

A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010

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Chronic kidney disease (CKD) is a major risk factor for end-stage renal disease, cardiovascular disease, and premature death. Here we estimated the global prevalence and absolute burden of CKD in 2010 by pooling data from population-based studies. We searched MEDLINE (January 1990 to December 2014), International Society of Nephrology Global Outreach Program-funded projects, and bibliographies of retrieved articles and selected 33 studies reporting gender- and age-specific prevalence of CKD in representative population samples. The age-standardized global prevalence of CKD stages 1–5 in adults aged 20 and older was 10.4% in men (95% confidence interval 9.3–11.9%) and 11.8% in women (11.2–12.6%). This consisted of 8.6% in men (7.3–9.8%) and 9.6% in women (7.7–11.1%) in high-income countries, and 10.6% in men (9.4–13.1%) and 12.5% in women (11.8–14.0%) in low- and middle-income countries. The total number of adults with CKD was 225.7 million (205.7–257.4 million) men and 271.8 million (258.0–293.7 million) women. This consisted of 48.3 million (42.3–53.3 million) men and 61.7 million (50.4–69.9 million) women in high-income countries, and 177.4 million (159.2–215.9 million) men and 210.1 million (200.8–231.7 million) women in low- and middle-income countries. Thus, CKD is an important global-health challenge, especially in low- and middle-income countries. National and international efforts for prevention, detection, and treatment of CKD are needed to reduce its morbidity and mortality worldwide.

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Chronic kidney disease (CKD) is a major global health burden because of its high prevalence and associated risk of end-stage renal disease (ESRD), cardiovascular disease (CVD), and premature death.^{1–3} The Global Burden of Disease Study 2013 estimated 956,200 deaths worldwide were directly attributable to CKD in 2013, representing a 134.6% increase from 1990.⁴ In addition, CKD was ranked as the 19th highest cause of years of life lost in 2013.⁴ This number of deaths and years of life lost has almost certainly underestimated the disease burden of CKD, as it probably only captures deaths due to ESRD. It is well documented that CVD causes most of the deaths in patients with CKD.^{2,3} Worldwide, an estimated 1.9 million ESRD patients were on renal replacement therapy in 2010.⁵ Medical costs for the treatment of CKD and ESRD are enormous and represent an immense financial burden to families and society as a whole. For example, overall US Medicare expenditures for CKD and renal replacement therapy in 2010 were 41.0 and 32.9 billion US dollars, respectively, accounting for 24% of the total Medicare budget.⁶

Diabetes and hypertension are the leading causes of CKD in all high-income countries and many low- and middle-income countries.¹ The global epidemic of diabetes and hypertension could lead to a worldwide increase in prevalence and in the number of individuals with CKD and its complications without effective interventions.^{7,8} Although the prevalence of CKD has been reported in individual countries, global estimates of CKD prevalence and absolute burden are not available. Accurate estimates of the worldwide prevalence of this condition are essential as a source of primary information and for rational planning of health services. Quantifying the global burden of CKD will allow public health policy makers around the world to assign sufficient priority and resources to its prevention and treatment. We aimed to estimate the global prevalence and absolute burden of CKD in 2010 by pooling data from population-based studies worldwide.

RESULTS

A total of 35 reports from 33 studies conducted in 32 countries, which represent 48.6% of the global population ≥ 20 years old, were included in the analysis (Figure 1).^{9–43} Among the included studies, 16 were conducted in nationally representative samples and the rest were in multisite or regional samples (Table 1). All included studies were published between 2006 and 2013. The crude prevalence of CKD stages 1–5 varied from 4.5% in South Korea to 25.7% in El Salvador in men, and from 4.1% in Saudi Arabia to 16.0% in Singapore in women; stages 3–5 varied from 1.3% in China to 15.4% in Nepal in men and from 1.7% in Singapore to 21.3% in Nepal in women.

The age-standardized global prevalence of CKD stages 1–5 among adults aged ≥ 20 years in 2010 was 10.4% in men (95% confidence interval (CI) 9.3–11.9%) and 11.8% in women (11.2–12.6%). The age-standardized prevalence was 8.6% in men (7.3–9.8%) and 9.6% in women (7.7–11.1%) in high-income countries, and 10.6% in men (9.4–13.1%) and 12.5% in women (11.8–14.0%) in low- and middle-income countries (Table 2). The age-standardized global prevalence of CKD stages 3–5 among adults aged ≥ 20 years in 2010 was 4.7% in men (95% CI 3.4–6.7%) and 5.8% in women (4.4–8.1%). The age-standardized prevalence was 4.3% in men (3.5–5.2%) and 5.7% in women (4.4–7.6%) in high-income countries, and 4.6% in men (3.1–7.7%) and 5.6% in women (3.9–9.2%) in low- and middle-income countries.

The estimated total number of adults with any stage of CKD in 2010 was 225.7 million (205.7–257.4 million) men

and 271.8 million (258.0–293.7 million) women worldwide. The estimated total number of adults with any stage of CKD was 48.3 million (42.3–53.3 million) men and 61.7 million (50.4–69.9 million) women in high-income countries, and 177.4 million (159.2–215.9 million) men and 210.1 million (200.8–231.7 million) women in low- and middle-income countries (Table 2). The estimated total number of adults with CKD stages 3–5 in 2010 was 100.6 million (72.0–146.4 million) men and 135.8 million (102.7–193.9 million) women worldwide. The estimated total number of adults with CKD stages 3–5 was 26.1 million (22.0–31.1 million) men and 44.1 million (35.3–54.8 million) women in high-income countries, and 74.5 million (50.3–123.5 million) men and 91.7 million (66.7–143.1 million) women in low- and middle-income countries.

The prevalence of CKD (both stages 1–5 and stages 3–5) increased with age (Figure 2). Overall, men and women had similar prevalences of CKD in younger age groups. Subsequently, women had higher prevalences than men in middle-age groups, and this sex difference became even greater in older age groups, especially for stages 3–5. The pattern of age-related increase in CKD prevalence in men and women was consistent in high-income and low- and middle-income countries (Table 2).

In general, age-specific prevalences of CKD were higher in low- and middle-income countries compared with high-income countries, except in those aged ≥ 70 years, whose prevalence was higher in high-income countries for both men and women. The absolute numbers of men and women with

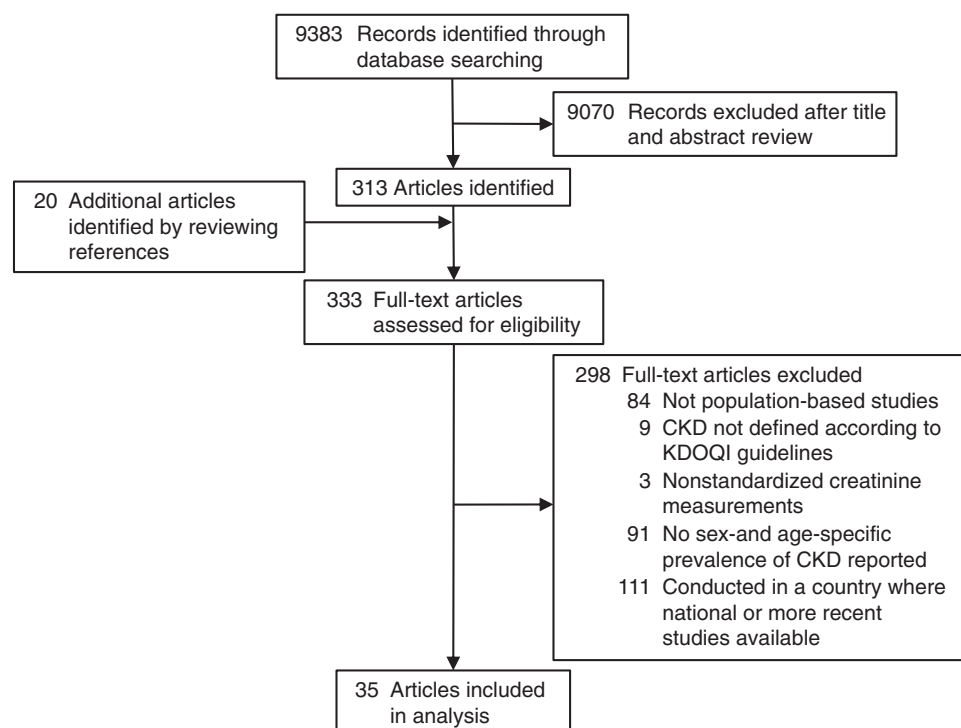


Figure 1 | Study selection process. CKD, chronic kidney disease; KDOQI, Kidney Disease Outcomes Quality Initiative.

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