

Acknowledgments

Funding

The 28th Annual Data Report (ADR) of the United States Renal Data System (USRDS) was produced by the USRDS Coordinating Center at the University of Michigan Kidney Epidemiology and Cost Center (UM-KECC) in partnership with Arbor Research Collaborative for Health. Funding for the USRDS is provided by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health, U.S. Department of Health and Human Services, under contract HHSN276201400001C with the University of Michigan. The Centers for Medicare & Medicaid Services partners with NIDDK in supporting the USRDS.

In addition to the USRDS Coordinating Center, the NIDDK has independently funded two USRDS special study centers, one at the University of California, Irvine, in collaboration with the University of Tennessee Health Science Center and Kaiser Permanente Southern California, and the other special study center at the University of Washington, Seattle, in collaboration with Stanford University.

Contributors

Included here are the names of individuals who contributed to the 2016 ADR.

USRDS Investigators

Director: Rajiv Saran, MD, MRCP, MS

Co-Deputy Directors: Bruce Robinson, MD, MS, FACP;

Vahakn Shahinian, MD, MS

Volume 1. Chronic Kidney Disease in the United States

- Ch 1 CKD in the General Population
 Jennifer Bragg-Gresham, MS, PhD; Rajiv Saran, MD,
 MRCP, MS; Peter Song, PhD
- Ch 2 Identification and Care of Patients With CKD
 Bruce Robinson, MD, MS, FACP; Rajiv Saran, MD,
 MRCP, MS; Vahakn Shahinian, MD, MS
- Ch 3 Morbidity and Mortality in Patients With CKD Kevin He, MS, PhD; Yi Li, PhD; Rajiv Saran, MD, MRCP, MS

Ch 4 Cardiovascular Disease in Patients With CKD
Brahmajee Nallamothu, MPH, MD; Rajiv Saran,
MD, MRCP, MS

Ch 5 Acute Kidney Injury Michael Heung, MD; Vahakn Shahinian, MD, MS; Diane Steffick, PhD

- Ch 6 Medicare Expenditures for Persons With CKD Rajesh Balkrishnan, PhD; Richard A. Hirth, PhD; David Hutton, PhD
- Ch 7 Medicare Part D Prescription Drug Coverage in Patients With CKD
 Rajesh Balkrishnan, PhD; Yun Han, MS; Richard A. Hirth, PhD; Rajiv Saran, MD, MRCP, MS
- Ch 8 USRDS Special Study Center on Transition of Care in CKD

Joline L.T. Chen, MD; Daniel Gillen, PhD; Steven J. Jacobsen, MD, PhD; Kamyar Kalantar-Zadeh, MD, MPH, PhD; Csaba P. Kovesdy, MD; Miklos Z. Molnar, MD, PhD; Danh V. Nguyen, PhD; Keith C Norris, MD; Yoshitsugu Obi, MD, PhD; Connie M. Rhee, MD, MSc; John J. Sim, MD; Melissa Soohoo, MPH; Elani Streja, MPH, PhD; Hui Zho, MS, PhD

Volume 2. End-Stage Renal Disease in the United States

Ch 1 Incidence, Prevalence, Patient Characteristics, and Treatment Modalities

Hal Morgenstern, PhD; Bruce Robinson, MD, MS, FACP; Rajiv Saran, MD, MRCP, MS

Ch 2 Healthy People 2020 Elizabeth Cope, PhD, MPH; Michael Heung, MD

Ch 3 Clinical Indicators and Preventive Care William Herman, MD, MPH; Ronald Pisoni, PhD, MS; Rajiv Saran, MD, MRCP, MS; Vahakn Shahinian, MD, MS; Francesca Tentori, MD, MS

Ch 4 Vascular Access

Ronald Pisoni, PhD, MS; Brett Plattner, MD; Rajiv Saran, MD, MRCP, MS; Kenneth J. Woodside, MD

Ch 5 Hospitalization

Kevin He, MS, PhD; Yi Li, PhD; Rajiv Saran, MD, MRCP, MS; Francesca Tentori, MD, MS

Ch 6 Mortality

Panduranga Rao, MD; Bruce Robinson, MD, MS, FACP; Douglas E. Schaubel, PhD

Ch 7 Transplantation

Yee Lu, MD; Friedrich K. Port, MD, MS; Vahakn Shahinian, MD, MS; Kenneth J. Woodside, MD

Ch 8 ESRD Among Children, Adolescents, and Young Adults

Debbie Gipson, MS, MD; Yee Lu, MD; Brett Plattner, MD; David T. Selewski, MD

Ch 9 Cardiovascular Disease in Patients With ESRD Brahmajee Nallamothu, MPH, MD; Rajiv Saran, MD, MRCP, MS

Ch 10 Dialysis Providers

John Ayanian, MD, MPP; Yi Li, PhD; Rajiv Saran, MD, MRCP, MS

Ch 11 Medicare Expenditures for Persons With ESRD Rajesh Balkrishnan, PhD; Richard A. Hirth, PhD; David Hutton, PhD

Ch 12 Medicare Part D Prescription Drug Coverage in Patients With ESRD

Rajesh Balkrishnan, PhD; Yun Han, MS; Richard Hirth, PhD; Rajiv Saran, MD, MRCP, MS

Ch 13 International Comparisons

Ronald Pisoni, PhD, MS; Bruce Robinson, MD, MS, FACP

Ch 14 USRDS Special Study Center on End-of-life Care for Patients With ESRD

Susan M. Hailpern, MS, DrPH; Yoshio Hall, MD, MS; Paul Hebert, PhD; Ronit Katz, PhD; Danielle Lavallee, PharmD, PhD; Maria Montez-Rath, PhD; Ann M. O'Hare, MD, MA; Manju Kurella Tamura, MD, MPH

BIOSTATISTICIANS AND RESEARCH ANALYSTS

Patrick Albertus, MPH; Valarie Ashby, MA; Sai Dharmarajan, MS; Xue Dietrich, MS; Ashley Eckard, MS; Charles Gaber, MPH; Yun Han, MS; Margaret Helmuth, MA; Nan Ji, MS; Yan Jin, PhD; Alissa Kapke, MS; Keith McCullough, MS; Purna Mukhopadhyay, PhD; Jeffrey Pearson, MS; Praveen Potukuchi, MS; Kaitlyn Ratkowiak, MS; Vanessa A. Ravel, MPH; Debabrata Ray, MA, MS; Tempie Shearon, MS; Jiaxiao M. Shi, PhD; Monica Shieu, MPH; Diane Steffick, MA, PhD; Anca Tilea, MPH; Lan Tong, MA, MS; Dongyu Wang, MS; Mia Wang, MS; Xin Xin, MA, MS; Lindsay Zepel, MS; Sai Zhang, BS

INFORMATION SYSTEMS & PROGRAMMING STAFF

Valarie Ashby, MA; Cora Brunton, MBA; Patrick Callahan, BS; Sandra Callard, MHSA; Yang Casher, MA; David Dickinson, MA; Xue Dietrich, MS; Zach Dietrich, MS; Haoyu Gu, MS, PhD; Jennie Jing, MS; William Kreuter, MPA; Frankie LaPorte, MS; Shannon Li, MS; Xizhao (Jenny) Li, MS; Lingqun Liu, MS; Sai Liu, MPH; Melinda MacDougall, MS; Keith McCullough, MS; Purna Mukhopadhyay, PhD; Kaitlyn Ratkowiak, MS; Diane Steffick, MA, PhD; Yating Sun, MS; Anca Tilea, MPH; Megan Turf, BA; Weizhang Zeng, MS; Thomas (Huiyong) Zheng, MS, PhD

ADMINISTRATIVE, EDITORIAL, AND PROJECT STAFF

Administrative: Tracy Nakata, BA; Manilay Pulsinelli, BS; Amanda Szymanski, BA

Editorial: Janet Kavanagh, MS; Katherine Pearson, MPP; Ruth Shamrai, MA

Project Managers: Vivian Kurtz, MPH; April Wyncott, MPH, MBA; Aya Inoue, BA; Sally Shaw, DrPH

WEBSITE TEAM

Benjamin Guidinger, BS; Michael Lipham, DMA; Charlie Sirich, MS, MBA

Suggested Citations

The suggested citation for this report is as follows:

United States Renal Data System. 2016 USRDS annual data report: Epidemiology of kidney disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2016.

Publications based upon data reported here or supplied upon request must include this citation and the following notice: "The data reported here have been supplied by the United States Renal Data System (USRDS). The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy or interpretation of the U.S. government."

The suggested citation for the AJKD e-supplement available at www.ajkd.org is:

Saran R, Robinson B, Abbott KC, et al. US Renal Data System 2016 Annual Data Report: epidemiology of kidney disease in the United States. *Am J Kidney Dis* 2017;69(3)(suppl 1):S1-S688.

USRDS Coordinating Center

Director: Rajiv Saran, MD, MRCP, MS **Co-Deputy Directors:** Bruce Robinson, MD, MS, FACP; Vahakn Shahinian, MD, MS

Project Manager

Vivian Kurtz, MPH 1415 Washington Heights, Suite 3626 SPH I Ann Arbor, MI 48109-2029 Phone (734) 763-1609

Data Requests

usrds@usrds.org — Caitlin Grabijas, BA Toll Free 1-888-99USRDS; Fax (734) 763-4004

Website: www.usrds.org

webmaster@usrds.org — Ben Guidinger, BS

USRDS Special Study Centers

TRANSITION OF CARE IN CKD

Principal Investigator (PI): Kamyar Kalantar-Zadeh, MD, MPH, PhD, University of California, Irvine (UCI) Co-PIs: Csaba P. Kovesdy, MD, University of Tennessee Health Science Center; Steven J. Jacobsen, MD, PhD, Kaiser Permanente Southern California

END-OF-LIFE CARE FOR PATIENTS WITH ESRD

Principal Investigator: Ann O'Hare, MD, MA, University of Washington, Seattle

Co-PI: Manjula Kurella Tamura, MD, MPH, Stanford University

USRDS Oversight

USRDS work is overseen by the Project Officers of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), the USRDS Steering Committee, and the USRDS External Expert Panel (EEP).

NIDDK PROJECT OFFICERS

Kevin C. Abbott, MD, MPH Director, Kidney and Urology Epidemiology Phone 301.594.7714 kevin.abbott@nih.gov

Lawrence Y.C. Agodoa, MD Phone 301.594.1932; Fax 301.594.9358 agodoal@extra.niddk.nih.gov

USRDS Steering Committee

The USRDS Steering Committee consists of the NIDDK project officers, the director and two deputy directors at the USRDS Coordinating Center, and the PIs and co-PIs at the Special Study Centers.

USRDS External Expert Panel

CHAIR

Catherine Stehman-Breen, MD, MS, Amgen, Regeneron Pharmaceuticals, Inc.

NIDDK

Kevin Abbott, MD, MPH; Lawrence Agodoa, MD

CENTERS FOR MEDICARE & MEDICAID SERVICES

Sharrilyn Evered, PhD

EEP MEMBERS

L. Ebony Boulware, MD, MPH, Duke UniversityM. Alan Brookhart, PhD, University of North Carolina at Chapel Hill

Nilka Ríos Burrows, MPH, MT (ASCP), Centers for Disease Control and Prevention

Bethany Foster, MD, MSCE, Montreal Children's Hospital

Mahesh Krishnan, MD, MPH, MBA, FASN, DaVita Healthcare Partners Inc.

Klemens Meyer, MD, Dialysis Clinic Inc. & Tufts Medical Center

Paul Muntner, PhD, University of Alabama at Birmingham

Robert Nee, MD, Walter Reed National Military Medical

Keith C. Norris, MD, PhD, University of California, Los Angeles

Rajiv Saran, MD, MRCP, MS, University of Michigan Mark Schnitzler, PhD, Saint Louis University Center for Outcomes Research (SLUCOR)

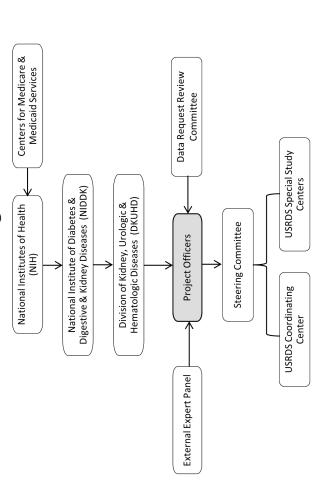
Theresa I. Shireman, PhD, RPh, University of Kansas Medical Center

Bradley A. Warady, MD, Children's Mercy Hospitals and Clinics, University of Missouri

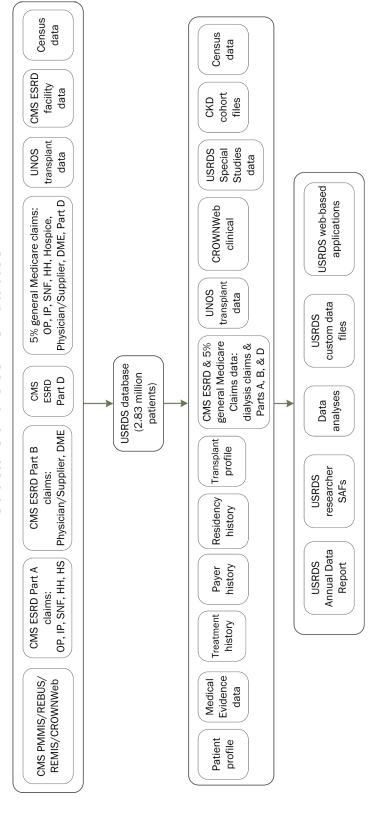
Haimanot (Monnie) Wasse, MPH, MD, Rush University Wolfgang C. Winkelmayer, MD, MPH, ScD, FASN, Baylor College of Medicine

Yining Xie, MD, NIDDK

Administrative Oversight of the USRDS



Structure of the USRDS Database



Disclosures

UM-KECC and Arbor Research Collaborative for Health have each enacted conflict of interest (COI) policies and practices governing the conduct of research within the USRDS and of other research not related to the USRDS. In addition to internal controls, USRDS work is overseen by the Project Officers of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), the USRDS Steering Committee, and the USRDS External Expert Panel.

Dr Kevin C. Abbott has less than \$10,000 invested in General Electric. Dr Jennifer Bragg-Gresham is a consultant with IMPAO, and also with the Medical Education Institute (MEI) involving quality-of-life performance measures. Dr William Herman is chair of the DMC (Data Monitoring Committee) for both Merck and Lexicon Pharmaceuticals. Dr Kamyar Kalantar-Zadeh has received honoraria and/or support from Abbott, Abbvie, Alexion, Amgen, Astra-Zeneca, Aveo, Chugai, DaVita, Fresenius, Genentech, Haymarket Media, Hospira, Kabi, Keryx, Novartis, Pfizer, Relypsa, Resverlogix, Sandoz, Sanofi, Shire, Vifor, UpToDate, and ZS-Pharma. Dr Csaba P. Kovesdy is a consultant for Abbott Nutrition, Relypsa, Sanofi-Aventis, ZS Pharma, and Nephrogenex. Dr Hal Morgenstern is a consultant at Arbor Research Collaborative for Health. Dr Ann M. O'Hare is employed at the University of Washington and the VA Puget Sound Health Care System; she has received grant support from NIDDK, CDC and the Veterans Administration; she has been a speaker and received fees/honoraria/travel support within the last three years from Fresenius, Dialysis Clinic, Inc., Greenfield Healthcare System, UpToDate, University of Alabama at Birmingham, and the Japanese Society of Dialysis and Transplantation.

Notes