HHS Public Access

Author manuscript

Am J Kidney Dis. Author manuscript; available in PMC 2017 December 01.

Published in final edited form as:

Am J Kidney Dis. 2016 December ; 68(6): 862–872. doi:10.1053/j.ajkd.2016.05.030.

Risk of ESRD in the United States

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Abstract

Background—Although incidence rates of end-stage renal disease (ESRD) in the United States are reported routinely by the US Renal Data System (USRDS), risks (probabilities) are not reported. Short- and long-term risk estimates need to be updated and expanded to minority populations, including Native Americans, Asian/Pacific Islanders, and Hispanics.

Study Design—Risk estimation from surveillance data in large populations using life-table methods. A competing-risks framework was applied by constructing a hypothetical cohort followed up from birth to death.

Setting & Participants—Total US population. Incidence and mortality rates of ESRD were obtained from the USRDS; all-cause mortality rates were obtained from CDC WONDER.

Predictors—Age, sex, race/ethnicity, and year.

Outcomes—10-year to lifetime risks (cumulative incidence) of ESRD.

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Contributions: Research idea and study design: PA, HM; data acquisition: PA, HM, BR, RS; data analysis/interpretation: PA, HM, BR, RS; statistical analysis: PA, HM; supervision or mentorship: HM, RS. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved. HM takes responsibility that this study has been reported honestly, accurately, and transparently; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Peer Review: Evaluated by 2 external peer reviewers, a Statistical Editor, a Co-Editor, and the Editor-in-Chief.

Results—Among males, the lifetime risks of ESRD from birth using 2013 data were 3.1% (95% CI, 3.0%-3.1%) for non-Hispanic (NH) whites, 8.0% (95% CI, 7.9%-8.2%) for NH blacks, 3.8% (95% CI, 3.4%-4.9%) for NH Native Americans, 5.1% (95% CI, 4.8%-5.4%) for NH Asians/Pacific Islanders, and 6.2% (95% CI, 6.1%-6.4%) for Hispanics. Among females, the lifetime risks were 2.0% (95% CI, 2.0%-2.1%) for NH whites, 6.8% (95% CI, 6.7%-6.9%) for NH blacks, 3.6% (95% CI, 3.3%-4.2%) for NH Native Americans, 3.8% (95% CI, 3.6%-4.0%) for NH Asian/Pacific Islanders, and 4.3% (95% CI, 4.2%-4.5%) for Hispanics. The lifetime risk of ESRD from birth increased from 3.5% in 2000 to 4.0% in 2013 in males and decreased from 3.0% to 2.8% in females.

Limitations—Standard life-time assumption of fixed age-specific rates over time; and possible ESRD misclassification. To be useful in clinical practice, this application will require additional predictors (e.g., comorbidities, chronic kidney disease stage).

Conclusions—ESRD risk in the United States varies more than 2-fold among racial/ethnic groups for both sexes.

Keywords

End-stage renal disease (ESRD); incidence; risk; cumulative incidence; risk estimate; lifetime risk; lifetable; racial disparity; US Renal Data System (USRDS); epidemiology; public health; mortality; nationwide surveillance; health inequity

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At the end of 2012, there were more than 600,000 prevalent end-stage renal disease (ESRD) patients in the United States.[1] For prevalent patients, aged 60-65 years, the life expectancy was 5.5 years for dialysis patients and 15.4 years for kidney transplant patients in 2012, compared to 19.1 years for 60- to 65-year-olds in the general US population in 2010.[1] In addition to a shortened lifespan, ESRD patients experience significant lifestyle changes, including the need for multiple medications, dietary restrictions, and frequent visits to a dialysis clinic. The growing population of ESRD patients and the consequences of the disease for the individual necessitate a proper understanding of ESRD risk—the probability of being diagnosed with ESRD—in the US population. Most of the research and monitoring of ESRD incidence in the United States has focused on rates,[1,2] which are strictly population measures with no application to individuals.[3,4] Cohort studies in which at-risk individuals are followed up for disease detection are the primary means of estimating risk; however, individually following up all US residents is not feasible. Life-table methods for estimating risk from surveillance data in large populations have been developed and applied to several chronic diseases including ESRD.[5-9]

Previous studies on ESRD risk in the total population did not capture a comprehensive understanding of ESRD risk in the United States that reflects the country's racial/ethnic diversity;[5-9] furthermore, most studies did not estimate risks across the entire lifespan. In addition, the most recent risk estimations for the US population were based on data from 2009.[7] Given the changes in ESRD incidence rates in the past decade, it is important to update risk estimates and compare them across calendar time. This information is needed to facilitate communication between physicians and patients,[10] to educate the public,[11] and to

inform policy-makers, as has been accomplished for other diseases including breast cancer,[12] hypertension,[13] diabetes,[14] and dementia.[15]

The primary aim of this study was to estimate risks of ESRD at different ages during the lifespan in the United States, by age, sex, and race/ethnicity. A secondary aim was to contrast risk estimates of ESRD based on data from 2000 and 2013. A tertiary aim was to compare risk estimates using the competing-risk method and an exponential (density) method that treats competing causes of death as censored and does not require mortality data.

Methods

The source of ESRD incidence data for this study is the US Renal Data System (USRDS), which is funded by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The USRDS maintains a database on all patients diagnosed with ESRD in the United States and registered with Form CMS (Centers for Medicare & Medicaid Services) 2728, including those treated with dialysis and those receiving kidney transplants. The USRDS was approved by the Institutional Review Board at the University of Michigan (no. HUM00086162).

Risks (probabilities) of being diagnosed with ESRD during a given age interval were estimated using the methods of Fay[16] and Fay et al.[17] with DevCan software (version 6.7.2)[18] developed at the National Cancer Institute. Fay and colleagues used a competing-risks framework to estimate risks (cumulative incidences) from incidence data collected through a surveillance system. The challenge with this approach is to derive risk estimates for any age interval during the lifespan, based on age-specific incidence rates obtained for a given calendar period (e.g., one year), taking into account competing causes of death. Thus, this approach also requires data on age-specific mortality rates for ESRD and other causes combined. DevCan applies the incidence and mortality rates of ESRD and the mortality rates of all other causes of death (competing events) to a large hypothetical cohort that is “aged” from birth until death. The age-sex-race/ethnicity distribution at birth for this hypothetical cohort is assumed to be the same as the age-sex-race/ethnicity distribution of the United States in the specified year. In our analysis, we used 5-year age intervals to estimate rates and to generate a hypothetical cohort, stratifying on sex and race/ethnicity (non-Hispanic [NH] white, NH black, NH Native American, NH Asian/Pacific Islander, and Hispanic). DevCan incorporates a “piecewise mid-age group joinpoint model” to smooth out risk estimates within 5-year age intervals, effectively assuming incidence rates are constant within half-year age intervals.[16] The method of Fay and colleagues was modified to accommodate ESRD, which (unlike cancer) can occur only once in a person’s life. Estimated incidence rates of ESRD were based on data from 2000 and 2013. An incident case of ESRD was defined as a patient with loss of kidney function that resulted in reported long-term dialysis or kidney transplantation.[1] The incidence rate for each 5-year age interval was estimated by dividing the number of incident ESRD cases in each period by the size of the mid-point population in that period. Incident counts were obtained from the USRDS database, and mid-point populations were obtained from census estimates for July 2000 and July 2013.

Mortality rates for each year were estimated similarly to incidence rates. The number of deaths (competing events) prior to ESRD onset was determined by subtracting the number of ESRD deaths for each period from the total number of deaths for the period. Numbers of deaths from all causes were obtained from the Centers for Disease Control and Prevention (CDC) Wide-Ranging Online Data for Epidemiologic Research (WONDER) online program,[19] which compiles data from the National Center for Health Statistics. Numbers of ESRD deaths were obtained from the USRDS database.

Data obtained from USRDS were restricted to individuals living in the United States (excluding territories) who were younger than 110 years old with known age, sex, ethnicity, and race (among non-Hispanics). Non-Hispanics with multiple races indicated were excluded. Only 123 (0.12%) of the total non-Hispanic incident ESRD population was in this category; therefore, including strata of male and female non-Hispanics with multiple races would not have yielded meaningful results. Hispanics included those with multiple (n=28 [0.18% of Hispanics]) or unknown race (n=23 [0.15% of Hispanics]) because we did not stratify on race within Hispanics. Within the USRDS database, race and ethnicity are determined primarily from the CMS 2728 form with verification and supplementation from the CMS Medicare Enrollment Database, REMIS patient identification file, and CROWNWeb/SIMS patient roster.

We estimated the cumulative incidence of ESRD for 2013 from birth until age 100+ for each stratum of sex and race/ethnicity. Age-specific 10-year, 20-year, 30-year, 40- year, 50-year, 60-year, 70-year, 80-year, 90-year, 100-year, and lifetime cumulative incidences (and 95% confidence intervals [CIs]) were also obtained for each stratum. In addition, we compared the cumulative incidence of ESRD from birth until age 100+ for data in 2000 and 2013.

Lastly, we compared DevCan results for the cumulative incidence of ESRD to risk estimates obtained from the exponential (density) method of risk estimation for 2013.[3,16,17] The exponential method, like the Kaplan-Meier method with individual follow-up data, treats deaths prior to ESRD onset as censored, rather than as competing events. Thus, these risk estimates are probabilities of ESRD diagnosis during a given age interval, conditional on not first dying from a competing event during that interval (and therefore are expected to be higher than DevCan risk estimates). The estimated risk for a given age interval of duration Δt is $1 - \exp(-\Sigma_{i=1}^{n}(R_i \times \Delta t_i))$, where R_i is the incidence rate of ESRD for the i-th age interval, Δt_i is the length of the i-th age interval (five years), and $\Delta t = \sum_{i=1}^{n} \Delta t_i$. For the last age interval, 100+, we assumed the end of life was 105 (Δt_{100+} = 5 years). Incidence rates are assumed to be constant within 5-year age intervals. This method also assumes constant age-specific rates over calendar time.

Results

The overall incidence rate of ESRD for US males peaked at age 80-84 years in 2013 at 2,129 per million/year, as well as in 2000 at 2,080 per million/year (Fig 1). Compared with males, US females had lower incidence rates of ESRD for all 5-year age groups in both years, with a peak at age 75-79 years (1,247 per million/year in 2013 and 1,254 per million/year in 2000). Compared with 2000, incidence rates in 2013 were higher in males at age 80-94 years

and higher in females at age 55-74 years. Non-ESRD mortality rates in 2000 and 2013 increased sharply after age 65 years in both sexes (Fig 2). Compared with 2000, mortality rates in 2013 were lower in older age groups (65-99 years in males and 75-100+ years in females).

The cumulative incidence of ESRD from birth in US males (Fig 3) and females (Fig 4) begins to rise at approximately age 30 years, based on data from 2013. The cumulative incidence increases rapidly for all race/ethnicity categories before stabilizing around age 85 years (figures *a-e* of Item S1, available as online supplementary material). The lifetime cumulative incidences of ESRD from birth for males are 3.08% (95% CI, 3.05%-3.11%) for NH whites, 8.05% (95% CI, 7.91%-8.19%) for NH blacks, 3.80% (95% CI, 3.43%-4.92%) for NH Native Americans, 5.05% (95% CI, 4.82%-5.36%) for NH Asians/Pacific Islanders, and 6.23% (95% CI, 6.06%-6.43%) for Hispanics. For females, the lifetime cumulative incidences of ESRD are 2.03% (95% CI, 2.00%-2.05%) for NH whites, 6.78% (95% CI, 6.66%-6.90%) for NH blacks, 3.63% (95% CI, 3.27%-4.25%) for NH Native Americans, 3.77% (95% CI, 3.57%-4.01%) for NH Asians/Pacific Islanders, and 4.32% (95% CI, 4.20%-4.46%) for Hispanics. The lifetime cumulative incidence from birth is higher in males than females for each race/ethnicity category. The high cumulative incidence of ESRD from birth among NH black men and women, relative to other racial/ethnic groups, starts early in life—around age 30—and that difference in risk increases until about age 85 years, then leveled off. We also observed a distinct cumulative incidence pattern for NH Native Americans, who had relatively high incidence rates of ESRD before age 50-60 years, but lower rates later in life (likely due to higher mortality rates from competing causes of death) (Fig 1 and 2). As a result, the cumulative incidence in both males and females rise rapidly early in life but is second lowest (to NH whites) by the end of life (Fig 3 and 4).

Tables 1 and 2 present the cumulative incidence of ESRD, by baseline age and years of follow-up in 10-year increments for all males and all females, respectively, based on data from 2013. (See tables *a-j* of Item S2 for similar tables for each sex-race/ethnicity stratum.) For example, a 40-year-old female without ESRD has a 1.29% (95% CI, 1.27%-1.30%) chance of being diagnosed with ESRD within the next 30 years (by age 70), and her lifetime risk at birth is 2.71% (95% CI, 2.69%-2.74%) (Table 2). In general, males have a higher cumulative incidence than females for a given baseline age and years of follow-up. The lifetime cumulative incidence of ESRD from birth is 3.96% (95% CI, 3.93%-3.99%) for males (Table 1) and 2.84% (95% CI, 2.81%-2.87%) for females (Table 2). Short-term cumulative incidences are relatively small, especially for the youngest age groups.

As shown in Figure 5 for the total US population using data from 2013, the exponential (density) method of risk estimation greatly overestimates the probability of being diagnosed with ESRD late in life because it assumes that persons dying from competing causes of death before ESRD onset could still become cases if they had not died of those other diseases. In contrast, the competing-risk (DevCan) method assumes that those persons dying from competing causes of death are no longer at risk for ESRD. The estimated lifetime risk from birth with the exponential method (5.17%) is 53% greater than that using the competing-risk method (3.38%).

The lifetime cumulative incidence of ESRD from birth to age 100+ in the total US population, by sex, is compared in Figure 6, using data obtained in 2013 versus 2000. The lifetime cumulative incidence increased during that decade in males from 3.53% to 3.96%; most of this change occurred after age 75 years. In contrast, the lifetime cumulative incidence decreased somewhat in females from 2.96% to 2.84%. The two racial/ethnic groups with the greatest changes in risk were NH Native Americans and Hispanics (figures *d and e* of Item S1). The lifetime cumulative incidence at birth decreased in female NH Native Americans from 6.95% to 3.63%, and in female Hispanics from 6.42% to 4.32%. In males, the lifetime cumulative incidence decreased by smaller amounts in Hispanics from 7.43% to 6.23%, and in NH Native Americans from 5.36% to 3.80%. Only NH white males and NH black males had increases in lifetime cumulative incidence of ESRD from birth during the previous decade.

Discussion

The USRDS presents an opportunity to study ESRD in the United States that is not available for most diseases. Because this nationwide surveillance program captures all reported cases of ESRD, it provides a system through which the disease can be monitored in large and small subgroups of the US population. Using USRDS data from 2013, we found that the probability that a male will be diagnosed with ESRD in his lifetime is 1.4 times that of a female. Even larger differences existed among racial/ethnic groups. We found a 2.6-fold difference in the lifetime probability of being diagnosed with ESRD between NH blacks and NH whites among males and a 3.3-fold difference between those racial/ethnic groups among females.

In previous studies, investigators have primarily focused on comparing ESRD risk in the United States among blacks and whites. Merrill et al.[5] made this comparison with USRDS data from 1993-1995, using a previous version of DevCan.[20] Merrill and colleagues found lower cumulative incidences for males and females of both racial groups using data from 1993-1995 than we found with data from 2013 (Tables 2-5 of Merrill et al.).[5] It should be noted, however, that Merrill et al. did not consider ethnicity; their estimates for blacks and especially whites included Hispanics. Grams et al.[7] also estimated lifetime cumulative incidences of ESRD in the United States for blacks and whites, using Monte Carlo simulation applied to 2009 data. Their estimates of lifetime cumulative incidence from birth for white males (3.3%), white females (2.2%), black males (8.5%), and black females (7.8%) were slightly higher than our estimates based on 2013 data. Kiberd and Clase,[6] using a Markov model applied to 2000 data, found lifetime cumulative incidences of 2.5% in white males, 1.8% in white females, 7.3% in black males, and 7.8% in black females. As with the two other studies, Kiberd and Clase did not consider ethnicity in their analyses. Despite the use of different methods and calendar periods, these three previous studies yielded results that were consistent with our findings.

Hoerger et al.[9] used the Chronic Kidney Disease (CKD) Health Policy Model to estimate the lifetime cumulative incidences of CKD stages 3, 4, and 5—determined by the estimated glomerular filtration rate (eGFR) and albuminuria levels. Although their age-specific lifetime risks of CKD stage 5 are similar to our results, they used a different definition of

kidney failure (based on laboratory values rather than initiation of renal replacement therapy), and they used much broader age categories.

By expanding our stratification on race/ethnicity relative to previous studies, we found new differences among racial/ethnic groups. The lifetime probability of being diagnosed with ESRD from birth is substantially higher for Hispanics, NH Asian/Pacific Islanders, and NH Native Americans (as well as NH blacks) than for NH whites. In an early study of race and ESRD, racial differences in ESRD risk were attributed to the larger burden of the primary causes of ESRD, including diabetes, hypertension, and glomerulonephritis, in the higher-risk racial/ethnic groups.[21] Research on these differences, however, has revealed that those primary causes do not explain most of the inequalities.[22-26] Another possible determinant of racial differences in ESRD is the *APOL1* gene, which is now recognized as a risk factor for ESRD in non-diabetic blacks.[27-32] Adjustment for other clinical,[22-26] socioeconomic,[2,22-25,33] lifestyle,[22,23] and treatment factors[25] attenuate the association between race and ESRD; but in all these studies, a residual association persists. Lack of access to appropriate medical care contributes to some of the difference between blacks and whites, but the contribution appears to be modest.[24] For two studies, inequalities between blacks and whites still persisted despite similar access to care within each study population.[2,34] Psychosocial factors such as depression, anxiety, social relations, and stress, may partly explain racial differences, but research in this area is sparse.[35,36] Most research on racial differences in ESRD risk has focused on blacks and whites. Only one study examined the difference in ESRD risk between Hispanics and NH whites.[25] As illustrated in our study, the greater risks of ESRD for other racial/ethnic groups compared to NH whites call for further inquiry into these differences.

The difference between lifetime risk at birth between men and women, favoring women, increased from 0.5% in 2000 to 1.2% in 2013. A change in lifetime risk, however, can reflect both a change in age-specific incidence rates of ESRD and/or a change in the age-specific mortality rates of other diseases (competing causes of death). Thus, to enhance the interpretation of our findings, we compared age-specific ESRD incidence rates and non-ESRD mortality rates, by sex and calendar year (Figs 1 and 2). We found that non-ESRD mortality rates decreased from 2000 to 2013 for both older men and older women; however, ESRD incidence rates increased in older men and decreased in older women. Thus, the increasing gender gap in lifetime risk was primarily due to different changes in ESRD incidence rates since 2000.

We also found that not all racial/ethnic groups had the same change in risk between 2000 and 2013. For example, the lifetime risk from birth decreased in NH Native American females by over 3%, whereas it increased in NH white and NH black males. Using the same approach for sex-race/ethnicity groups as described above for sex (figures *a-j* of Item S3), the increase in lifetime risk for NH black males appears to be due to the decrease in non-ESRD mortality rates (figures *c* and *d* of Item S3), whereas decreases in lifetime risk in both Native Americans and Hispanics appear to be due to decreases in ESRD incidence rates (figures *h-j* of Item S3). The reasons for these changes in rates and risk are unknown and provide important questions for future research.

Because cumulative incidence (risk) can be interpreted as a probability, clinicians can use risks to better communicate with patients about their chances of developing ESRD.[10] This application will be most informative in clinical practice when risks are stratified by major ESRD risk factors such as CKD stage, proteinuria, diabetes, and hypertension, in addition to age, sex, and race/ethnicity. With that additional information, our approach could also be applied in health policy planning to assess and reduce health disparities.

One limitation of our study is inherent in the lifetable method for estimating risks across age groups for any outcome event on the basis of data observed in only one year. We have assumed that the age-specific incidence and mortality rates remain constant over calendar time, steady-state conditions. In fact, the US population is not in a steady state with respect to ESRD; the overall incidence rate rose sharply in the 1980s and 1990s, leveled off in the 2000s, and has declined slightly since its peak in 2009.[1] Thus, long-term risks presented in this study are useful statistics for understanding and comparing the frequency of ESRD in demographic groups and for policy planning, but they may not correspond closely to the actual lifetime experience of persons born or observed in any given year. Indeed, such a goal would be beyond the reach of empirical methods for estimating the lifetime risk of any outcome. On the other hand, short-term risk estimates, e.g., the 10-year cumulative incidence of ESRD, are more likely to accurately reflect the probability of being diagnosed with ESRD in the next 10 years among persons in any age-sex-race/ethnicity group.

Another limitation is that some patients with terminal kidney disease die without initiating renal replacement therapy; or completion of CMS form 2728 is delayed for some patients initiating dialysis, so that death could occur without being registered with ESRD. In both situations, the result would be to undercount ESRD cases. Another possibility is that patients with acute kidney injury who recover later than expected might be misdiagnosed with ESRD, resulting in an overcount of ESRD cases. Unfortunately, determining the net impact of these misclassifications on our risk estimates is not possible. Thus, technically, we are estimating the risk of renal replacement therapy due to kidney failure.

Cumulative incidence provides an individual perspective for quantifying the incidence of disease as an average probability for specific age-sex-race/ethnicity groups; this feature is not true of incidence rates, which are strictly population measures. Using a life-table approach, applying a competing-risks framework to surveillance data, we found that ESRD risk across the lifespan varies appreciably by category of age, sex, and race/ethnicity in the United States. The lifetime cumulative incidence from birth ranged from a low of 2.0% in NH white females to a high of 8.1% in NH black males. Comparing lifetime risk estimates based on data 13 years apart, we found a small overall change in lifetime risk, but those changes varied appreciably among demographic groups, increasing the most for NH black males and decreasing the most for NH Native American females. The ratio of lifetime ESRD risk at birth for males versus females increased from about 1.2 in 2000 to 1.4 in 2013—a growing inequality that deserves attention among renal researchers. We also showed the appropriateness of the competing-risk method by documenting how the lifetime probability of being diagnosed with ESRD from birth appears more than 50% greater when competing causes of death are treated as censored. The statistical approach used in this study can be applied routinely to USRDS data to estimate the probability that individuals will be

diagnosed with ESRD. To enhance applicability in clinical practice or policy planning, however, the approach will require additional data on ESRD risk factors aside from age, sex, and race/ethnicity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

We thank the investigators at the USRDS Coordinating Center at the University of Michigan, whose comments regarding the results of this project aided in the preparation of our manuscript; the DevCan Support Team, who helped us master the application of their software; and the analysts and programmers at the University of Michigan Kidney Epidemiology and Cost Center (KECC), who provided clean datasets for the analyses.

We also thank Dr. John Ayanian for his helpful comments on a previous draft and Ruth Shamraj for her editorial assistance.

Support: This project has been funded in part with federal funds from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health, Department of Health and Human Services (contract no. HHSN276201400001C). The data reported here have been supplied by the USRDS, which is funded by the NIDDK. The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy or interpretation of the US government.

Financial Disclosure: Dr Morgenstern is a consultant at Arbor Research Collaborative for Health. Dr Robinson is the principal investigator of the Dialysis Outcomes and Practice Patterns Study (DOPPS) program (data from which were not used in this study), which is supported via grants to Arbor Research Collaborative for Health by Amgen, Kyowa Hakko Kirin, AbbVie Inc, Sanofi Renal, Baxter Healthcare, and Vifor Fresenius Medical Care Renal Pharma Ltd; additional support for specific projects and countries is also provided in Canada by Amgen, BHC Medical, Janssen, Takeda, Kidney Foundation of Canada (for logistics support); in Germany by Hexal, DGfN, Shire, WiNe Institute; and for Peritoneal DOPPS in Japan by the Japanese Society for Peritoneal Dialysis.. Dr Robinson also reports honoraria from the University of Toronto and Rhode Island Hospital, and honoraria and travel support from Kyowa Hakko Kirin. Dr Saran received an honorarium from Amgen for participating in their Third Annual Health Policy Summit in 2015. Dr Albertus declares that he has no other relevant financial interests.

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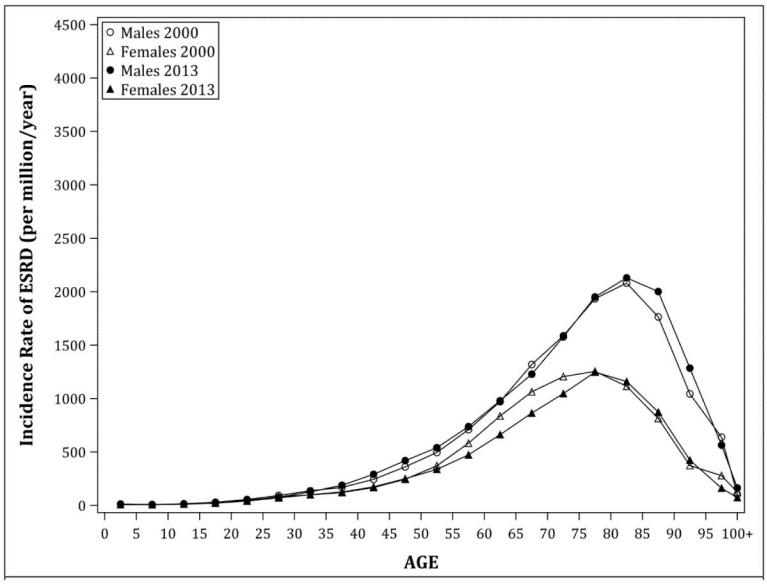

Figure 1.

Incidence rate (per million/year) of ESRD in the total US population, by age, sex, and the calendar period from which data were obtained

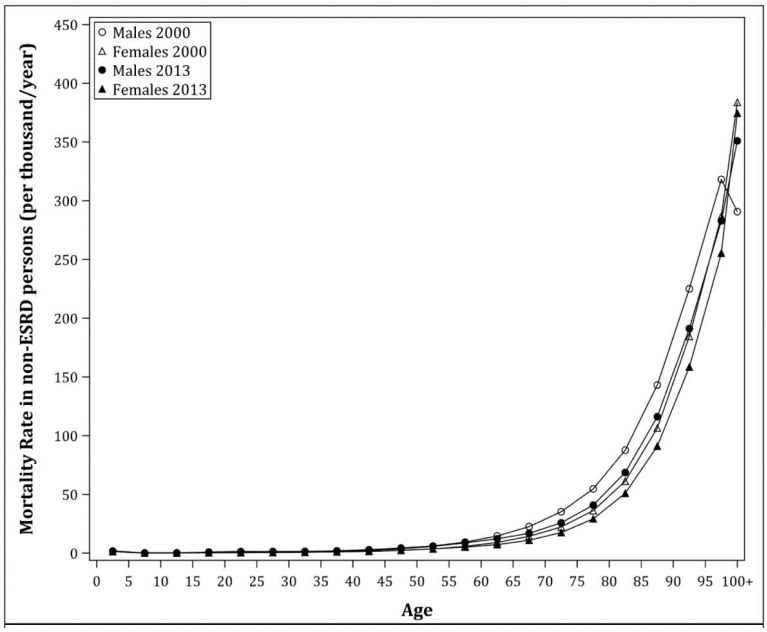

Figure 2.

Mortality rate (per thousand/year) in non-ESRD persons in the total US population, by age, sex, and the calendar period from which data were obtained

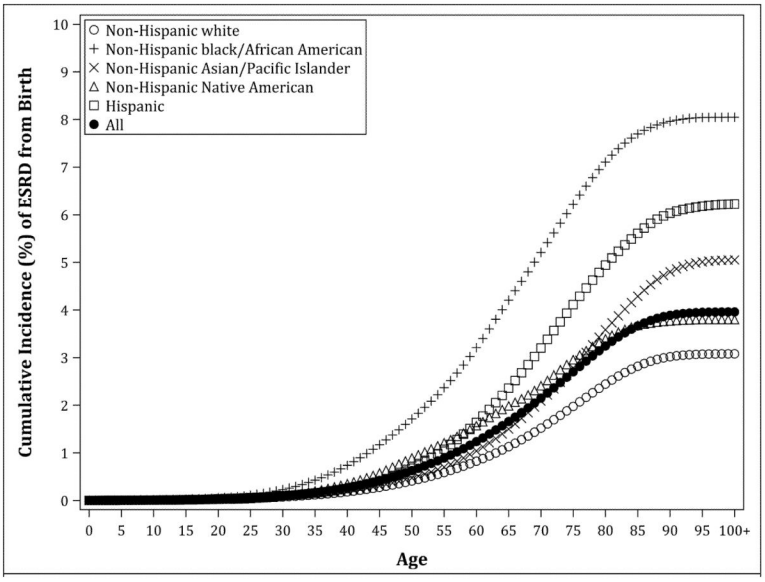

Figure 3.

Cumulative incidence (%) of ESRD from birth to age 100+, by race/ethnicity, in the US male population; based on data in 2013

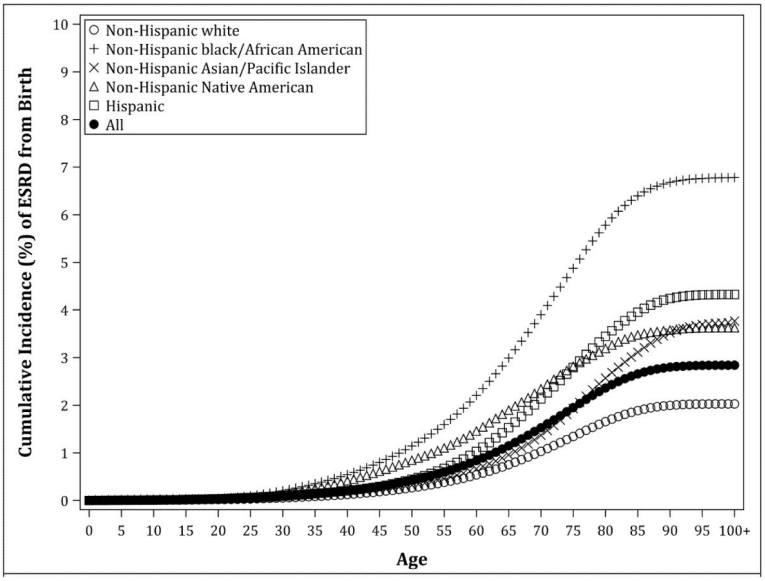

Figure 4.

Cumulative incidence (%) of ESRD from birth to age 100+, by race/ethnicity, in the US female population; based on data in 2013

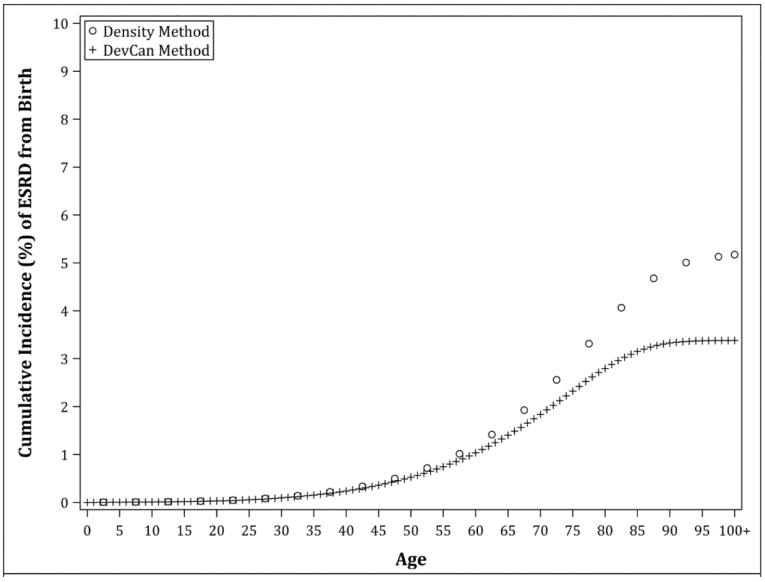

Figure 5.

Cumulative incidence (%) of ESRD from birth to age 100+, by method of estimation, in the total US population; based on data in 2013.

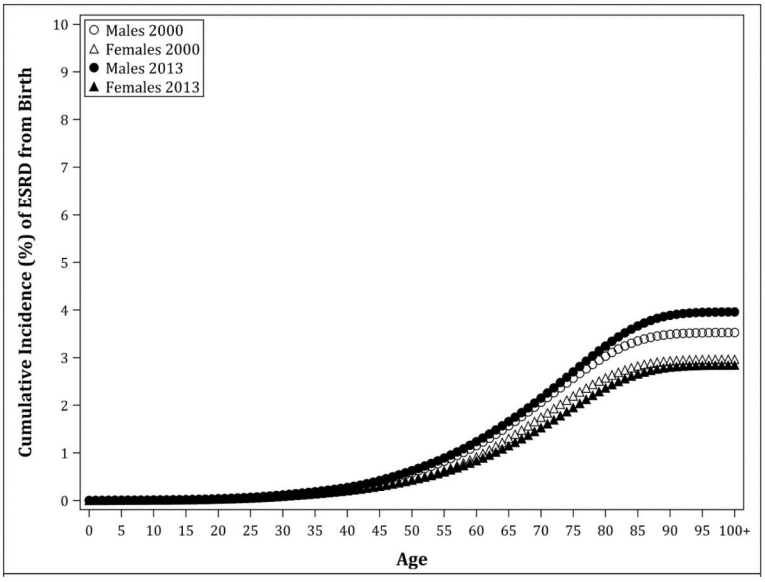

Figure 6.

Cumulative incidence (%) of ESRD from birth to age 100+ in the total US population, by sex and the calendar period from which data were obtained

Am J Kidney Dis. Author manuscript; available in PMC 2017 December 01.

Table 1

Cumulative incidence of ESRD, by baseline age and years of follow-up, in the US male population; based on data in 2013

Baseline Age (y)	Duration of Follow-up										
	10 years	20 years	30 years	40 years	50 years	60 years	70 years	80 years	90 Years	100 Years	Lifetime*
Birth	0.010 (0.009, 0.011)	0.029 (0.027, 0.031)	0.091 (0.087, 0.095)	0.246 (0.240, 0.252)	0.58 (0.57, 0.59)	1.16 (1.15, 1.17)	2.05 (2.03, 2.06)	3.14 (3.12, 3.17)	3.86 (3.83, 3.89)	3.96 (3.93, 3.99)	3.96 (3.93, 3.99)
10	0.019 (0.018, 0.021)	0.082 (0.078, 0.085)	0.238 (0.232, 0.244)	0.58 (0.57, 0.59)	1.16 (1.15, 1.17)	2.05 (2.03, 2.07)	3.16 (3.13, 3.18)	3.88 (3.85, 3.91)	3.98 (3.95, 4.01)	.	3.98 (3.95, 4.02)
20	0.063 (0.060, 0.66)	0.22 (0.21, 0.23)	0.56 (0.55, 0.57)	1.15 (1.13, 1.16)	2.04 (2.02, 2.06)	3.15 (3.13, 3.18)	3.88 (3.85, 3.91)	3.98 (3.95, 4.01)	.	.	3.98 (3.95, 4.01)
30	0.159 (0.154, 0.164)	0.504 (0.495, 0.513)	1.10 (1.08, 1.11)	2.01 (1.99, 2.02)	3.13 (3.11, 3.16)	3.87 (3.84, 3.90)	3.97 (3.94, 4.00)	.	.	.	3.97 (3.94, 4.00)
40	0.35 (0.34, 0.36)	0.96 (0.94, 0.97)	1.88 (1.86, 1.90)	3.03 (3.00, 3.05)	3.78 (3.75, 3.81)	3.88 (3.85, 3.91)	.	.	.	.	3.88 (3.85, 3.91)
50	0.625 (0.616, 0.634)	1.58 (1.57, 1.60)	2.77 (2.74, 2.80)	3.55 (3.51, 3.58)	3.65 (3.62, 3.69)	.	.	.	.	.	3.65 (3.62, 3.69)
60	1.04 (1.02, 1.05)	2.32 (2.30, 2.35)	3.16 (3.13, 3.20)	3.28 (3.24, 3.31)	.	.	.	.	.	.	3.28 (3.25, 3.31)
70	1.51 (1.49, 1.53)	2.49 (2.46, 2.53)	2.63 (2.60, 2.66)	.	.	.	.	.	.	.	2.63 (2.60, 2.67)
80	1.42 (1.39, 1.45)	1.61 (1.58, 1.64)	.	.	.	.	.	.	.	.	1.61 (1.58, 1.65)
90	0.51 (0.48, 0.54)	.	.	.	.	.	.	.	.	.	0.52 (0.49, 0.55)
100	.	.	.	.	.	.	.	.	.	.	0.07 (0.02, 0.17)

Note: Values are given as incidence (95% confidence interval) in percentages.

*Lifetime corresponds to a follow-up time of more than 100 years.

Am J Kidney Dis. Author manuscript; available in PMC 2017 December 01.

Table 2

Cumulative incidence of ESRD, by baseline age and years of follow-up, in the US female population; based on data in 2013

Baseline Age (y)	Duration of Follow-up										
	10 years	20 years	30 years	40 years	50 years	60 years	70 years	80 years	90 Years	100 Years	Lifetime*
Birth	0.007 (0.006, 0.009)	0.024 (0.022, 0.026)	0.080 (0.076, 0.084)	0.191 (0.186, 0.197)	0.40 (0.39, 0.41)	0.78 (0.77, 0.79)	1.45 (1.43, 1.46)	2.29 (2.26, 2.31)	2.78 (2.76, 2.81)	2.84 (2.81, 2.87)	2.84 (2.81, 2.87)
10	0.017 (0.015, 0.018)	0.073 (0.070, 0.076)	0.185 (0.179, 0.191)	0.393 (0.385, 0.402)	0.78 (0.77, 0.79)	1.45 (1.43, 1.47)	2.29 (2.27, 2.32)	2.79 (2.77, 2.82)	2.85 (2.83, 2.88)	.	2.85 (2.83, 2.88)
20	0.056 (0.053, 0.059)	0.169 (0.163, 0.174)	0.38 (0.37, 0.39)	0.77 (0.75, 0.78)	1.44 (1.42, 1.45)	2.28 (2.26, 2.30)	2.78 (2.76, 2.81)	2.84 (2.81, 2.87)	.	.	2.84 (2.82, 2.87)
30	0.113 (0.109, 0.117)	0.323 (0.316, 0.330)	0.71 (0.70, 0.72)	1.39 (1.37, 1.40)	2.24 (2.22, 2.26)	2.74 (2.72, 2.77)	2.80 (2.77, 2.83)	.	.	.	2.80 (2.77, 2.83)
40	0.212 (0.207, 0.218)	0.61 (0.60, 0.62)	1.29 (1.27, 1.30)	2.15 (2.13, 2.17)	2.65 (2.63, 2.68)	2.71 (2.69, 2.74)	.	.	.	.	2.71 (2.69, 2.74)
50	0.403 (0.396, 0.410)	1.10 (1.09, 1.11)	1.98 (1.96, 2.00)	2.50 (2.47, 2.52)	2.56 (2.53, 2.58)	.	.	.	.	.	2.56 (2.53, 2.58)
60	0.73 (0.72, 0.74)	1.65 (1.63, 1.67)	2.20 (2.17, 2.22)	2.26 (2.23, 2.29)	.	.	.	.	.	.	2.26 (2.24, 2.29)
70	1.02 (1.00, 1.04)	1.62 (1.60, 1.65)	1.69 (1.67, 1.72)	.	.	.	.	.	.	.	1.69 (1.67, 1.72)
80	0.78 (0.76, 0.79)	0.87 (0.85, 0.89)	.	.	.	.	.	.	.	.	0.87 (0.85, 0.89)
90	0.19 (0.18, 0.21)	.	.	.	.	.	.	.	.	.	0.20 (0.18, 0.21)
100	.	.	.	.	.	.	.	.	.	.	0.02 (0.01, 0.05)

Note: Values are given as incidence (95% confidence interval) in percentages.

*Lifetime corresponds to a follow-up time of more than 100 years.