.5) | 4974 (47%) | 4490 (43%) | 566 (5%) | NA | NA | 1536 (14%) | NA | 1536 (14%) | NA |
| Geisinger | 64503 | 3727 (6%) | 1298 (2%) | 4.3 (0.4) | 23817 (37%) | 18824 (29%) | 5434 (8%) | 28 (0%) | 2687 (4%) | 18889 (29%) | 7422 (12%) | 12336 (19%) | 51 (0%) |
| Maccabi | 246712 | 12681 (5%) | 830 (0%) | 4.4 (0.4) | 67908 (28%) | 45960 (19%) | 23442 (10%) | 7 (0%) | 2518 (1%) | 18829 (8%) | 5184 (2%) | 13841 (6%) | 85 (0%) |
| Mt Sinai BioMe | 8044 | 519 (6%) | 293 (4%) | 4.3 (0.7) | 3126 (39%) | 2190 (27%) | 1032 (13%) | 10 (0%) | 246 (3%) | 2141 (27%) | 602 (7%) | 1604 (20%) | 141 (2%) |
| SCREAM | 208611 | 2369 (1%) | 7089 (3%) | 4.1 (0.4) | 51217 (25%) | 29420 (14%) | 23293 (11%) | 1 (0%) | 4652 (2%) | 22516 (11%) | 16036 (8%) | 6702 (3%) | 308 (0%) |
| ZODIAC | 1153 | 55 (5%) | 7 (1%) | 4.4 (0.4) | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **Subtotal** | **540056** | **20192 (4%)** | **9699 (2%)** | **4.3 (0.4)** | **151351 (28%)** | **101364 (19%)** | **53912 (10%)** | **46 (0%)** | **10136 (2%)** | **63911 (12%)** | **29342 (6%)** | **36019 (7%)** | **585 (0%)** |
| **General population/ high risk subtotal** | **898531** | **24487 (3%)** | **16109 (2%)** | **4.2 (0.4)** | **157759 (26%)** | **106069 (18%)** | **55689 (9%)** | **60 (0%)** | **11559 (2%)** | **71173 (12%)** | **31013 (5%)** | **40572 (7%)** | **585 (0%)** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Total†** | **1076762** |  |  |  |  |  |  |  |  |  |  |  |  |
| Hyperkalemia: Potassium >5 mmol/LHypokalemia: Potassium <3.5 mmol/L† CKD population from three administrative high risk cohorts, not included in the total N |

# eTable 3. Proportion with acidosis and mean value of serum bicarbonate, by cohort

|  |  |  |  |
| --- | --- | --- | --- |
| Study | N | % Acidosis | Bicarbonate, mean (SD) |
| **CKD Cohorts** |  |  |  |
| AASK | 984 | 100 (10%) | 25 (3) |
| BC CKD | 11162 | 1300 (12%) | 26 (4) |
| CanPREDDICT | 1822 | 260 (14%) | 25 (4) |
| CCF | 16218 | 1665 (10%) | 26 (3) |
| CRIB | 324 | 151 (47%) | 24 (4) |
| Geisinger CKD† | 24358 | 1302 (5%) | 27 (3) |
| MASTERPLAN | 668 | 124 (19%) | 25 (4) |
| MDRD | 1725 | 549 (32%) | 23 (4) |
| Mt Sinai BioMe CKD† | 3520 | 591 (17%) | 25 (4) |
| PSP-CKD | 228 | 36 (16%) | 26 (4) |
| RCAV | 119959 | 6908 (6%) | 27 (3) |
| SCREAM CKD† | 7011 | 1366 (19%) | 24 (4) |
| SRR-CKD | 1613 | 469 (29%) | 23 (3) |
| Sunnybrook | 2748 | 264 (10%) | 26 (4) |
| **Subtotal** | **192340** | **15086 (8%)** | **26 (4)** |
|  |  |  |  |
| **General Population** |  |  |  |
| NHANES | 41359 | 3654 (9%) | 25 (2) |
|  |
| **High Risk Cohorts** |
| Geisinger | 64341 | 1896 (3%) | 27 (3) |
| Mt Sinai BioMe | 8047 | 794 (10%) | 26 (3) |
| SCREAM | 12001 | 1494 (12%) | 25 (3) |
| **General population/ high risk subtotal** | **125748** | **7840 (6%)** | **26 (3)** |
|  |  |  |  |
| **Total†** | **283199** |  |  |
|  |  |  |  |
| Acidosis: Bicarbonate <22 mmol/L† CKD population from three administrative high risk cohorts, not included in the total N |

# eTable 4. Proportion with hyperparathyroidism and mean value of serum parathyroid hormone, by cohort

|  |  |  |  |
| --- | --- | --- | --- |
| Study | N | % Hyperparathyroidism | PTH, median (IQR) |
| **CKD** |  |  |  |
| BC CKD | 10075 | 6787 (67%) | 91 (55-151) |
| CanPREDDICT | 1900 | 618 (33%) | 45 (26-77) |
| CARE FOR HOMe | 371 | 114 (31%) | 51 (36-74) |
| CCF | 1758 | 1013 (58%) | 78 (45-134) |
| CKD-JAC | 2670 | 1692 (63%) | 80 (54-126) |
| CRIB | 316 | 254 (80%) | 134 (73-228) |
| GCKD | 5030 | 1000 (20%) | 37 (25-58) |
| Geisinger CKD | 7803 | 3947 (51%) | 66 (43-105) |
| MASTERPLAN | 638 | 373 (58%) | 75 (46-125) |
| MMKD | 201 | 104 (52%) | 67 (39-160) |
| Mt Sinai BioMe CKD | 1538 | 1090 (71%) | 101 (60-183) |
| SCREAM CKD | 6850 | 5005 (73%) | 99 (63-165) |
| SRR-CKD | 2420 | 2076 (86%) | 135 (86-218) |
| Sunnybrook | 1415 | 710 (50%) | 65 (39-117) |
| **Subtotal** | **42985** | **24783 (58%)** | **NA** |
|  |  |  |  |
| **General Population** |  |  |  |
| NHANES | 9774 | 1333 (14%) | 40 (29-54) |
| PREVEND | 7314 | 285 (4%) | 35 (28-43) |
| REGARDS | 2700 | 471 (17%) | 42 (32-57) |
| ULSAM | 894 | 79 (9%) | 38 (28-50) |
| **Subtotal** | **20682** | **2168 (10%)** | **NA** |
| **High Risk** |
| Maccabi | 19967 | 6635 (33%) | 50 (34-77) |
| ZODIAC | 1203 | 260 (22%) | 47 (36-62) |
| **Subtotal** | **21170** | **6895 (33%)** | **NA** |
| **General population/ high risk subtotal** | **41852** | **9063 (22%)** | **NA** |
|  |  |  |  |
| **Total** | **84837** |  |  |
| Hyperparathyroidism: intact PTH: >65 pg/mL |

# eTable 5. Proportion with hyperphosphatemia and mean value of serum phosphorus, by cohort

|  |  |  |  |
| --- | --- | --- | --- |
| Study | N | % hyperphos | phos, mean (SD) |
| **CKD Cohorts** |  |  |  |
| AASK | 1093 | 46 (4%) | 3.5 (0.6) |
| BC CKD | 11237 | 1757 (16%) | 3.8 (0.8) |
| CanPREDDICT | 1978 | 283 (14%) | 3.8 (0.8) |
| CARE FOR HOMe | 371 | 8 (2%) | 3.3 (0.6) |
| CCF | 3030 | 372 (12%) | 3.7 (0.9) |
| CKD-JAC | 2379 | 161 (7%) | 3.5 (0.7) |
| CRIB | 360 | 131 (36%) | 4.5 (1.3) |
| GCKD | 5160 | 255 (5%) | 3.4 (0.6) |
| Geisinger CKD | 12879 | 925 (7%) | 3.6 (0.7) |
| Gonryo | 2278 | 133 (6%) | 3.5 (0.7) |
| MASTERPLAN | 670 | 53 (8%) | 3.5 (0.8) |
| MDRD | 1735 | 278 (16%) | 3.8 (0.8) |
| MMKD | 202 | 30 (15%) | 3.6 (1.1) |
| Mt Sinai BioMe CKD | 1904 | 260 (14%) | 3.8 (0.8) |
| RCAV | 25507 | 1774 (7%) | 3.5 (0.7) |
| RENAAL | 1510 | 223 (15%) | 3.9 (0.7) |
| SCREAM CKD | 9517 | 1213 (13%) | 3.6 (0.9) |
| SRR-CKD | 2975 | 777 (26%) | 4.1 (0.9) |
| Sunnybrook | 2389 | 376 (16%) | 3.9 (1.0) |
| **Subtotal** | **87174** | **9055 (10%)** | **3.6 (0.8)** |
|  |  |  |  |
| **General Population** |  |  |  |
| BIS | 2048 | 116 (6%) | 3.5 (0.7) |
| Gubbio | 1684 | 36 (2%) | 3.3 (0.6) |
| KHS | 152742 | 5454 (4%) | 3.6 (0.9) |
| MRC | 11334 | 362 (3%) | 3.4 (0.7) |
| NHANES | 57208 | 3568 (6%) | 3.7 (0.6) |
| Nippon 2010 | 2749 | 1064 (39%) | 4.5 (0.3) |
| PREVEND | 7319 | 25 (0%) | 3.1 (0.5) |
| Rancho Bernardo | 1484 | 16 (1%) | 3.4 (0.5) |
| REGARDS | 1960 | 40 (2%) | 3.5 (0.5) |
| RSIII | 3375 | 84 (2%) | 3.5 (0.5) |
| Taiwan MJ | 369932 | 8650 (2%) | 3.6 (0.5) |
| Takahata | 1923 | 86 (4%) | 3.6 (0.5) |
| ULSAM | 1104 | 11 (1%) | 3.0 (0.6) |
| **Subtotal** | **614862** | **19512 (3%)** | **3.6 (0.6)** |
| **High Risk Cohorts** |  |  |  |
| Maccabi | 71310 | 3254 (5%) | 3.6 (0.5) |
| ZODIAC | 1154 | 19 (2%) | 3.4 (0.5) |
| **Subtotal** | **72464** | **3273 (5%)** | **3.6 (0.5)** |
| **General population/ high risk subtotal** | **687326** | **22785 (3%)** | **3.6 (0.6)** |
|  |  |  |  |
| **Total** | **774500** |  |  |
| Hyperphosphatemia: Phosphorus > 4.5 mg/dL |

# eTable 6. Proportion with hypocalcemia and hypercalcemia and mean value of albumin-corrected serum calcium, by cohort

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Study | N | % hypocalcemia | % hypercalcemia | corrected calcium,mean (SD) | albumin, mean (SD) |
| **CKD Cohorts** |  |  |  |  |  |
| AASK | 984 | 169 (17%) | 7 (1%) | 8.8 (0.5) | 4.1 (0.3) |
| BC CKD | 10966 | 590 (5%) | 284 (3%) | 9.3 (0.5) | 4.0 (0.4) |
| CanPREDDICT | 1956 | 147 (8%) | 46 (2%) | 9.2 (0.5) | 4.0 (0.4) |
| CARE FOR HOMe | 370 | 27 (7%) | 5 (1%) | 9.2 (0.5) | 4.4 (0.3) |
| CCF | 12923 | 346 (3%) | 631 (5%) | 9.4 (0.6) | 4.1 (0.5) |
| CKD-JAC | 2413 | 219 (9%) | 11 (0%) | 9.0 (0.5) | 4.0 (0.4) |
| CRIB | 374 | 27 (7%) | 20 (5%) | 9.3 (0.7) | 4.2 (0.4) |
| GCKD | 5159 | 327 (6%) | 128 (2%) | 9.2 (0.5) | 3.8 (0.4) |
| Geisinger CKD† | 1778 | 52 (3%) | 662 (3%) | 9.4 (1.1) | 4.0 (1.3) |
| Gonryo | 2042 | 145 (7%) | 22 (1%) | 9.1 (0.5) | 4.0 (0.5) |
| MASTERPLAN | 669 | 18 (3%) | 56 (8%) | 9.5 (0.6) | 4.0 (0.4) |
| MDRD | 1725 | 152 (9%) | 16 (1%) | 9.1 (0.5) | 4.0 (0.4) |
| MMKD | 202 | 41 (20%) | 3 (1%) | 9.0 (0.8) | 4.4 (0.5) |
| Mt Sinai BioMe CKD† | 3112 | 97 (3%) | 208 (7%) | 9.5 (0.6) | 4.1 (0.5) |
| RCAV | 98308 | 1593 (2%) | 2839 (3%) | 9.4 (0.5) | 3.9 (0.5) |
| RENAAL | 1509 | 15 (1%) | 44 (3%) | 9.5 (0.4) | 3.8 (0.4) |
| SCREAM CKD† | 15330 | 177 (1%) | 1002 (7%) | 9.6 (0.5) | 3.6 (0.4) |
| SRR-CKD | 2833 | 102 (4%) | 186 (7%) | 9.5 (0.6) | 3.6 (0.5) |
| Sunnybrook | 2426 | 59 (2%) | 97 (4%) | 9.4 (1.0) | 4.0 (1.2) |
| **Subtotal** | **182866** | **4800 (3%)** | **6270 (3%)** | **9.4 (0.5)** | **4.0 (0.5)** |
|  |  |  |  |  |  |
| **General Population** |  |  |  |  |  |
| BIS | 2052 | 295 (14%) | 15 (1%) | 9.0 (0.5) | 4.0 (0.3) |
| KHS | 224193 | 26100 (12%) | 353 (0%) | 9.0 (0.5) | 4.5 (0.3) |
| MRC | 12026 | 459 (4%) | 541 (4%) | 9.3 (0.5) | 4.1 (0.3) |
| NHANES | 41405 | 591 (1%) | 334 (1%) | 9.2 (0.4) | 4.3 (0.4) |
| PREVEND | 7313 | 2093 (29%) | 9 (0%) | 8.7 (0.3) | 4.6 (0.3) |
| Rancho Bernardo | 1484 | 54 (4%) | 7 (0%) | 9.1 (0.4) | 4.1 (0.3) |
| REGARDS | 1347 | 39 (3%) | 24 (2%) | 9.2 (0.8) | 4.1 (0.3) |
| TaiwanMJ | 369833 | 91847 (25%) | 412 (0%) | 8.8 (0.4) | 4.5 (0.3) |
| Takahata | 1923 | 114 (6%) | 33 (2%) | 9.2 (0.5) | 4.5 (0.3) |
| ULSAM | 1089 | 121 (11%) | 2 (0%) | 8.9 (0.4) | 4.3 (0.3) |
| **Subtotal** | **662665** | **121713 (18%)** | **1730 (0%)** | **8.9 (0.5)** | **4.5 (0.3)** |
|  |  |  |  |  |  |
| **High Risk Cohorts** |  |  |  |  |  |
| Geisinger | 51372 | 1523 (3%) | 1036 (2%) | 9.3 (0.5) | 4.2 (0.4) |
| Maccabi | 153794 | 4521 (3%) | 1646 (1%) | 9.2 (0.4) | 4.3 (0.3) |
| Mt Sinai BioMe | 7240 | 183 (3%) | 364 (5%) | 9.4 (0.5) | 4.2 (0.5) |
| SCREAM | 83703 | 853 (1%) | 2074 (2%) | 9.4 (0.4) | 3.8 (0.4) |
| ZODIAC | 1153 | 63 (5%) | 7 (1%) | 9.0 (0.4) | 4.5 (0.3) |
| **Subtotal** | **297262** | **7144 (2%)** | **5131 (2%)** | **9.3 (0.4)** | **4.2 (0.4)** |
| **General population/ high risk subtotal** | **959927** | **128857 (13%)** | **6861 (1%)** | **9.0 (0.5)** | **4.4 (0.4)** |
| **Total†** | **1122573** |  |  |  |  |
|  |  |  |  |  |  |
| Hypocalcemia: Corrected calcium < 8.5 mg/dLHypercalcemia: Corrected calcium > 10.3 mg/dL† CKD population from three administrative high risk cohorts, not included in the total N |

# eFigure 1. Forest plot of mean difference of hemoglobin at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 2. Forest plot of mean difference of serum potassium at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 3. Forest plot of mean difference of serum bicarbonate at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 4. Forest plot of mean difference of serum parathyroid hormone at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 5. Forest plot of mean difference of serum phosphorus at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 6. Forest plot of mean difference of corrected serum calcium at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

  

# eFigure 7. Association between eGFR and hemoglobin by albuminuria stages in CKD cohorts excluding users of iron supplementation and erythropoietin stimulating agents.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.



# eFigure 8. Association between eGFR and serum potassium by albuminuria stages in CKD cohorts excluding users of medications that affect potassium.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.



# eFigure 9. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by diabetes status in CKD cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 10. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by diabetes status in general population and high risk cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.



# eFigure 11. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by age in CKD cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 12. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by age in general population and high risk cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 13. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by sex in CKD cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 14. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by sex in general population and high risk cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 15. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by age and sex in CKD cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 16. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by age and sex in general population and high risk cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 17. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by race in CKD cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 18. Association between eGFR and continuous laboratory measures (A) hemoglobin, (B) potassium, (C) bicarbonate, (D) parathyroid hormone, (E) phosphorus, (F) calcium, by race in general population and high risk cohorts.

Y axis depicts the difference from meta-analyzed adjusted value at eGFR 50 ml/min/1.73 m2 and albuminuria <30 mg/g.

 

# eFigure 19. Meta-analyzed adjusted prevalence (25th and 75th percentile cohort) of abnormalities (categorical laboratory measures) in CKD (top panels) and general population and high risk (bottom panels) cohorts



The adjusted prevalence of each abnormality at each eGFR and albuminuria stage was computed as follows: first, we converted the random-effects weighted adjusted mean odds at the reference point (eGFR 50 ml/min/1.73 m2) into a prevalence estimate. To the reference estimate, we applied the meta-analyzed odds ratios to obtain prevalence estimates at eGFR 95, 65, 50, 35, and 20 ml/min/1.73 m2 for each stage of albuminuria. The prevalence estimates were adjusted to 60 years old, half male, non-black, 30% diabetes, 20% history of CVD, 40% ever smoker, and body-mass index 30 kg/m2. The 25th and 75th percentiles for predicted prevalence were the estimates from individual cohorts in the corresponding percentiles of the random-effects weighted distribution of adjusted odds. This was done separately for each abnormality and cohort type (CKD and general population/high risk).

Note that the cohorts included in the analyses of each abnormality may differ based on data availability. For example, the cohort in the 25th percentile of anemia may not be the same as the cohort in the 25th percentile of hyperparathyroidism.

Color coding is based on odds ratio quartile within each abnormality. Bold red font indicates the reference cell.

Definitions of each abnormality are as follows: Anemia: Hgb: male<13 g/dL, female<12 g/dL; Hct: male<39%, female<36%. Hyperkalemia: potassium >5 mmol/L. Acidosis: bicarbonate <22 mmol/L. Hyperparathyroidism: intact PTH >65 pg/mL. Hyperphosphatemia: phosphorus >4.5 mg/dL. Hypocalcemia: corrected calcium <8.5 mg/dL.

# eFigure 20. Forest plot of adjusted odds ratio of hypertension at (A) eGFR 30 vs. 50 ml/min/1.73 m2 at stage A1 in CKD cohorts and (B) eGFR 50 vs. 80 ml/min/1.73 m2 at stage A1 in general population and high risk cohorts

 

# eFigure 21. Association between eGFR and hypertension by (A) diabetes, (B) age, (C) sex, (D) age and sex, and (E) race in CKD cohorts



# eFigure 22. Association between eGFR and hypertension by (A) diabetes, (B) age, (C) sex, (D) age and sex, and (E) race in general population and high risk cohorts



# References

1. Matsushita K, van der Velde M, Astor BC, Woodward M, Levey AS, de Jong PE, et al. Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality in general population cohorts: a collaborative meta-analysis. *Lancet* 2010; **375**(9731): 2073-81.

2. Matsushita K, Mahmoodi BK, Woodward M, Emberson JR, Jafar TH, Jee SH, et al. Comparison of risk prediction using the CKD-EPI equation and the MDRD study equation for estimated glomerular filtration rate. *JAMA* 2012; **307**(18): 1941-51.

3. Hallan SI, Matsushita K, Sang Y, Mahmoodi BK, Black C, Ishani A, et al. Age and Association of Kidney Measures With Mortality and End-stage Renal Disease. *JAMA* 2012; **308**(22): 2349-60.

4. Levey AS, Coresh J, Greene T, Marsh J, Stevens LA, Kusek JW, et al. Expressing the Modification of Diet in Renal Disease Study Equation for Estimating Glomerular Filtration Rate with Standardized Serum Creatinine Values. *Clin Chem* 2007; **53**(4): 766-72.

5. Levey AS, Stevens LA, Schmid CH, Zhang YL, Castro AF, 3rd, Feldman HI, et al. A new equation to estimate glomerular filtration rate. *Ann Intern Med* 2009; **150**(9): 604-12.

6. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney International Supplements* 2013; **3**(1): 1-150.

7. Wright JT, Jr., Bakris G, Greene T, Agodoa LY, Appel LJ, Charleston J, et al. Effect of blood pressure lowering and antihypertensive drug class on progression of hypertensive kidney disease: results from the AASK trial. *JAMA* 2002; **288**(19): 2421-31.

8. Patel A, MacMahon S, Chalmers J, Neal B, Woodward M, Billot L, et al. Effects of a fixed combination of perindopril and indapamide on macrovascular and microvascular outcomes in patients with type 2 diabetes mellitus (the ADVANCE trial): a randomised controlled trial. *Lancet* 2007; **370**(9590): 829-40.

9. Mitsuhashi H, Yatsuya H, Matsushita K, Zhang H, Otsuka R, Muramatsu T, et al. Uric acid and left ventricular hypertrophy in Japanese men. *Circ J* 2009; **73**(4): 667-72.

10. Matsushita K, Selvin E, Bash LD, Franceschini N, Astor BC, Coresh J. Change in estimated GFR associates with coronary heart disease and mortality. *J Am Soc Nephrol* 2009; **20**(12): 2617-24.

11. Levin A, Djurdjev O, Beaulieu M, Er L. Variability and risk factors for kidney disease progression and death following attainment of stage 4 CKD in a referred cohort. *Am J Kidney Dis* 2008; **52**(4): 661-71.

12. Zhang L, Zuo L, Xu G, Wang F, Wang M, Wang S, et al. Community-based screening for chronic kidney disease among populations older than 40 years in Beijing. *Nephrol Dial Transplant* 2007; **22**(4): 1093-9.

13. Ebert N, Jakob O, Gaedeke J, van der Giet M, Kuhlmann MK, Martus P, et al. Prevalence of reduced kidney function and albuminuria in older adults: the Berlin Initiative Study. *Nephrol Dial Transplant* 2017; **32**(6): 997-1005.

14. Levin A, Rigatto C, Brendan B, Madore F, Muirhead N, Holmes D, et al. Cohort profile: Canadian study of prediction of death, dialysis and interim cardiovascular events (CanPREDDICT). *BMC Nephrol* 2013; **14**: 121.

15. Schold JD, Navaneethan SD, Jolly SE, Poggio ED, Arrigain S, Saupe W, et al. Implications of the CKD-EPI GFR estimation equation in clinical practice. *Clin J Am Soc Nephrol* 2011; **6**(3): 497-504.

16. Shlipak MG, Katz R, Kestenbaum B, Fried LF, Newman AB, Siscovick DS, et al. Rate of kidney function decline in older adults: a comparison using creatinine and cystatin C. *Am J Nephrol* 2009; **30**(3): 171-8.

17. Shimizu Y, Maeda K, Imano H, Ohira T, Kitamura A, Kiyama M, et al. Chronic kidney disease and drinking status in relation to risks of stroke and its subtypes: the Circulatory Risk in Communities Study (CIRCS). *Stroke* 2011; **42**(9): 2531-7.

18. Landray MJ, Thambyrajah J, McGlynn FJ, Jones HJ, Baigent C, Kendall MJ, et al. Epidemiological evaluation of known and suspected cardiovascular risk factors in chronic renal impairment. *Am J Kidney Dis* 2001; **38**(3): 537-46.

19. Zhang QL, Koenig W, Raum E, Stegmaier C, Brenner H, Rothenbacher D. Epidemiology of chronic kidney disease: results from a population of older adults in Germany. *Prev Med* 2009; **48**(2): 122-7.

20. Parikh NI, Hwang S-J, Larson MG, Levy D, Fox CS. Chronic Kidney Disease as a Predictor of Cardiovascular Disease (from the Framingham Heart Study). *Am J Cardiol* 2008; **102**(1): 47-53.

21. Titze S, Schmid M, Kottgen A, Busch M, Floege J, Wanner C, et al. Disease burden and risk profile in referred patients with moderate chronic kidney disease: composition of the German Chronic Kidney Disease (GCKD) cohort. *Nephrol Dial Transplant* 2015; **30**(3): 441-51.

22. Perkins RM, Bucaloiu ID, Kirchner HL, Ashouian N, Hartle JE, Yahya T. GFR decline and mortality risk among patients with chronic kidney disease. *Clin J Am Soc Nephrol* 2011; **6**(8): 1879-86.

23. Cirillo M, Lanti MP, Menotti A, Laurenzi M, Mancini M, Zanchetti A, et al. Definition of kidney dysfunction as a cardiovascular risk factor: use of urinary albumin excretion and estimated glomerular filtration rate. *Arch Intern Med* 2008; **168**(6): 617-24.

24. Noda H, Iso H, Irie F, Sairenchi T, Ohtaka E, Doi M, et al. Low-density lipoprotein cholesterol concentrations and death due to intraparenchymal hemorrhage: the Ibaraki Prefectural Health Study. *Circulation* 2009; **119**(16): 2136-45.

25. Shalev V, Chodick G, Goren I, Silber H, Kokia E, Heymann AD. The use of an automated patient registry to manage and monitor cardiovascular conditions and related outcomes in a large health organization. *Int J Cardiol* 2011; **152**(3): 345-9.

26. van Zuilen AD, Bots ML, Dulger A, van der Tweel I, van Buren M, Ten Dam MA, et al. Multifactorial intervention with nurse practitioners does not change cardiovascular outcomes in patients with chronic kidney disease. *Kidney Int* 2012; **82**: 710-7.

27. Klahr S, Levey AS, Beck GJ, Caggiula AW, Hunsicker L, Kusek JW, et al. The effects of dietary protein restriction and blood-pressure control on the progression of chronic renal disease. Modification of Diet in Renal Disease Study Group. *N Engl J Med* 1994; **330**(13): 877-84.

28. Bui AL, Katz R, Kestenbaum B, de Boer IH, Fried LF, Polak JF, et al. Cystatin C and carotid intima-media thickness in asymptomatic adults: the Multi-Ethnic Study of Atherosclerosis (MESA). *Am J Kidney Dis* 2009; **53**(3): 389-98.

29. Kronenberg F, Kuen E, Ritz E, Junker R, Konig P, Kraatz G, et al. Lipoprotein(a) serum concentrations and apolipoprotein(a) phenotypes in mild and moderate renal failure. *J Am Soc Nephrol* 2000; **11**(1): 105-15.

30. Roderick PJ, Atkins RJ, Smeeth L, Mylne A, Nitsch DD, Hubbard RB, et al. CKD and mortality risk in older people: a community-based population study in the United Kingdom. *Am J Kidney Dis* 2009; **53**(6): 950-60.

31. Tayo BO, Teil M, Tong L, Qin H, Khitrov G, Zhang W, et al. Genetic background of patients from a university medical center in Manhattan: implications for personalized medicine. *PLoS ONE* 2011; **6**(5): e19166.

32. National Health and Nutrition Examination Survey. [cited 2017 January 19]; Available from: <https://wwwn.cdc.gov/nchs/nhanes/Default.aspx>

33. Elley CR, Kenealy T, Robinson E, Drury PL. Glycated haemoglobin and cardiovascular outcomes in people with Type 2 diabetes: a large prospective cohort study. *Diabet Med* 2008; **25**(11): 1295-301.

34. Nakayama M, Metoki H, Terawaki H, Ohkubo T, Kikuya M, Sato T, et al. Kidney dysfunction as a risk factor for first symptomatic stroke events in a general Japanese population--the Ohasama study. *Nephrol Dial Transplant* 2007; **22**(7): 1910-5.

35. Pavkov ME, Knowler WC, Hanson RL, Bennett PH, Nelson RG. Predictive power of sequential measures of albuminuria for progression to ESRD or death in Pima Indians with type 2 diabetes. *Am J Kidney Dis* 2008; **51**(5): 759-66.

36. Hillege HL, Fidler V, Diercks GF, van Gilst WH, de Zeeuw D, van Veldhuisen DJ, et al. Urinary albumin excretion predicts cardiovascular and noncardiovascular mortality in general population. *Circulation* 2002; **106**(14): 1777-82.

37. Jassal SK, Kritz-Silverstein D, Barrett-Connor E. A Prospective Study of Albuminuria and Cognitive Function in Older Adults: The Rancho Bernardo Study. *Am J Epidemiol* 2010; **171**(3): 277-86.

38. Kovesdy CP, Norris KC, Boulware LE, Lu JL, Ma JZ, Streja E, et al. Association of Race With Mortality and Cardiovascular Events in a Large Cohort of US Veterans. *Circulation* 2015; **132**(16): 1538-48.

39. Howard VJ, Cushman M, Pulley L, Gomez CR, Go RC, Prineas RJ, et al. The reasons for geographic and racial differences in stroke study: objectives and design. *Neuroepidemiology* 2005; **25**(3): 135-43.

40. Brenner BM, Cooper ME, de Zeeuw D, Keane WF, Mitch WE, Parving HH, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. *N Engl J Med* 2001; **345**(12): 861-9.

41. Ikram MA, Brusselle GGO, Murad SD, van Duijn CM, Franco OH, Goedegebure A, et al. The Rotterdam Study: 2018 update on objectives, design and main results. *Eur J Epidemiol* 2017; **32**(9): 807-50.

42. Gasparini A, Evans M, Coresh J, Grams ME, Norin O, Qureshi AR, et al. Prevalence and recognition of chronic kidney disease in Stockholm healthcare. *Nephrol Dial Transplant* 2016; **31**(12): 2086-94.

43. Lundstrom UH, Gasparini A, Bellocco R, Qureshi AR, Carrero JJ, Evans M. Low renal replacement therapy incidence among slowly progressing elderly chronic kidney disease patients referred to nephrology care: an observational study. *BMC Nephrol* 2017; **18**(1): 59.

44. Tangri N, Stevens LA, Griffith J, Tighiouart H, Djurdjev O, Naimark D, et al. A predictive model for progression of chronic kidney disease to kidney failure. *JAMA* 2011; **305**(15): 1553-9.

45. Wen CP, Cheng TY, Tsai MK, Chang YC, Chan HT, Tsai SP, et al. All-cause mortality attributable to chronic kidney disease: a prospective cohort study based on 462 293 adults in Taiwan. *Lancet* 2008; **371**(9631): 2173-82.

46. Konta T, Hao Z, Abiko H, Ishikawa M, Takahashi T, Ikeda A, et al. Prevalence and risk factor analysis of microalbuminuria in Japanese general population: the Takahata study. *Kidney Int* 2006; **70**(4): 751-6.

47. Bilo HJ, Logtenberg SJ, Joosten H, Groenier KH, Ubink-Veltmaat LJ, Kleefstra N. Modification of diet in renal disease and Cockcroft-Gault formulas do not predict mortality (ZODIAC-6). *Diabet Med* 2009; **26**(5): 478-82.