# Disease burden and challenges of chronic kidney disease in North and East Asia

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North and East Asia includes mainland China (including Hong Kong), Japan, Mongolia, North Korea, South Korea, and Taiwan (Figure 1). The region comprises a population of more than 1.6 billion, with considerable diversities in economy, living habits, climates, and environments. North Korea is classified as a low-income country by World Bank criteria, whereas China and Mongolia belong to the upper middle income group, and Japan, Hong Kong, South Korea, and Taiwan to the high-income group with highly developed economies. Therefore, the burden and spectrum of chronic kidney disease (CKD), as well as strategies to prevent and manage the disease, should be highly diverse.

## Disease burden of CKD

CKD is common in the region. The prevalence among the general adult population was 10.8% in mainland China, 11.9% in Taiwan, 12.9% in Japan, 13.7% in South Korea, and 13.9% in Mongolia.[1,2] So far, North Korea has no formal data reported on CKD prevalence. Although the total prevalence is equivalent, Taiwan, Japan, and South Korea reported a much higher prevalence of reduced estimated glomerular filtration rate (typically >5%) than that in China (only 1.7% in a national survey).[1] This indicates that a large proportion of CKD patients in China is in the early stages with proteinuria as a sole indicator.

Regarding the incidence and prevalence of treated end-stage kidney disease (ESKD), Taiwan has the highest numbers around the world, which was 455.0 per million population (pmp)/yr and 3219.4 pmp in 2014, according to the statistics released by the United States Renal Data System.[3] The corresponding figures in Japan and South Korea were 284.6 pmp/yr and 2504.8 pmp, 256.0 pmp/yr and 1571.5 pmp, respectively. Nearly one-half of the ESKD cases were attributed to diabetes.[3] China reported a much lower burden of ESKD, with an incidence and prevalence of dialysis at 15.4 pmp/yr and 237.3 pmp, respectively, in 2011. However, the corresponding rates were higher in big cities. The incidence


**Figure 1 | Countries/regions in North and East Asia.**

and prevalence were 107.3 pmp/yr and 524.6 pmp in Beijing and 82.9 pmp/yr and 544.7 pmp in Shanghai in 2011.[4] From 2001/2002 to 2013/2014, the prevalence of ESKD increased by 48.2%, 85.0%, and 124.4% in Japan, Taiwan, and South Korea, respectively. One of the reasons for this significant rise in ESKD prevalence was aging; the elderly population (65 years or above) not only constituted the largest proportion of ESKD cases (around 80% in both Japan and Taiwan), but this population also continued to increase in incident ESKD during the past decade.[3] The large number of patients with ESKD will impose a huge economic burden on the society as they inevitably incur high medical expenses through renal replacement therapy (RRT) (Table 1).

### Changing pattern in spectrum of CKD

Diabetes mellitus and hypertension are the leading causes of CKD worldwide. In North and East Asia, the same pattern is observed in high-income countries, while the spectrum of CKD and ESRD in middle-income countries is still undergoing transition. In the past 3 decades, China witnessed an economic boom, and it is speculated that a high dietary caloric intake and a sedentary lifestyle led to a considerable increase in metabolic diseases. Since the surge in the prevalence of hypertension and diabetes in the 1990s, metabolic diseases may eventually take over glomerulonephritis as the main cause of CKD and ESKD in China. Based on a national in-patient database of China, it was found that the proportion of hospital discharges from CKD due to diabetes mellitus had surpassed that from glomerulonephritis since 2010, and that the magnitude of this gap was more significant in urban cities than in rural areas.[5] Regarding the etiology of glomerulonephritis, the disease spectrum is also changing. Based on an 11-year (2004–2014) renal biopsy series with 71,151 native biopsies in 283 cities in China, Xu *et al.*[6] found that the frequency of membranous nephropathy increased by 13% annually and that the risk of the disease was associated with long-term exposure to high levels of fine particulate matter of $<2.5$ μm, which is the primary composite of air pollution identified in China.

Another important reason for the heightening of CKD in North and East Asia is the wide use of certain potentially toxic traditional herbal medicines. The now well-known nephrotoxin, aristolochic acid (AA), is contained in some commonly used traditional herbal products. According to the China National Survey of CKD, the prevalence of self-reported long-term intake of AA-containing herbal medicine was 1.5%.[2] Although few incidence or prevalence investigations had been conducted in the region, the disease burden of AA-associated nephropathy could be huge in the setting of ubiquitous use of herbal medicines in the past. However, after the official banning of AA-containing herbal medicine in China, AA-associated nephropathy cases decreased significantly though detailed data are lacking. Another cause of drug-induced CKD is the abuse of nonsteroidal anti-inflammatory drugs (NSAIDs), which could be easily accessed in China. NSAIDs are commonly used to relieve labor-associated chronic tiredness or used as a painkiller, which may lead to addiction, especially in rural areas of China. Long-term exposure to NSAIDs induces chronic interstitial nephritis and is an important cause of CKD in China. The national survey of CKD in China showed the estimated prevalence of regular use of NSAIDs to be 3.6%.[2]