**Supplemental Methods:**

**Decomposition analysis:**

We first used the decomposition methodology of Das Gupta[1-3](#_ENREF_1) to decompose CKD DALYs by population age structure, population growth, and epidemiologic changes. The number of DALYs at each location was obtained from the following formula:

DALY ay, py, ey = a i, y \* p y \* e i, y)

Where DALY ay, py, ey represented DALYs based on the factors of age structure, population, and DALYs rate for specific year y; a i y represents the proportion of population for the age category i of the 20 age categories in given year y; p y represents the total population in given year y; and e i, y represents DALYs rate given age category i in year y. The contribution of each factor to the change in DALYs from 1990 to 2016 was defined by the effect of one factor changing while the other factors were held constant. For example, the effect of age structure was calculated as:

[(DALY a2016, p1990, e1990 + DALY a2016, p2016, e2016)/3+ (DALY a2016, p1990, e2016 + DALY a2016, p2016, e1990)/6] - [(DALY a1990, p2016, e2016 + DALY a1990, p1990, e1990)/3+ (DALY a1990, p2016b, e1990 + DALY a1990, p1990, e2016)/6]

In order to specify the increased in DALYs that were not expected by demographic factors, we further decomposed those regions with increased effect of epidemiologic changes into 6 components (age structure, population growth and epidemiologic changes due to diabetes, hypertension, glomerulonephritis and other causes) by age group. The number of DALYs at each location and age group was obtained from the following formula:

DALYs = a  y \* p y \* (dm y+htn y +gn y +other y))

Where dm y, htn y, gn y, other y represents theCKD DALYs rate due to diabetes, hypertension, glomerulonephritis and other causes in year y and within the certain age group. Graphic results were only presented the changes in DALYs due to change of rate from the four causes in each age group.

We additionally decomposed the changes in CKD DALYs numbers due to diabetes, hypertension, glomerulonephritis and other causes. The all-cause CKD DAYs change equals to the sum of change in CKD DALYs due to these 4 causes Proportion of change attributable to specific cause was calculated as the quotient of the change of cause-specific CKD DALYs to the change of all-cause CKD DALYs.

**Health Care Access and Quality**

The Health Care Access and Quality (HAQ) index was developed by the GBD study group[4](#_ENREF_4); it is based on risk, age and population-standardized cause-specific death rates of 32 GBD causes of morality amenable to personal healthcare. It provides a summary measure on a scale of 0 to 100 to facilitate comparison of personal health-care access and quality by geography and over time[4](#_ENREF_4)

Because SDI may confound the association between age-standardized DALYs rates and HAQ, we used all data available for DALYs rates and HAQ in 1990, 1995, 2000, 2005, 2010, and 2015 to build a generalized estimating equation with identity link and an independence working correlation structure. To account for possible non-linear relationship between HAQ/SDI and DALYs, HAQ was treat as restricted cubic spline function while controlling for SDI (which was also treated as a spline function). Knots were placed every quartile for the cubic function. In addition, because the association of HAQ and DALYs may vary by GBD region, we examined the relationship within GBD region by placing it as the indicator variable in the models[5](#_ENREF_5).

**Frontier Analysis:**

In order to evaluate the relationship between burden of CKD and socio-demographic development, we applied a frontier analysis as a quantitative methodology to identify the lowest potentially achievable age-standardized DALYs rate on the basis of development status as measured by the Socio-demographic Index (SDI). The DALYs frontier pinpoints the minimum DALYs that could be attained for every country or territory given its SDI. Distance from the frontier is termed effective difference; a large effective difference from the frontier suggests there may be unrealized opportunities for gains or improvement (reduction in CKD DALYs) that should be possible based on the country or territory’s place on the development spectrum. A data envelope analysis, which allows for the delineation of non-linear frontiers, utilizing the free disposal hull method was developed to produce a frontier for age-adjusted CKD DALYs by SDI[4](#_ENREF_4), [6](#_ENREF_6) using data from 1990-2016. In order to account for uncertainty, we used 1,000 bootstrapped samples of the data, randomly sampling with replacement from all countries and territories in all years. Mean CKD DALYs at each SDI value from the bootstrapped samples was computed. LOESS regression with local polynomial degree of 1 and span of 0.2 was then developed to generate a smoothed frontier[4](#_ENREF_4). To exclude influence of outliers, super-efficient countries were excluded in the generation of the frontier[4](#_ENREF_4). To understand the relationship of age-standardized CKD DALYs rates vis-à-vis the frontier in 2016, we calculated the effective difference (the absolute distance from the frontier) using 2016 SDI and age-standardized CKD DALYs rate data point for each country or territory. Countries or territories with lower DALYs than the frontiers were assigned a zero distance.

**References:**

S1. P. DG. *Standardization and decomposition of rates: a user’s manual, Pages 19-36*, 1993.

S2. Das Gupta P. Standardization and decomposition of rates from cross-classified data. *Genus* 1994; **50:** 171-196.

S3. Chevan A, Sutherland M. Revisiting Das Gupta: refinement and extension of standardization and decomposition. *Demography* 2009; **46:** 429-449.

S4. Access GBDH, Quality Collaborators. Electronic address cue, Access GBDH*, et al.* Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990-2015: a novel analysis from the Global Burden of Disease Study 2015. *Lancet* 2017.

S5. Bowe B, Xie Y, Li T*, et al.* Particulate Matter Air Pollution and the Risk of Incident CKD and Progression to ESRD. *Journal of the American Society of Nephrology : JASN* 2018; **29:** 218-230.

S6. Xie Y, Bowe B, Xian H*, et al.* Rate of Kidney Function Decline and Risk of Hospitalizations in Stage 3A CKD. *Clinical journal of the American Society of Nephrology : CJASN* 2015; **10:** 1946-1955.