Anticipated Increase in the Number of Patients Who Require Dialysis Treatment among the Aging Population of Japan

Minako Wakasugi[1], Junichiro James Kazama[3], and Ichiei Narita.[2]

[1]Center for Inter-organ Communication Research and [2]Division of Clinical Nephrology and Rheumatology, Niigata University Graduate School of Medical and Dental Science, and [3]Division of Blood Purification Therapy, Niigata University Medical and Dental Hospital, Japan

Corresponding Author:

Minako Wakasugi, M.D., M.P.H., Ph.D.

1-757 Asahimachi, Chuo-ku, Niigata 951-8510, Japan

Tel: +81-25-227-2116

Fax: +81-25-227-2116

E-mail: minakowa@med.niigata-u.ac.jp

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Abstract

Background

The aging population is anticipated to have a large impact on the number of incident dialysis patients, as the risk of end-stage kidney disease increases with age. This study aimed to examine trends in the sex- and age-specific incidence rates of dialysis between 2008 and 2012, and to assess the impact of population aging on the number of incident dialysis patients over the next decade in Japan.

Methods

Incidence was calculated using published data and Japan's population statistics. The 2012 incidence was extrapolated, and projected future demographic changes within the Japanese population were used to estimate the number of incident dialysis patients in 2020 and 2025.

Results

As a general trend, the sex- and age-specific incidence rates of dialysis decreased gradually between 2008 and 2012, except among men aged ≥80 years. The total number of incident dialysis patients was projected to increase by 12.8% from 36 590 in 2012 to 41 270 in 2025. Greater increases were observed in the oldest age group (≥85 years). In 2025, the number of incident dialysis patients in this group was projected to increase by 92.6% in men and 62.2% in women.

Conclusions

This study shows the number of patients who initiate dialysis treatment is projected to increase over the next decade in Japan due to aging of the population. Effective strategies are needed to offset the challenges faced by the aging population, with a particular focus

on octogenarians and older, given the notable proportion of patients requiring dialysis treatment in the future.

Key Words: Aging, dialysis, epidemiology, incidence, population projection

Introduction

Population aging is a global phenomenon that is both inevitable and predictable (1). While Europe and Japan were among the first to experience population aging, this demographic change is taking place worldwide, with each country experiencing a different stage of this transition (1).

Patients with chronic kidney disease (CKD) have a high risk not only for end-stage kidney disease (ESKD) but also for cardiovascular disease and all-cause mortality (2, 3). Moreover, the increasing number of dialysis patients is a public health problem of growing importance, as this poses a serious economic threat to governments due to the high cost of dialysis. Predicting the number of incident dialysis patients will thus have important clinical and public health implications. As the risk of ESKD increases with age (4, 5), we hypothesize that an aging population will have a large impact on the number of incident dialysis patients.

This study aimed to examine trends in the sex- and age-specific incidence rates of dialysis between 2008 and 2012, and to assess the impact of population aging on the number of incident dialysis patients over the next decade.

Materials and Methods

Sources of Data

The numbers of incident dialysis patients were extracted from data published by the Committee of Renal Data Registry of the Japanese Society of Dialysis Therapy (JSDT) from 2008 to 2012 (5-9). The JSDT registry data collection techniques and the characteristics of the dialysis population have been described in detail elsewhere (5-8).

Briefly, the JSDT registry collects annual data by sending questionnaires to all dialysis facilities in Japan. Response rates were 99.0% in 2008 (6), 98.5% in 2009 (7), 98.6% in 2010 (8), 99.0% in 2011 (5), and 99.0% in 2012 (9).

Population data from 2008 to 2012 were extracted from the national census (10-14). Information about projected future demographic changes within the Japanese population was obtained from the Department of Population Dynamics Research, National Institute of Population and Social Security Research (*Population Projections for Japan (January 2012): 2011 to 2060*) (15).

The current analyses used existing data without any individual patient identifiers. The study was performed according to the principles of the Declaration of Helsinki, Japanese privacy protection laws, and ethical guidelines for epidemiological studies published by the Ministry of Education, Science and Culture, and the Ministry of Health, Labour and Welfare in 2005.

Data Analyses

First, the sex- and age-specific incidence rates of dialysis were calculated for each year between 2008 and 2012 by dividing the number of incident dialysis patients for each age-gender category by the total number of people in the corresponding population. Age was analyzed in five-year increments, starting at <5 years and ending at ≥85 years.

Next, the projected numbers of incident dialysis patients in 2020 and 2025 were calculated by multiplying the projected population for each age-gender category by the corresponding age- and sex-specific incidence rates from 2012 (i.e., the most recent year with available information about the incidence of dialysis in Japan). This estimation was

based on the assumption that the age- and sex-specific incidence rates observed in 2012 will remain constant over the next decade despite the changes in population size and age structure predicted by the Population Projections for Japan. The Population Projections for Japan are based on three alternative assumptions about future changes in both fertility and mortality, with low, medium, and high variants of each. The combination of these variants results in a total of nine projections. This study utilized data from a medium fertility and medium mortality scenario. Sensitivity analyses used data from the two extreme scenarios, i.e., a low fertility and high mortality scenario, and a high fertility and low mortality scenario.

Results

The incidence rates of dialysis by sex and age group are shown in Figure 1. The incidence increased with age, peaking between age 80 and 84 years in both sexes. As a general trend, the incidence showed a gradual decrease between 2008 and 2012 in all age groups for both sexes, except in the two oldest age groups (80-84 and ≥85 years) in men.

Table 1 shows the observed numbers of male incident dialysis patients in 2012 and the projected numbers for 2020 and 2025 for the three selected scenarios: medium fertility and medium mortality, low fertility and high mortality, and high fertility and low mortality. Assuming unchanged age- and sex-specific incident rates from 2012 to 2025, the total annual number of patients initiating dialysis treatment was projected to increase by 2 370 (from 24 688 to 27 058; 9.6%) in 2020, and by 3 195 (from 24 688 to 27 883; 12.9%) in 2025. These figures were based on the changes in age structure and population size projected by the medium fertility and medium mortality scenario. Greater increases

in incidence of dialysis were observed in the oldest age group (≥85 years). The number of incident dialysis patients in this age group was projected to increase by 92.6% in 2025. Corresponding results were not substantially changed under the two other scenarios.

Table 2 shows the observed number of female incident dialysis patients in 2012 and the projected numbers for 2020 and 2025 for the three selected scenarios. The increase is projected to be 1 061(from 11 899 to 12 960; 8.9%) in 2020 and 1 488 (from 11 899 to 13 387; 12.5%) in 2025, based on the medium fertility and medium mortality scenario. Greater increases were also observed in the oldest age group, with the number of incident dialysis patients projected to increase by 62.2% in 2025. Corresponding results were not substantially changed under the two other scenarios.

Discussion

The presented data support the hypothesis that the aging population will have a large impact on the number of incident dialysis patients over the next decade in Japan. Assuming unchanged age- and sex-specific incident rates from 2012 to 2025, the annual number of patients who need to initiate dialysis treatment is expected to increase substantially over the next decade in Japan due to aging of the population. Moreover, greater increases were observed in the oldest age groups (≥85 years) in both sexes. These findings suggest that effective strategies to delay or prevent ESKD are urgently needed to offset the challenges faced by the aging population, particularly in octogenarians and older with the notable increases in the number of patients requiring dialysis treatment.

Incidence rates of dialysis gradually decreased between 2008 and 2012 in all age groups for both sexes, except in the two oldest age groups in men. Although the reason

underlying this decrease is unclear, many activities may have contributed to preventing the development and progression of CKD, such as World Kidney Day. These activities have been implemented in Japan since about 2007, and may have contributed to the decreasing incidence as a general trend. Registry data from other countries have reported a similar trend. For instance, the United States Renal Data System (USRDS) reported that the adjusted incidence rates of ESKD for patients aged 45–64 and 65–74 in 2013 were lower than in 2000 (16). The Renal Association UK Renal Registry reported an overall leveling off of incidence rates in the last seven years (17). The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) reported stable or decreased rates of accepting new patients for all age groups under 85 in Australia in 2012 compared with 2011. Moreover, in New Zealand, decreases were observed in the 65-69, 70-74, 80-84, and ≥85 age groups in 2012 (18).

With respect to older age groups, the ERA-EDTA Registry reported substantial variation in incidence rates between countries in the oldest age category of ≥75 years at the start of renal replacement therapy (19). ANZDATA reported increased acceptance rates of new patients among those ≥85 years in Australia compared with 2011 (18). In the present study, the incidence rates of dialysis also increased in the two oldest age groups in men. Although the underlying reason is unknown, this might be attributed to better life expectancy and an increased incidence of nephrosclerosis as the primary cause of ESKD in Japan. The average male life expectancy increased slightly from 79.29 years in 2008 (20) to 79.94 years in 2012 (21), and nephrosclerosis is now the third most common primary disease next to diabetic nephropathy and chronic glomerulonephritis in Japan (9).

Indeed, the rate of nephrosclerosis as the cause of ESKD increased from 10.6% in 2008 to 12.3% in 2012 (5-9).

This study assumes that the sex- and age-specific incidence rates in 2012 will remain the same over the next 10 years. Since the main aim of this study was not to predict the exact number of incident dialysis patients, but rather to assess the impact of population aging on the number of such patients, this assumption was made despite observed decreases in sex- and age-specific incidence rates. The assumption may be somewhat pessimistic, particularly given the potentially positive effects of recent activities aimed at preventing the development and progression of CKD which are beginning to emerge and are likely establish themselves in the next decade. Moreover, initiatives have been advanced which aim to initiate and continue dialysis for elderly patients with ESKD in Japan. All of these point to the possibility that the number of incident dialysis patients will increase less than projected. It should be noted, however, that this assumption does not account for the fact that the prevalence of diabetes and obesity is increasing in Japan (22). Since diabetic nephropathy is the leading cause of ESKD in Japan (5), it is possible that the sex- and age-specific incidence rates may increase over the next 10 years. In that case, the number of incident dialysis patients will increase more than projected.

This study shows that greater increases are anticipated in the oldest age groups (≥85 years) in both sexes. By 2025, the number of incident dialysis patients in this group is projected to nearly double in men and increase by 62.2% in women. Given the increase in very elderly incident dialysis patients and attendant morbidity (4, 23), high mortality (24), and costs, studies addressing patients in these age groups are urgently needed. Many

trials evaluating therapies for CKD exclude older patients, and most do not provide guidance on how to manage the comorbidities that often accompany CKD in elderly patients (4).

Though nephrologists cannot prevent the population from aging, numerous possible measures exist to prevent increases in the development and progression of CKD. For example, modifications to lifestyle-related factors (25, 26) would be effective in the primary prevention of albuminuria and proteinuria, which are cardinal signs and prognostic markers of kidney disease. Screening of high-risk individuals as well as promoting awareness (27, 28) would also be effective for the secondary prevention of CKD. To offset the challenges faced by the aging population, more effective strategies to delay or prevent ESKD are urgently needed.

There are some limitations to this study worth noting. First, only patients who initiated dialysis treatment were included in this study, as data were unavailable for patients who did not initiate dialysis or who received preemptive kidney transplant. However, the number of preemptive kidney transplant patients is small in Japan, with only 101 patients being reported in 2009 (29). Second, the oldest group included all individuals over 85 years of age. Therefore, the increasingly important changes that take place among the oldest part of the population were not considered in this study.

Despite these limitations, this study has several strengths. Data were extracted from a nationwide survey of Japanese dialysis facilities and a national census. These findings are thus considered broadly generalizable to the Japanese population. Moreover, although these calculations are based on Japanese data, countries that have experienced similar trends in disease and population growth could possibly expect results similar to

those in Japan. To the best of our knowledge, this study is the first to demonstrate that population aging will lead to an increase in the number of incident dialysis patients, despite gradually decreasing sex- and age-specific incidence rates. Awareness of these trends could help guide future health promotion activities and health policy.

Conclusion

Despite observed decreases in sex- and age-specific incidence rates, the number of incident dialysis patients is projected to increase over the next decade as a result of population aging in Japan. Since the main aim of this study was not to predict the exact number of incident dialysis patients, but rather to assess the impact of population aging on the number of such patients, the anticipated increase in the number of patients who require dialysis treatment might never materialize. However, population aging is both inevitable and predictable. Thus, effective strategies to delay or prevent ESKD are urgently needed to offset the challenges faced by the aging population—particularly octogenarians and older— given the notable proportion of patients requiring dialysis treatment in the future.

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Figure Legend

Figure 1. Incidence rates of dialysis by sex and age group in Japan, 2008-2012.

This figure is a bar graph with a trend line that represents the incident rate (per million population) of dialysis, by age group and year (2008-2012), as reported by the Japanese Society of Dialysis Therapy registry. The graph shows a gradual decrease in the incidence of dialysis for all age groups except male patients aged 80 years or older.