Prevalence of chronic kidney disease (CKD) in the Japanese general population predicted by the MDRD equation modified by a Japanese coefficient

Received: December 7, 2006 / Accepted: January 30, 2007

Abstract

Background. The number of patients with end-stage renal disease (ESRD) in Japan has continuously increased in the past three decades. In 2005, 36,063 patients whose average age was 66 years entered a new dialysis program. This large number of ESRD patients could be just the tip of the iceberg of an increasing number of patients with chronic kidney disease (CKD). However, to date, a nationwide epidemiological study has not been conducted yet to survey the CKD population.

Methods. Data for 527,594 (male, 211,034; female, 316,560) participants were obtained from the general adult popula-
tion aged over 20 years who received annual health check programs in 2000–2004, from seven different prefectures in Japan: Hokkaido, Fukushima, Ibaraki, Tokyo, Osaka, Fukuoka, and Okinawa prefectures. The glomerular filtration rate (GFR) for each participant was estimated from the serum creatinine values, using the abbreviated Modification of Diet in Renal Disease (MDRD) study equation modified by the Japanese coefficient.

**Results.** The prevalences of CKD stage 3 in the study population, stratified by age groups of 20–29, 30–39, 40–49, 50–59, 60–69, 70–79, and 80–89 years, were 1.4%, 3.6%, 10.8%, 15.9%, 31.8%, 44.0%, and 59.1%, respectively, predicting 19.1 million patients with stage 3 CKD in the Japanese general adult population of 103.2 million in 2004. CKD stage 4 + 5 was predicted in 200,000 patients in the Japanese general adult population. Comorbidity of hypertension, diabetes, and proteinuria increased as the estimated GFR (eGFR) decreased. The prevalence of concurrent CKD was significantly higher in hypertensive and diabetic populations than in the study population overall when CKD was defined as being present with an eGFR of less than 60 ml/min per 1.73 m² instead of less than 60 ml/min per 1.73 m².

**Conclusions.** About 20% of the Japanese adult population (i.e., approximately 19 million people) are predicted to have stage 3 to 5 CKD, as defined by a GFR of less than 60 ml/min per 1.73 m².

**Key words** CKD · Hypertension · Proteinuria · Diabetes · MDRD equation

---

**Introduction**

Japanese society has a considerable aging population, which number will presumably continue to increase for at least the next two decades. With the prediction that more than 25% of the Japanese population will be elderly (over 65 years old) in 2025, the population shift may affect the spectrum of disease among Japanese. The trend in the incidence of renal disease, especially chronic kidney disease (CKD) and end-stage renal disease (ESRD) will increase as the elderly population increases, because renal function is known to decrease with aging. In fact, of 200,000 dialysis patients with ESRD in 2005, 36,063 patients, whose average age was 66 years, were new to dialysis. Because the number of new dialysis patients has been increasing in the past 30 years, the number of people with latent CKD appears to be enormous. Thus, it was necessary to estimate the prevalence of CKD among Japanese with a nationwide epidemiological study.

In the United States, the Kidney Disease Outcome Quality Initiative (K/DOQI) of the National Kidney Foundation proposed guidelines for the diagnosis and classification of CKD. The basic principles of the clinical guidelines were accepted as international guidelines and have been used in the activities of Kidney Disease: Improving Global Outcomes (KDIGO). In the clinical guidelines, CKD prevalence and the distribution of the glomerular filtration rate (GFR) in the American general population was predicted from the GFR estimated with the Modification of Diet in Renal Disease (MDRD) study equation. The equation was accurate when a coefficient modifier was used for some of the ethnic populations. However, coefficient modifiers for Asian populations have not been established, except that for Chinese.

In our previous study, we calculated a coefficient multiplier of 0.881 to adapt the abbreviated MDRD in the Japanese population, using GFR data for inulin clearance in Japanese CKD patients, which provided a reasonable estimated GFR for Japanese CKD patients with a GFR below 60 ml/min per 1.73 m². In 2004, the Japanese Society of Nephrology launched the Japan Chronic Kidney Disease Initiatives (J/CKDI) project. The first aim of the J/CKDI was to survey the prevalence of CKD, defined by a GFR of less than 60 ml/min per 1.73 m², in the Japanese general population. This is a report of the survey, in which we estimated the prevalence of CKD among Japanese, using participants’ GFR estimated by the MDRD equation modified by the Japanese coefficient. The data were sampled across half a million adults in the general population who participated in annual check programs conducted in seven prefectures of Japan.

**Methods**

**Study population**

In this study in the adult population, serum creatinine values were obtained from 527,594 people, aged 20 years or older (male, 211,034; female, 316,560), who participated in large-scale annual community-based, company-based, and hospital-based health check programs conducted in seven prefectures of Japan – Hokkaido, Fukushima, Ibaraki, Tokyo, Osaka, Fukuoka, and Okinawa – in 2000 to 2004. The prevalence of proteinuria, hypertension, and diabetes in the study population was calculated from participants who had data measurements for each condition. The prevalence of proteinuria was 4.1%; it was detected in 12,238 of 298,537 participants in whom urinary protein in spontaneous voided fresh urine was measured using the dipstick test, with proteinuria defined as urinary protein (1+) or more (about ≥30 mg/dl). Hypertension, defined by sitting blood pressure of 140/90 mmHg or more, was detected in 87,305 of 300,877 participants (29.0%). The prevalence of diabetes, defined as serum HbA1c higher than 6.0%, was 6.2% (detected in 14,419 of 232,418 participants). All the participants were kept anonymous and the study was conducted according to the Japanese law of privacy protection.

**Calibration of serum creatinine values to the value of noncompensated Jaffe method**

Many laboratories in Japan have changed the creatinine assay method they use, from the noncompensated Jaffe...