Use of JSDT Dialysis Tables to Compare the Local and National Incidence of Dialysis

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Abstract

The Japanese Society for Dialysis Therapy generates many tables of data on dialysis patients in their annual reports. These tables, derived from over 37 000 patients who started dialysis in 2008, allow comparison of the local incidence of new dialysis patients with the national incidence by estimating a standardized incidence ratio and confidence interval. Since this method adjusts for age and gender, it may be useful to evaluate local strategies for managing chronic kidney disease, including the response to campaigns and local quality assurance. Furthermore, the end-stage renal disease population of other countries can also be directly compared by this method. That is, the age- and gender-adjusted incidence of dialysis can be calculated for another country and compared with the national data for Japan. This might be one step toward improving local care and preventing the progression of chronic kidney disease.

Key Words: Chronic kidney disease, dialysis, incidence, methodology, confidence intervals

Introduction

Each year more than 30 000 new patients start dialysis in Japan (1), and approximately 13.3 million people are estimated to have chronic kidney disease (CKD) in this country (2). As patients with CKD have a high risk of not only progression to end-stage renal disease (ESRD), but also cardiovascular disease and all-cause mortality (3,4), this is a public health problem of growing importance. To prevent the development and progression of CKD, many activities such as World Kidney Day have been carried out in Japan at both the national and local level. However, the effectiveness of these campaigns and educational programs has not been evaluated at a local level. To improve the response to these activities and for quality assurance, evaluation and feedback at a local level are useful.

The Japanese Society for Dialysis Therapy (JSDT) maintains a vast database of information on dialysis patients in Japan, which is updated and summarized every year. Thus, JSDT provides nationwide information on the number of patients who start dialysis every year. In the present study, we utilized JSDT reference tables to compare the observed number of new dialysis patients with that expected on the basis of national data. This method may be useful to evaluate the local efficacy of educational programs/campaigns concerning CKD, as well as for quality assurance.

Materials and Methods

The Renal Data Registry Committee of the JSDT (Table 5) reported the age group and gender of all new patients who started dialysis in Japan during 2008 (1). The details of JSDT registry data collection techniques have been described elsewhere (5). Briefly, the JSDT registry collects data every year by sending questionnaires to all dialysis facilities in Japan. This registry collected information on the epidemiological features, treatment, and outcome of individual dialysis patients with a very high response rate of 99.9% in 2008.

The national incidence rate of starting dialysis was calculated as the number of new dialysis patients divided by the number of the general population in each age group stratified by gender. Population data from the 2008 national census were used to calculate the incidence rates (6). To compare the incidence of dialysis at a local level with the national incidence, the number of patients predicted to start dialysis was calculated by multiplying the number of males or females in each age group from the target area by the corresponding age- and gender-specific national incidence. The results for all of the age and gender subgroups were totaled to give the predicted number starting dialysis in the target area. Finally, the standardized incidence ratio (SIR) was calculated as the ratio of the observed to the predicted number. The SIR can be interpreted as the relative trend of new dialysis in a local population compared with that of the national population. Among several methods of calculating confidence intervals, we selected a method that yields fairly accurate results without requiring complex calculations (7,8) and allows confidence intervals to be determined with a hand calculator.

Calculation of the SIR for Niigata Prefecture

We used the 2008 data from Niigata Prefecture, which is located on the main island of Japan (Honshu) to the north of Tokyo and stretches for nearly 250 km along the coast of the Sea of Japan, with a population of 2.4 million. There were 50 facilities of dialysis, 1 706 bedside consoles, and 4 562 patients with ESRD treated by dialysis in Niigata Prefecture at the end of 2008.The population data from the 2008 census in Niigata Prefecture were used to calculate the predicted number of patients starting dialysis in this prefecture (9). Then the number of patients actually starting dialysis in Niigata Prefecture during 2008 was obtained from data reported by the JSDT (10).

All calculations can be done with a hand calculator. We used Microsoft Excel (Redmond, WA, USA) for easy calculation.

Results

The number of patients who started dialysis in Japan during 2008 was 37 104, according to the patient registry data obtained from the JSDT (1). After excluding 58 male and 27 female patients with no information about age, there were 37 019 patients available for analysis. Since the collection rate of the JSDT patient survey in 2008 was 99.9% (3 995 facilities), this number of new dialysis patients was almost equal to all the new patients in Japan.

The national incidence rates of dialysis stratified by age and gender are shown in Table 1. The overall national incidence rate was 3.93 and 2.00 per 10 000 person years for males and females, respectively. The incidence rate increased with increasing age until 85 years for both sexes and then decreased, while the incidence rates for females were lower than those for males in all age groups.

The results of our calculations are listed in Table 2. The predicted and observed number of patients starting dialysis were 774.4 and 572, respectively. The SIR was 0.74, indicating that Niigata Prefecture had a 26% lower incidence of dialysis than the national average. The lower and upper 95% confidence limits of the SIR were calculated as 0.68 and 0.80, respectively. The confidence interval provides a plausible range for the true SIR. Since this 95% confidence interval for SIR did not include 1.0, the null hypothesis of equality between the new dialysis rate of Niigata Prefecture and the national rate can be rejected at the $p=0.05$ level. Thus, the incidence of starting dialysis in Niigata Prefecture is significantly lower than the national average for Japan.

Figure 1 clearly shows that the incidence of starting dialysis in Niigata Prefecture was lower than the national average across all of the age subgroups.

Discussion

The method described here allows adjusted comparison of the incidence of starting dialysis at a local level with the national average. We used real data from Niigata Prefecture as an example of calculation, but any local or regional data could be compared with national data by this method.

The JSDT performs annual nationwide surveys of Japanese dialysis facilities, so its database has a large sample size and contains detailed information about patients with a long dialysis duration. Many other large databases, such as the United States Renal Data System, contain little information about Asian dialysis patients, and because there are many similarities, such as in body size, race, and custom, among these countries, the JSDT database would contain useful information not only for studies of Japanese dialysis patients but also for those of patients from other Asian countries. The method we presented here allows JSDT data to be utilized in a relatively simple way.

We calculated the SIR for comparison to the national average. This ratio is derived in a similar way to the standardized mortality ratio proposed by Wolfe et al. (11), or the standardized hospitalization ratio proposed by Strawderman et al. (12), using United States Renal Data System tables. Our method of using JSDT data tables is an "homage" to their reports. One advantage of the SIR, which is calculated from the total number, is that age-specific incidence data are not required for its calculation. However, several cautions are needed. First, comparison of the SIRs between different local areas is invalid, because local areas show differences in the structure of their study populations (7,13). Thus, we can only use the SIR to compare local data to the reference population. Second, the national average is just the "mean value" and should not be misinterpreted as a standard of ideal care. Decisions on when to start dialysis may differ among the regions of Japan and competing risks, such as higher mortality, may be associated with an apparent lower incidence of starting dialysis. We think that the present study is only a first step toward understanding the real situation in the local areas, with the next step being a more focused comparison to identify the reasons for local differences.

The method employed in the present study has several limitations. First, the SIR was only adjusted for age and gender. Unfortunately, we could not stratify patients by the primary diseases causing ESRD. Second, the incidence of starting dialysis is not a true outcome. Delaying the initiation of dialysis may lead to a lower SIR in a local area, but this does not necessarily mean good outcome for the patients. Also, withholding patients from dialysis could lower the incidence of starting dialysis, but we have no data about withholding from dialysis in Japan. Finally, the JSDT registry covers all patients with ESRD treated by dialysis, except for those with preemptive kidney transplantation, which is rare in Japan. It is unlikely that the very small number of cases have an impact on the results of this study.

Despite these limitations, this study has several strengths. First, we could conveniently compare local data with the national average. Second, we could calculate confidence intervals in a simple way. Third, as the JSDT collects data annually, we can perform sequential comparisons with local data.

Furthermore, this method allows comparison with data from other countries. The age- and gender-adjusted incidence of starting dialysis can be calculated for another country and compared with the national incidence for Japan. Finally, the results of this study may lead to re-evaluation of local efforts to prevent the progression of CKD.

Conclusions

We demonstrated a practical method of using the JSDT database. We hope that this method may be one way to provide information that guides us regarding ways of improving local care to prevent CKD.

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Figure legend

Figure 1. Observed and predicted number of patients starting dialysis in Niigata Prefecture

Predicted: the number of patients predicted to start dialysis in Niigata Prefecture.

Observed: the actual number of patients starting dialysis in Niigata Prefecture.

Table 1. Incidence rates of dialysis stratified by age and gender in 2008

Age of starting dialysis (years)	Male			Female		
	Number of dialysis patients	National population	Incidence rate of dialysis †	Number of dialysis patients	National population	Incidence rate of dialysis †
<5	8	2 740 000	0.03	8	2 608 000	0.03
5-9	3	2 942 000	0.01	3	2 794 000	0.01
10-14	7	3 040 000	0.02	3	2 895 000	0.01
15-19	25	3 114 000	0.08	17	2 959 000	0.06
20-24	67	3 536 000	0.19	30	3 334 000	0.09
25-29	99	3 767 000	0.26	66	3 612 000	0.18
30-34	247	4 467 000	0.55	128	4 321 000	0.30
35-39	464	4 775 000	0.97	219	4 644 000	0.47
40-44	663	4 167 000	1.59	270	4 080 000	0.66
45-49	954	3 853 000	2.48	419	3 807 000	1.10
50-54	1 468	3 862 000	3.80	613	3 869 000	1.58
55-59	2 706	4 828 000	5.60	1 100	4 936 000	2.23
60-64	3 080	4 345 000	7.09	1 287	4 557 000	2.82
65-69	3 413	3 825 000	8.92	1 597	4 174 000	3.83
70-74	3 791	3 199 000	11.85	1 981	3 728 000	5.31
75-79	3 510	2 464 000	14.25	2 135	3 221 000	6.63
80-84	2 426	1 562 000	15.53	1 772	2 482 000	7.14
85-89	950	643 000	14.77	971	1 522 000	6.38
90-94	229	235 000	9.74	229	716 000	3.20
95<	25	61 000	4.10	36	266 000	1.35
Total	24 135	61 424 000	3.93	12 884	64 525 000	2.00

† per 10 000 per year

Table 2. Example of using Table 1 (incidence rates of dialysis) to compare the local and national incidence of dialysis

Age of starting dialysis (years)	Males			Females			Total	
	incidence rate of dialysis (a)	Local population (b)	Predicted number of dialysis patients (c)	Incidence rate of dialysis (d)	Local population (e)	Predicted number of dialysis patients (f)	Predicted number of patients (g)	Observed number of patients (h)
<5	0.03	48 263	0.1	0.03	45 549	0.1	0.3	0
5-9	0.01	53 412	0.1	0.01	51 006	0.1	0.1	0
10-14	0.02	58 630	0.1	0.01	56 130	0.1	0.2	0
15-19	0.08	61 681	0.5	0.06	58 868	0.3	0.8	1
20-24	0.19	57 125	1.1	0.09	54 094	0.5	1.6	2
25-29	0.26	60 973	1.6	0.18	58 796	1.1	2.7	1
30-34	0.55	76 029	4.2	0.30	72 934	2.2	6.4	9
35-39	0.97	78 666	7.6	0.47	75 692	3.6	11.2	6
40-44	1.59	72 436	11.5	0.66	71 608	4.7	16.3	14
45-49	2.48	71 954	17.8	1.10	70 633	7.8	25.6	19
50-54	3.80	80 136	30.5	1.58	78 619	12.5	42.9	36
55-59	5.60	98 195	55.0	2.23	97 811	21.8	76.8	60
60-64	7.09	83 423	59.1	2.82	83 088	23.5	82.6	58
65-69	8.92	71 461	63.8	3.83	78 134	29.9	93.7	68
70-74	11.85	64 435	76.4	5.31	77 572	41.2	117.6	94
75-79	14.25	55 286	78.8	6.63	75 412	50.0	128.7	101
80-84	15.53	38 350	59.6	7.14	63 270	45.2	104.7	66
85-89	14.77	16 070	23.7	6.38	40 086	25.6	49.3	29
90-94	9.74	5 749	5.6	3.20	18 043	5.8	11.4	6
95<	4.10	1 485	0.6	1.35	6 831	0.9	1.5	2
Total			497.7			276.7		
(predicted and observed numbers)			→	→	→	→	774.4	572

Calculation of the standardized incidence ratio (SIR) and 95% confidence interval (CI)

SIR: Observed/Predicted

= 572/774.4

= 0.74

95%CI:

Lower confidence limit:

$$= \frac{(\text{Observed})}{(\text{Predicted})}\left(1 - \frac{1}{9(\text{Observed})} - \frac{1.96}{3\sqrt{(\text{Observed})}}\right)^3$$

$$= \frac{572}{774.4}\left(1 - \frac{1}{9\times 572} - \frac{1.96}{3\sqrt{572}}\right)^3$$

=0.68

Upper confidence limit:

$$= \frac{(\text{Observed } +1)}{(\text{Predicted })}\left(1 - \frac{1}{9(\text{Observed } +1)} + \frac{1.96}{3\sqrt{(\text{Observed } +1)}}\right)^3$$

$$= \frac{572+1}{774.4}\left(1 - \frac{1}{9\times(572+1)} + \frac{1.96}{3\sqrt{(572+1)}}\right)^3$$

=0.80

(a), (d) rates per 10 000 participant years for the given age and gender subgroup from Table 1

(b) Enter the number of males in the local population stratified by age

(c) Calculated as (male incidence rate of dialysis)$\times$(number of males in the population)/10 000

(e) Enter the number of females in the local population stratified by age

(f) Calculated as (female incidence rates of dialysis)$\times$(number of females in the population)/10 000

(g) Calculated as (predicted number of male dialysis patients) + (predicted number of female dialysis patients)

(h) Enter the number of the local dialysis patients stratified by age

IMPORTANT: ONLY INCLUDE DIALYSIS PATIENTS (NO TRANSPLANT PATIENTS)

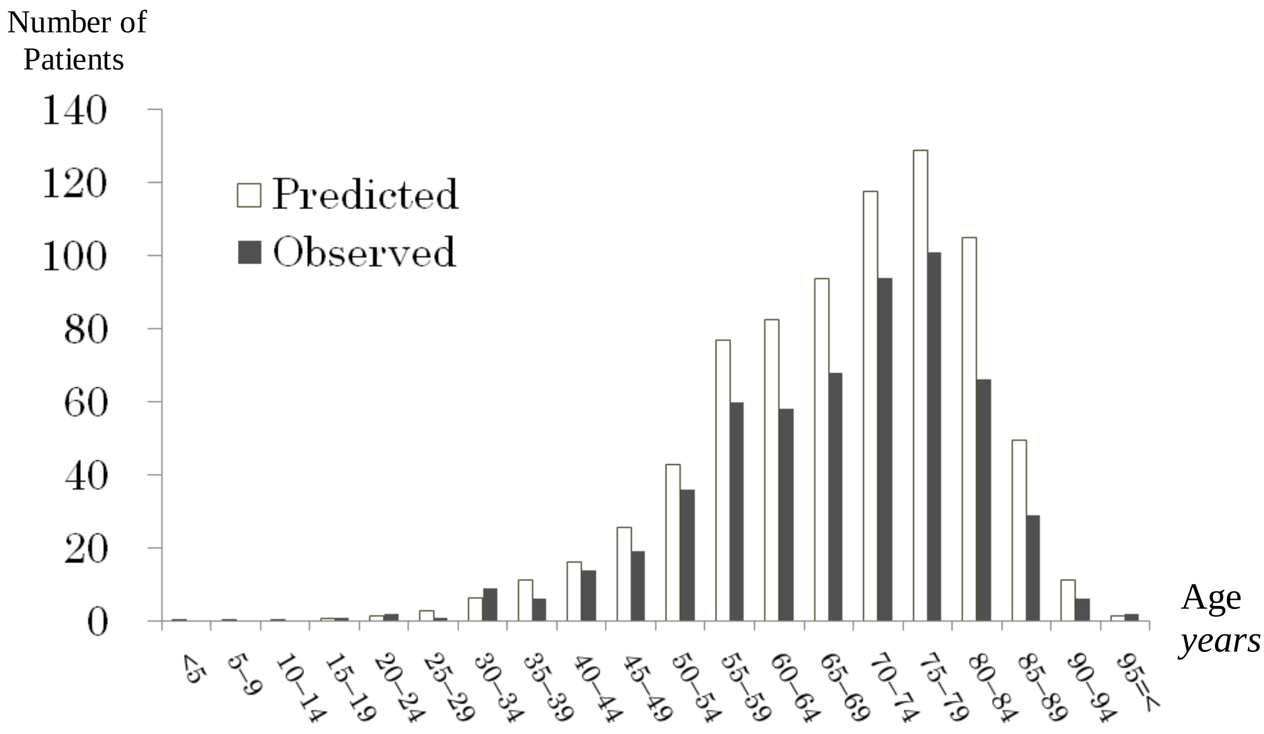
Number of Patients
140
120
100
80
60
40
20
0
Predicted
Observed
Age years
<5
5–9
10–14
15–19
20–24
25–29
30–34
35–39
40–44
45–49
50–54
55–59
60–64
65–69
70–74
75–79
80–84
85–89
90–94
95=<

Fig. 1