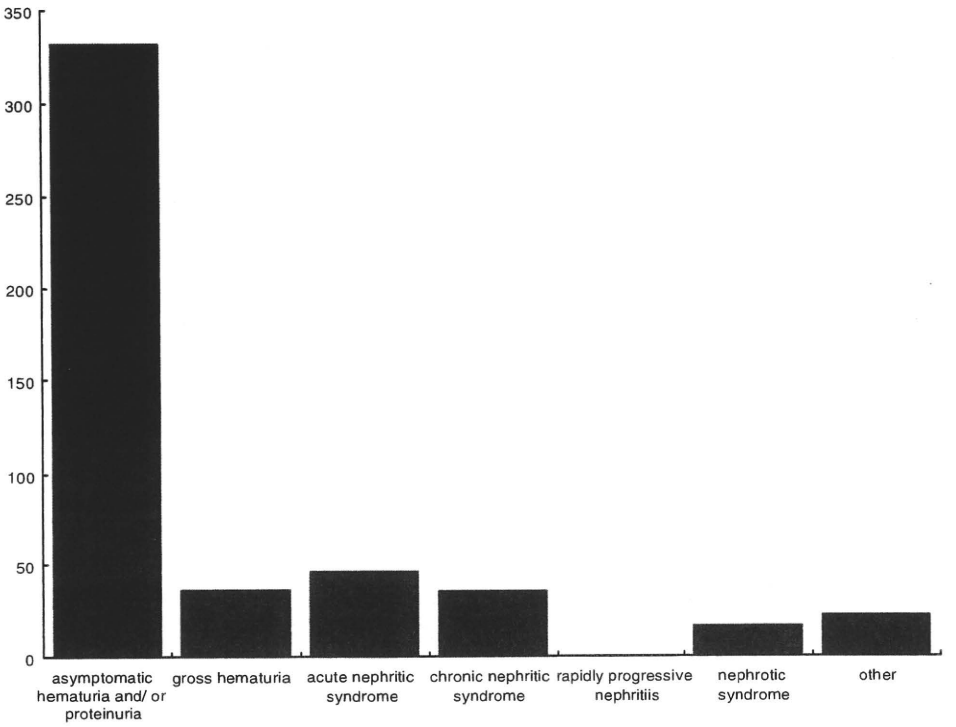

Fig. 3 Clinical manifestation of IgA nephropathy among 487 patients. Approximately 68.2% of the patients with IgA nephropathy were discovered by asymptomatic proteinuria and/ or hematuria by a urinalysis screening program held in Japan

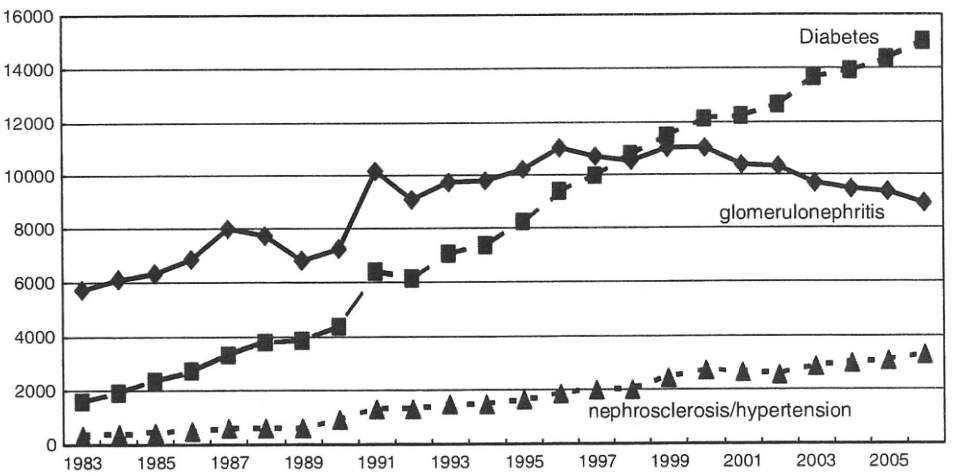

Fig. 4 Yearly changes for the number of patients starting RRT due to diabetes, glomerulonephritis and nephrosclerosis/hypertension. A significant linear relationship was observed between the year and incidence of RRT patients due to diabetes and nephrosclerosis/hypertension [20], while the number of ESRD cases due to glomerulonephritis has decreased recently

in Japan. Recently the number of ESRD cases due to glomerulonephritis has decreased in Japan [20, 43]. There are several reasons for this decrease. One is an improvement in the prognosis of patients with IgA nephropathy. IgA nephropathy is the most common glomerulonephritis worldwide [44, 45], and 68.2% of patients with IgA nephropathy were detected by the Japanese urinalysis screening program as mentioned above [23, 34]. Early referral to a nephrologist and starting early treatment were established by this program [20, 43]. Although treatment methods for protenuric subjects were an angiotensin converting enzyme (ACE) inhibitor [46] or angiotensin receptor blocker (ARB) [47], treatment methods for IgA nephropathy were diverse, including steroids [48, 49], immunosuppressants [49] and tonsillectomy [50, 51], which showed superior results than treatment to ACEI or ARB alone. In countries or races where glomerulonephritis was the frequent primary renal disease for ESRD, such as Japan and Asian countries, universal dip-stick proteinuria screening is recommended.

Racial difference of proteinuria prevalence

Boulware et al. [52] reported that annual screening for proteinuria in US adults was not cost-effective because the prevalence and incidence of proteinuria were very low. However, selective annual testing focusing on high-risk groups is highly cost-effective. They reported that annual screening starting at age 60 years or older is cost-effective for persons with neither hypertension nor diabetes, and annual screening from ages 30 to 70 years is highly cost-effective for persons with hypertension. Table 1 shows the prevalence of proteinuria from NHANES III [53] and annual urinalysis data held in Ibaraki prefecture in Japan [54]. As shown in Table 1, the prevalence of proteinuria in US adults aged 60 years or older with neither hypertension nor diabetes was 0.8%, while the prevalence of proteinuria in Japanese adults with neither hypertension nor diabetes of same age group was 1.8%. Furthermore, the prevalence of proteinuria in US adults with hypertension was 2.2%, but the prevalence of proteinuria in Japanese adults with hypertension was 3.3%. Iseki et al. [55] reported that the positive rate of proteinuria in screened subjects was as high as 5.3% among 106,177 subjects in Okinawa, Japan. This high prevalence of proteinuria in the overall Japanese population supported the idea that annual urinalysis screening for the whole population in Japan might be cost-effective. A striking difference between the Japanese population and US population is the high prevalence of proteinuria in Japanese adults with neither hypertension nor diabetes. Most of these subjects have no symptoms, and the only sign of renal disease is asymptomatic urinary abnormalities [56]. The Malay race, a Southeast Asian population, also showed a high prevalence of proteinuria [57].

Table 1 Prevalence of proteinuria in US and Japan

	Age range (years)					Total
	40–49	50–59	60–69	70–79	80	
Whole population						
Japan						
Number	18,639	35,212	49,249	30,561	2,941	136,602
Proteinuria (%)	1.0	1.4	2.2	3.3	5.1	2.1
USA						
Number	2,330	1,680	2,078	1,524	1,011	8,623
Proteinuria (%)	0.8	1.1	1.7	2.3	4.7	1.8
Diabetic population						
Japan						
Number	334	1,509	3,401	2,317	214	7,775
Proteinuria (%)	5.1	6.2	6.1	8.2	9.8	6.8
USA						
Number	149	194	325	257	129	1,054
Proteinuria (%)	7.4	5.3	5.4	6.8	12.5	6.8
Non-diabetic hypertensive population						
Japan						
Number	2,602	9,899	21,765	17,423	1,873	53,562
Proteinuria (%)	3.2	2.5	3.0	3.7	5.9	3.3
USA						
Number	661	645	1,033	841	641	3,821
Proteinuria (%)	1.7	1.5	1.7	1.8	4.8	2.2
Non-diabetic non-hypertensive population						
Japan						
Number	15,703	23,804	24,083	10,821	854	75,265
Proteinuria (%)	0.5	0.7	0.9	1.7	2.1	0.9
USA						
Number	1,503	829	710	417	233	3,692
Proteinuria (%)	0.1	0.2	0.7	1.2	0.5	0.4

Data source: USA: NHANES III, macroalbuminuria, Japan: annual urinalysis screening data held in Ibaraki prefecture, Japan in 2001

Proteinuria is a better risk marker for developing ESRD than impaired renal function

Both proteinuria and impaired renal function predict a worse prognosis with respect to cardiovascular morbidity and mortality [10–13]. Subjects with proteinuria showed three times faster GFR loss than both control and impaired renal function subjects [58]. Therefore, proteinuria is a better risk marker than impaired renal function in population screening of individuals to identify who is at risk for developing ESRD [58]. Hallan et al. [59] reported that during an 8-year follow-up, only 38 of 3,069 people (1.2%) with impaired renal function (CKD stage 3 or later) progressed to ESRD, while Iseki et al. [37] reported that during a 17-year follow-up, 186 of 5,436 people (3.4%) with proteinuria progressed to ESRD.

There are several reasons for the large dialysis population in Japan, including a low transplantation rate, full coverage of medical expenses for dialysis patients and an excellent survival rate after initiation of RRT. From the Japan ESRD registry, 10-year survival of the ESRD population is 52.7% for glomerulonephritis, 28.0% for diabetes, and 27.0% for nephrosclerosis (hypertensive nephropathy) [3]. Consequently, to reduce the prevalence of ESRD patients effectively in Japan, both increasing kidney transplantation and decreasing the incidence of ESRD due to glomerulonephritis are effective methods.

Furthermore, there are several reports about a higher incidence of ESRD in Asian races than in Caucasians [60–62]. Reasons for these differences are unclear, but genetic [60, 63] and environmental differences [64] are related. Further studies are needed to clarify about these points.

Future strategy for CKD screening in Japan

Chronic kidney disease was first proposed by K/DOQI, and it was accepted by KDIGO; however, most written standards and effective CKD perspectives are suitable for Caucasians or people living in Western countries [65, 66]. One example is CVD morbidity and mortality differences between Japanese and Caucasians. Hollan et al. [67] reported that the prevalence of CKD in the USA and Norway was the same, and the occurrence of CVD in CKD patients in Norway was almost the same as in the US population, while the proportion of heart disease and stroke among CVD patients was identical between Norway and the USA [21]. During an 8-year observation period, 2,604 of 5,640 deaths were from CVD, and 691 of 2,604 deaths (26.5%) had CKD stage III or higher in Norway [59]. However, during a 10-year observation period, 1,932 of 6,906 deaths were from CVD, while only 307 subjects (15.9%) had CKD in Japan [68], and the Japanese general population had an incidence of CVD among CKD subjects that was much lower than the US population [69].

Another example is the indication for microalbuminuria. Previous studies in general Western populations have suggested that microalbuminuria was a significant predictor for both coronary heart disease and stroke [70, 71]. Some people proposed that universal testing for microalbuminuria should be considered [72–74]. However, the prevalence of microalbuminuria in mass screening was 11.8–17.8% of the study population in Asians [75, 76], which was a several times higher positive rate compared to the USA [53]. It is possible to improve microalbuminuria by using ARB, ACEI and statins [74, 77–81] and to avoid the development of both ESRD and CVD. However, medical fees for follow-up and prescriptions of these drugs are very expensive, especially in countries and for races with a high prevalence of microalbuminuria. Furthermore, urinary albumin and creatinine ratio testing is more expensive than the urine dip-stick test for proteinuria. Consequently, universal screening with the urine dip-stick test for proteinuria is suitable for most countries or races that have a high prevalence of proteinuria such as Asians and Japanese. However, there are lifestyle modifications; along with a higher prevalence of diabetes in the general population and a higher incidence of stroke and stroke mortality in Japan, we might have to change urinalysis screening policy from the urine dip-stick test for proteinuria to microalbuminuria in the near future.

In summary, universal screening with the urine dip-stick test for proteinuria has been used in Japan. There are several reasons for continuing this screening program. First, the positive rate of proteinuria is high in the Japanese general population. Second, the prevalence and incidence of glomerulonephritis, especially IgA nephropathy, are high in Japan. Third, urinalysis is the only method for early detection of most chronic glomerulonephritis. Fourth, reducing the incidence of ESRD due to glomerulonephritis is one of the best ways to reduce the prevalence of ESRD. Furthermore, the death rate due to CVD was the same between Japan and the USA. Although CKD is one of the important risk factors for CVD in the Japanese general population, the Japanese incidence of CVD and mortality due to CVD among CKD subjects were lower than those of Caucasians. Japanese and Asians should focus on reducing ESRD and subjects with reduced renal function. To do this, universal screening with the urine dip-stick test for proteinuria could be one solution.

References

1. Xue JL, Ma JZ, Louis TA, Collins AJ. Forecast of the number of patients with end-stage renal disease in the United States to the year 2010. J Am Soc Nephrol. 2001;12:2753–8.
2. Lysaght MJ. Maintenance dialysis population dynamics: current trends and long-term implications. J Am Soc Nephrol. 2002;13(Suppl 1):S37–40.
3. Nakai S, Masagane I, Akiba T, Iseki K, Watanabe Y, Itami Y, et al. An overview of dialysis treatment in Japan (as of Dec. 31, 2005). J Jpn Soc Dial Ther. 2007;40:1–30.
4. Systems USRD: USRDS 2006 Annual Data Report. Bethesda: National Institute of Health; 2007.
5. Fukuhara S, Lopes AA, Bragg-Gresham JL, Kurokawa K, Mapes DL, Akizawa T, et al. Health-related quality of life among dialysis patients on three continents: the Dialysis Outcomes and Practice Patterns Study. Kidney Int. 2003;64:1903–10.
6. K/DOQI Clinical Practice Guidelines for Chronic Kidney Disease: evaluation, classification, and stratification. Part 5. Evaluation of laboratory measurements for clinical assessment of kidney disease. Am J Kidney Dis. 2002;39:76–110.
7. Levey AS, Eckardt KU, Tsukamoto Y, Levin A, Coresh J, Rossert J, et al. Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). Kidney Int. 2005;67:2089–100.
8. Coresh J, Astor BC, Greene T, Eknoyan G, Levey AS. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third National Health and Nutrition Examination Survey. Am J Kidney Dis. 2003;41:1–12.
9. Schieppati A, Remuzzi G. Chronic renal diseases as a public health problem: epidemiology, social, and economic implications. Kidney Int. 2005;67(Suppl 98):S7–10.
10. Levey AS, Beto JA, Coronado BE, Eknoyan G, Foley RN, Kasiske BL, et al. Controlling the epidemic of cardiovascular disease in chronic renal disease: what do we know? What do we need to learn? Where do we go from here? National Kidney Foundation Task Force on Cardiovascular Disease. Am J Kidney Dis. 1998;32:853–906.
11. Anavekar NS, McMurray JJ, Velazquez EJ, Solomon SD, Kober L, Rouleau JL, et al. Relation between renal dysfunction and cardiovascular outcomes after myocardial infarction. N Engl J Med. 2004;351:1285–95.
12. Weiner DE, Tighiouart H, Amin MG, Stark PC, MacLeod B, Griffith JL, et al. Chronic kidney disease as a risk factor for cardiovascular disease and all-cause mortality: a pooled analysis of community-based studies. J Am Soc Nephrol. 2004;15:1307–15.

13. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004;351:1296–305.
14. Foley RN, Murray AM, Li S, Herzog CA, McBean AM, Eggers PW, et al. Chronic kidney disease and the risk for cardiovascular disease, renal replacement, and death in the United States Medicare population, 1998 to 1999. J Am Soc Nephrol. 2005;16:489–95.
15. Eknoyan G, Lameire N, Barsoum R, Eckardt KU, Levin A, Levin N, et al. The burden of kidney disease: improving global outcomes. Kidney Int. 2004;66:1310–4.
16. Uhlig K, Macleod A, Craig J, Lau J, Levey AS, Levin A, et al. Grading evidence and recommendations for clinical practice guidelines in nephrology. A position statement from kidney disease: improving global outcomes (KDIGO). Kidney Int. 2006;70:2058–65.
17. Maisonneuve P, Agodoa L, Gellert R, Stewart JH, Buccianti G, Lowenfels AB, et al. Distribution of primary renal diseases leading to end-stage renal failure in the United States, Europe, and Australia/New Zealand: results from an international comparative study. Am J Kidney Dis. 2000;35:157–65.
18. Racial differences in trends of end-stage renal disease, by primary diagnosis-United States, 1994–2004. MMWR Morb Mortal Wkly Rep. 2007;56:253–6.
19. Hemmelgarn BR, Chou S, Wiebe N, Culleton BF, Manns BJ, Klarenbach S, et al. Differences in use of peritoneal dialysis and survival among East Asian, Indo Asian, and white ESRD patients in Canada. Am J Kidney Dis. 2006;48:964–71.
20. Yamagata K, Takahashi H, Suzuki S, Mase K, Hagiwara M, Shimizu Y, et al. Age distribution and yearly changes in the incidence of end-stage renal disease in Japan. Am J Kidney Dis. 2004;43:433–43.
21. World Health Organization: World Health Statistics 2006, 2007.
22. Wu Z, Yao C, Zhao D, Wu G, Wang W, Liu J, et al. Sino-MONICA project: a collaborative study on trends and determinants in cardiovascular diseases in China, Part I: morbidity and mortality monitoring. Circulation. 2001;103:462–8.
23. Yamagata K, Takahashi H, Tomida C, Yamagata Y, Koyama A. Prognosis of asymptomatic hematuria and/or proteinuria in men. Nephron. 2002;91:34–42.
24. Ishida K, Ishida H, Narita M, Sairenchi T, Saito Y, Fukutomi H, et al. Factors affecting renal function in 119 985 adults over three years. QJM. 2001;94:541–50.
25. Woolhandler S, Pels RJ, Bor DH, Himmelstein DU, Lawrence RS. Dipstick urinalysis screening of asymptomatic adults for urinary tract disorders. I. Hematuria and proteinuria. JAMA. 1989;262:1214–9.
26. Nephrology TSo: Anual data report of ESRD in Taiwan. http://www.tsn.org.tw/ (2006).
27. Caskey FJ, Schober-Halstenberg HJ, Roderick PJ, Edenharter G, Ansell D, Frei U, et al. Exploring the differences in epidemiology of treated ESRD between Germany and England and Wales. Am J Kidney Dis. 2006;47:445–54.
28. Registry AaNZDaT: The 29th Annual Report 2006 Report—Data to 2005. http://www.anzdata.org.au/ (2007).
29. Stewart JH, McCredie M, Disney AP, Mathew TH. Trends in incidence of end-stage renal failure in Australia, 1972–1991. Nephrol Dial Transplant. 1994;9:1377–82.
30. Wimmer F, Oberaigner W, Kramar R, Mayer G. Regional variability in the incidence of end-stage renal disease: an epidemiological approach. Nephrol Dial Transplant. 2003;18:1562–7.
31. Kuo HW, Tsai SS, Tiao MM, Yang CY. Epidemiological features of CKD in Taiwan. Am J Kidney Dis. 2007;49:46–55.
32. Tiebosch ATMG, Wolters J, Frederik PFM, van der Wiel TWM, Zeppenfeldt E, van Breda Vriesman PJC. Epidemiology of idiopathic glomerular disease: a prospective study. Kidney Int. 1987;32:112–6.
33. Simon P, Ramee MP, Autuly V, Laruelle E, Charasse C, Cam G, et al. Epidemiology of primary glomerular diseases in a Frecnch region. Variations according to period of age. Kidney Int. 1994;46:1192–8.
34. Koyama A, Igarashi M, Kobayashi M. Naturals history and risk factors for immunoglobulin A nephropathy. Am J Kid Dis. 1997;29:526–32.
35. Cameron JS. Proteinuria and progression in human glomerular diseases. Am J Nephrol. 1990;1:81–7.
36. Cameron JS. The long-term outcome of glomerular diseases. 6th ed. Boston/Tronto/London: Little Brown and Company;1997.
37. Iseki K, Ikemiya Y, Iseki C, Takishita S. Proteinuria and the risk of developing end-stage renal disease. Kidney Int. 2003;63:1468–74.
38. Usui J, Yamagata K, Kai H, Outeki T, Yamamoto S, Muro K, et al. Heterogeneity of prognosis in adult IgA nephropathy, especially with mild proteinuria or mild histological features. Intern Med. 2001;40:697–702.
39. Keane WF. Proteinuria: its clinical importance and role in progressive renal disease. Am J Kidney Dis. 2000;35:S97–105.
40. Remuzzi G, Benigni A, Remuzzi A. Mechanisms of progression and regression of renal lesions of chronic nephropathies and diabetes. J Clin Invest. 2006;116:288–96.
41. Bartosik LP, Lajoie G, Sugar L, Cattran DC. Predicting progression in IgA nephropathy. Am J Kidney Dis. 2001;38:728–35.
42. Nagai R, Wang EEL, Feldman W. Dipstick proteinuria screening of asymptomatic adults to prevent progressive renal disease. In: Canadian Task Force on the Periodic Health Examination. Otawa: Health Canada; 1994.
43. Murakami M, Hayakawa M, Yanagihara T, Hukunaga Y. Proteinuria screening for children. Kidney Int Suppl. 2005; 67:S23–7.
44. D'Amico G. The commonest glomerulonephritis in the world: IgA nephropathy. Quart J Med. 1987;64:709–27.
45. Nair R, Walker PD. Is IgA nephropathy the commonest primary glomerulopathy among young adults in the USA? Kidney Int. 2006;69:1455–8.
46. Jafar TH, Stark PC, Schmid CH, Landa M, Maschio G, de Jong PE, et al. Progression of chronic kidney disease: the role of blood pressure control, proteinuria, and angiotensin-converting enzyme inhibition: a patient-level meta-analysis. Ann Intern Med. 2003;139:244–52.
47. Laverman GD, Navis G, Henning RH, de Jong PE, de Zeeuw D. Dual renin-angiotensin system blockade at optimal doses for proteinuria. Kidney Int. 2002;62:1020–5.
48. Pozzi C, Bolasco PG, Fogazzi GB, Andrulli S, Altieri P, Ponticelli C, et al. Corticosteroids in IgA nephropathy: a randomised controlled trial. Lancet. 1999;353:883–7.
49. Shoji T, Nakanishi I, Suzuki A, Hayashi T, Togawa M, Okada N, et al. Early treatment with corticosteroids ameliorates proteinuria, proliferative lesions, and mesangial phenotypic modulation in adult diffuse proliferative IgA nephropathy. Am J Kidney Dis. 2000;35:194–201.
50. Hotta O, Miyazaki M, Furuta T, Tomioka S, Chiba S, Horigome I, et al. Tonsillectomy and steroid pulse therapy significantly impact on clinical remission in patients with IgA nephropathy. Am J Kidney Dis. 2001;38:736–43.
51. Xie Y, Nishi S, Ueno M, Imai N, Sakatsume M, Narita I, et al. The efficacy of tonsillectomy on long-term renal survival in patients with IgA nephropathy. Kidney Int. 2003;63:1861–7.
52. Boulware LE, Jaar BG, Tarver-Carr ME, Brancati FL, Powe NR. Screening for proteinuria in US adults: a cost-effectiveness analysis. JAMA. 2003;290:3101–14.

53. Garg AX, Kiberd BA, Clark WF, Haynes RB, Clase CM. Albuminuria and renal insufficiency prevalence guides population screening: results from the NHANES III. Kidney Int. 2002;61:2165–75.
54. Yamagata K, Ishida K, Sairenchi T, Takahashi H, Ohba S, Shiigai T, et al. Risk factors for chronic kidney disease in a community-based population: a 10-year follow-up study. Kidney Int. 2007;71:159–66.
55. Iseki K, Iseki C, Ikemiya Y, Fukiyama K. Risk of developing end-stage renal disease in a cohort of mass screening. Kidney Int. 1996;49:800–5.
56. Yamagata K, Yamagata Y, Kobayashi M, Koyama A. A long-term follow-up study of asymptomatic hematuria and/or proteinuria in adults. Clin Nephrol. 1996;45:281–8.
57. Ramirez SP, McClellan W, Port FK, Hsu SI. Risk factors for proteinuria in a large, multiracial, southeast Asian population. J Am Soc Nephrol. 2002;13:1907–17.
58. Halbesma N, Kuiken DS, Brantsma AH, Bakker SJ, Wetzels JF, De Zeeuw D, et al. Macroalbuminuria is a better risk marker than low estimated GFR to identify individuals at risk for accelerated GFR loss in population screening. J Am Soc Nephrol. 2006;17:2582–90.
59. Hallan SI, Dahl K, Oien CM, Grootendorst DC, Aasberg A, Holmen J, et al. Screening strategies for chronic kidney disease in the general population: follow-up of cross sectional health survey. BMJ. 2006;333:1047.
60. Chandie Shaw PK, Baboe F, van Es LA, van der Vijver JC, van de Ree MA, de Jonge N, et al. South-Asian type 2 diabetic patients have higher incidence and faster progression of renal disease compared with Dutch–European diabetic patients. Diabetes Care. 2006;29:1383–5.
61. Burden AC, McNally PG, Feehally J, Walls J. Increased incidence of end-stage renal failure secondary to diabetes mellitus in Asian ethnic groups in the United Kingdom. Diabet Med. 1992;9:641–5.
62. Lightstone L, Rees AJ, Tomson C, Walls J, Winearls CG, Feehally J. High incidence of end-stage renal disease in Indo-Asians in the UK. QJM. 1995;88:191–5.
63. Iyengar SK, Abboud HE, Goddard KA, Saad MF, Adler SG, Arar NH, et al. Genome-wide scans for diabetic nephropathy and albuminuria in multiethnic populations: the family investigation of nephropathy and diabetes (FIND). Diabetes. 2007;56:1577–85.
64. Trehan A, Winterbottom J, Lane B, Foley R, Venning M, Coward R, et al. End-stage renal disease in Indo-Asians in the North-West of England. QJM. 2003;96:499–504.
65. Brown WW, Peters RM, Ohmit SE, Keane WF, Collins A, Chen SC, et al. Early detection of kidney disease in community settings: the Kidney Early Evaluation Program (KEEP). Am J Kidney Dis. 2003;42:22–35.
66. McGill JB, Brown WW, Chen SC, Collins AJ, Gannon MR. Kidney Early Evaluation Program (KEEP). Findings from a community screening program. Diabetes Educ. 2004;30:196–8 (200–192, 206).
67. Hallan SI, Coresh J, Astor BC, Asberg A, Powe NR, Romundstad S, et al. International comparison of the relationship of chronic kidney disease prevalence and ESRD risk. J Am Soc Nephrol. 2006;17:2275–84.
68. Irie F, Iso H, Sairenchi T, Fukasawa N, Yamagishi K, Ikehara S, et al. The relationships of proteinuria, serum creatinine, glomerular filtration rate with cardiovascular disease mortality in Japanese general population. Kidney Int. 2006;69:1264–71.
69. Ninomiya T, Kiyohara Y, Kubo M, Tanizaki Y, Doi Y, Okubo K, et al. Chronic kidney disease and cardiovascular disease in a general Japanese population: the Hisayama Study. Kidney Int. 2005;68:228–36.
70. Hillege HL, Fidler V, Diercks GF, van Gilst WH, de Zeeuw D, van Veldhuisen DJ, et al. Urinary albumin excretion predicts cardiovascular and noncardiovascular mortality in general population. Circulation. 2002;106:1777–82.
71. Yuyun MF, Khaw KT, Luben R, Welch A, Bingham S, Day NE, et al. Microalbuminuria independently predicts all-cause and cardiovascular mortality in a British population: The European Prospective Investigation into Cancer in Norfolk (EPIC-Norfolk) population study. Int J Epidemiol. 2004;33:189–98.
72. Dell'Omo G, Penno G, Giorgi D, Di Bello V, Mariani M, Pedrinelli R. Association between high-normal albuminuria and risk factors for cardiovascular and renal disease in essential hypertensive men. Am J Kidney Dis. 2002;40:1–8.
73. Remuzzi G, Weening JJ. Albuminuria as early test for vascular disease. Lancet. 2005;365:556–7.
74. de Jong PE, Brenner BM. From secondary to primary prevention of progressive renal disease: the case for screening for albuminuria. Kidney Int. 2004;66:2109–18.
75. Konta T, Hao Z, Abiko H, Ishikawa M, Takahashi T, Ikeda A, et al. Prevalence and risk factor analysis of microalbuminuria in Japanese general population: the Takahata study. Kidney Int. 2006;70:751–6.
76. Jafar TH, Chaturvedi N, Hatcher J, Levey AS. Use of albumin creatinine ratio and urine albumin concentration as a screening test for albuminuria in an Indo-Asian population. Nephrol Dial Transplant. 2007.
77. de Zeeuw D, Remuzzi G, Parving HH, Keane WF, Zhang Z, Shahinfar S, et al. Albuminuria, a therapeutic target for cardiovascular protection in type 2 diabetic patients with nephropathy. Circulation. 2004;110:921–7.
78. de Zeeuw D, Remuzzi G, Parving HH, Keane WF, Zhang Z, Shahinfar S, et al. Proteinuria, a target for renoprotection in patients with type 2 diabetic nephropathy: lessons from RENAAL. Kidney Int. 2004;65:2309–20.
79. Eijkelkamp WB, Zhang Z, Remuzzi G, Parving HH, Cooper ME, Keane WF, et al. Albuminuria is a target for renoprotective therapy independent from blood pressure in patients with type 2 diabetic nephropathy: post hoc analysis from the reduction of endpoints in NIDDM with the Angiotensin II Antagonist Losartan (RENAAL) Trial. J Am Soc Nephrol. 2007;18:1540–6.
80. Brenner BM, Cooper ME, de Zeeuw D, Keane WF, Mitch WE, Parving HH, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. N Engl J Med. 2001;345:861–9.
81. Jafar TH, Stark PC, Schmid CH, Landa M, Maschio G, Marcantoni C, et al. Proteinuria as a modifiable risk factor for the progression of non-diabetic renal disease. Kidney Int. 2001;60:1131–40.

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Overview of Regular Dialysis Treatment in Japan as of 31 December 2006

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Abstract: A statistical survey of dialysis patients for the year 2006 was carried out for 4051 medical facilities across Japan, and responses were received from 3985 (98.37%) facilities. There were 264 473 dialysis patients (including 9003 peritoneal dialysis patients) in Japan at the end of 2006, which showed an increase of 6708 (2.6%) from the end of 2005. The number of patients per million population was 2069.9. The crude mortality rate during 2006 was 9.2%. The mean age of the patients who began dialysis (in 2006) was 66.4 years, and the mean age of the entire dialysis population was 64.4 years. The primary renal diseases of the patients who began dialysis were diabetic nephropathy (42.9%), chronic glomerulonephritis (25.6%), and nephrosclerosis (9.4%). Of the 3488 facilities that participated in the survey on the dialysate water quality, 2873 facilities (82.4%) measured the endotoxin concentration in the dialysate; and 1197 facilities (37.1%) out of 3228 measured the bacterial count in the dialysate. The mean hemoglobin concentration in the dialysis population at the end of 2006 was 10.23 ± 1.33 g/dL, which was equal to that at the end of 2005 (10.23 ± 1.37 g/dL). The mean concentration of serum creatinine in 15 853 patients who started dialysis during 2006 was 8.37 ± 3.58 mg/dL. The estimated glomerular filtration rate, which was calculated with formula modified for the Japanese population from the Modification of Diet in Renal Disease (MDRD) Study equation, was 5.46 ± 6.60 mL/min/1.73 m^2. **Key Words:** Annual mortality, Dialysate quality, Dialysis, Endotoxin, End-stage renal disease, Diet modification, Survey.

The Japanese Society for Dialysis Therapy has conducted a statistical survey of dialysis facilities across the country once a year since 1968. A nationwide statistical survey of 4051 dialysis facilities was conducted at the end of 2006, and 3985 facilities (98.37%) responded. The number of patients undergoing dialysis at the end of 2006 determined on the basis of the survey results from dialysis facilities was 264 473, an increase of 6708 patients (2.6%) from 2005. The crude mortality rate of dialysis patients in 2006 was 9.2%; there has been no significant change in the crude mortality rate in the last 10 years (1).

In the first part of this report, basic data on chronic dialysis patients in Japan at the end of 2006 are summarized. The second part summarizes the data obtained from the survey on the following two new items: the clinical condition of patients upon introduction to dialysis; and the current status of dialysate quality control.

In April 2006 the point system of the National Health Insurance (NHI) regarding fee allocation for medical treatment was revised, and the cost of erythropoietin was included in the dialysis management fee. Following this change, there is a possibility that the erythropoietin dose and the clinical condition of renal anemia of the patients have changed. Therefore, in the third part of this report, the status of renal anemia therapy at the end of 2006 was compared with

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that at the end of 2005. On the basis of the results of this comparison, the effects of the revision of the NHI on the clinical condition of renal anemia of dialysis patients and its therapy were examined.

PATIENTS AND METHODS

This survey is conducted every year by sending questionnaires to individual dialysis facilities at the end of each year. The 4051 facilities surveyed at the end of 2006, increased by 66 (1.66%) from that in the preceding year's survey. The questionnaires were sent and collected by mail, although they were also faxed to some of the facilities. A floppy disk instead of the paper questionnaire was sent to the facilities that had earlier indicated a preference for it.

The survey investigated both the facilities and the patients. The facility survey contained items that related to the details of dialysis facilities, such as the numbers of patients, staff members, and the hemodialysis capacity, were investigated (using the questionnaire referred to as "Sheet I"). The patient survey investigated the epidemiological background, treatment conditions, and outcomes (using the questionnaires referred to as "Sheets II, III, and IV").

The response rate for the survey (collection rate of the questionnaire [Sheet I] at the end of 2006) was 98.37% (3985 facilities), which was almost identical to that for the 2005 survey (98.89%). The number of facilities that replied to both questionnaires, that is, the facility survey and the patient survey, was 3807 facilities (93.98%), which was also almost identical to that for the 2005 survey (93.73%). In addition, the number of facilities that responded via floppy disk was 2758 facilities (69.21%).

I. Tabulation of basic data on chronic dialysis patients at the end of 2006

Data on dialysis patient population dynamics for the year 2006 were tabulated mainly on the basis of the results of the facility survey. The data included the number of new patients begun on dialysis, the number of patients who died, the crude mortality rate for the year 2006, and the total number of dialysis patients at the end of 2006. The cumulative survival rate after introduction onto dialysis was actuarially calculated (2).

II. Tabulation of data on new items surveyed

Items investigated for the first time in this survey were the clinical condition of patients at the introduction of dialysis, the current status of dialysate quality control, and the current status of renal anemia therapy. Tabulation was carried out on these items.

RESULTS AND DISCUSSION

I. Tabulation of basic data on chronic dialysis patients at the end of 2006

1. Number of patients

Table 1 shows a summary of the dynamics of the dialysis patient population in Japan at the end of 2006 obtained from the present survey. Only the data on the durations of dialysis and the longest dialysis shown in this table were obtained from the patient survey, otherwise parameters were obtained from the facility survey.

The total number of dialysis patients in Japan at the end of 2006 was 264 473, as determined from the facility survey. The number of dialysis patients at the end of 2005 was 257 765, showing an increase of 2.6% (6708 patients) from the end of 2005 to the end of 2006. Except for the data at the end of 1989, when the collection rate of the questionnaire was significantly low, it is the first time that a rate of increase in the number of dialysis patients from the previous year of $\leq$3% has been obtained.

For reference, the trend for the rate of the annual increase in the number of dialysis patients since 1980 is shown in Figure 1. As shown in the figure, it is obvious that the rate of increase in the number of dialysis patients decreases linearly. In Figure 1 an estimated trend of the rate obtained by linear regression is also shown. If this estimation is correct, the increase in the dialysis patient population will stop between 2013 and 2014.

The number of facilities that responded to the questionnaire at the end of 2006 was 3985, which increased by 45 (1.1%) from the previous year. The number of patient stations at the end of 2006 was 104 382, which increased by 3830 (3.8%) from the previous year. The rates of increase in the number of patient stations and in the number of dialysis patients were higher than that in the number of dialysis facilities. This finding indicates that the number of patients treated at any one facility has been increasing. The total number of patients who can simultaneously receive dialysis was 103 573 this year, which is the first time for this number to exceed 100 000. Moreover, the maximum capacity of all the facilities to treat patients was 350 943; this number also exceeds 350 000 for the first time this year.

The percentage of patients who received dialysis during the daytime increased to 80.7%, whereas that during the nighttime decreased to 15.7%. The longest duration on chronic dialysis was 39 years.

Table 2 shows the total number of dialysis patients in each prefecture of Japan determined from the facility survey. The number of dialysis patients per

TABLE 1. *Current status of chronic dialysis therapy in Japan (as of 31 December 2006)*

Number of facilities	3 985	Increase of 45 (1.1%)
Equipment		
Number of patient stations	104 382	Increase of 3 830 (3.8%)
Capacity		
Simultaneous dialysis (people)	103 573	Increase of 3 690 (3.7%)
Maximum accommodation capacity (people)	350 943	Increase of 11 528 (3.4%)
Chronic dialysis patients†	264 473	Increase of 6 708
Daytime dialysis	213 454 (80.7%)	
Nighttime dialysis	41 641 (15.7%)	
Home dialysis	147 (0.1%)	
CAPD	9 003 (3.4%)	
IPD	220 (0.1%)	
Number of patients newly introduced to dialysis	36 373	Increase of 310 (0.9%)
Number of deceased patients	24 034	Increase of 51 (0.2%)

†The total number of chronic dialysis patients is the total of the column for the number of patients in Sheet I, and does not necessarily agree with the total number of patients counted according to the method of treatment. CAPD, continuous ambulatory peritoneal dialysis; IPD, intermittent peritoneal dialysis.

Years on dialysis‡	Male	Female	Unknown	Total
0–4	79 246	45 271	59	124 576 (49.8%)
5–9	37 735	24 378	4	62 117 (24.9%)
10–14	17 662	12 653	3	30 318 (12.1%)
15–19	8 496	6 923	0	15 419 (6.2%)
20–24	5 042	4 210	0	9 252 (3.7%)
≥25	4 707	3 568	0	8 275 (3.3%)
Total	152 888	97 003	66	249 957 (100.0%)
Patients per million	2 069.9	Increase of 52.3		
Longest dialysis history	39 years and 0 months			

‡The number of dialysis patients was calculated from questionnaire Sheets II to IV.

million population at the end of 2006 was 2069.9. Table 3 shows the change in the number of dialysis patients per million population. The number of patients per million population is increasing each year.

2. Mean age

The dialysis patient population in Japan is aging yearly. The patient survey showed that the mean age of new patients started on dialysis in 2006 was 66.4 ± 13.4 years (mean ± SD) and the mean age of the prevalent dialysis patient population in 2006 was 64.4 ± 12.8 years (Table 4). The dialysis patient population aged by 7.5 years from the end of 1986 to the end of 1996, but aged by only 6.4 years from the end of 1996 to the end of 2006. The rate of aging of the dialysis patient population has decreased. The mean age of new patients started on dialysis increased by 6.4 years from the end of 1986 to the end of 1996, but increased by only 4.9 years from the end of 1996 to the end of 2006. These findings show that the rate of aging of new patients started on dialysis has also decreased.

Table 5 shows the gender and age distributions of new patients started on dialysis in 2006. Table 6 shows the gender and age distributions of prevalent dialysis patients in 2006. Tables 7 and 8 show the age distribution according to the primary renal disease. The data in these tables were obtained from the results of the patient survey.

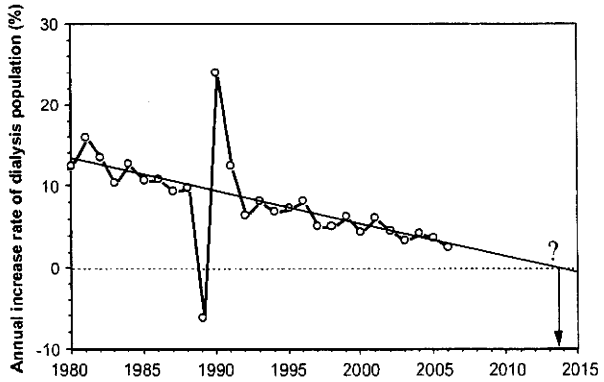

FIG. 1. The trend for the rate of the annual increase in the number of dialysis patients since 1980.

3. Primary renal disease of new patients started on dialysis

Table 7 shows a summary of the primary renal diseases of new patients started on dialysis in 2006.

TABLE 2. *The number of chronic dialysis patients in each prefecture*

Administrative division names	Daytime	Nighttime	Home hemodialysis	CAPD	IPD	Total†
Hokkaido	10 881	1 491	3	424	18	12 817
Aomori prefecture	2 501	207	0	119	4	2 831
Iwate prefecture	2 118	356	0	147	3	2 625
Miyagi prefecture	3 266	751	0	103	0	4 120
Akita prefecture	1 575	138	0	80	0	1 793
Yamagata prefecture	1 672	280	1	175	1	2 129
Fukushima prefecture	3 510	413	0	222	6	4 153
Ibaraki prefecture	5 126	844	1	154	0	6 125
Tochigi prefecture	4 076	746	1	58	2	4 883
Gunma prefecture	3 652	713	0	102	0	4 468
Saitama prefecture	10 818	1 921	8	430	0	13 177
Chiba prefecture	8 897	1 983	0	247	3	11 130
Tokyo	20 153	4 950	5	821	25	25 954
Kanagawa prefecture	12 213	2 937	4	405	21	15 582
Niigata prefecture	3 246	1 104	1	126	1	4 478
Toyama prefecture	1 747	311	0	75	0	2 133
Ishikawa prefecture	1 962	304	0	95	0	2 360
Fukui prefecture	1 310	175	0	70	0	1 555
Yamanashi prefecture	1 674	207	1	49	0	1 931
Nagano prefecture	3 390	604	2	144	0	4 140
Gifu prefecture	3 165	585	1	163	4	3 919
Shizuoka prefecture	6 765	1 344	3	304	3	8 421
Aichi prefecture	10 170	3 040	32	467	3	13 712
Mie prefecture	2 815	645	3	102	13	3 578
Shiga prefecture	1 958	450	8	68	2	2 486
Kyoto prefecture	3 899	1 001	2	175	4	5 081
Osaka prefecture	15 536	3 012	45	682	13	19 287
Hyogo prefecture	8 852	1 613	8	342	24	10 839
Nara prefecture	2 450	223	4	115	1	2 793
Wakayama prefecture	2 127	345	1	31	2	2 506
Tottori prefecture	952	118	0	133	1	1 204
Shimane prefecture	1 042	152	0	90	0	1 284
Okayama prefecture	3 277	489	0	230	30	4 026
Hiroshima prefecture	5 358	584	1	431	4	6 378
Yamaguchi prefecture	2 487	373	0	124	1	2 985
Tokushima prefecture	1 792	255	0	174	2	2 223
Kagawa prefecture	1 850	297	6	198	16	2 367
Ehime prefecture	2 563	412	1	147	1	3 122
Kochi prefecture	1 778	168	0	37	2	1 985
Fukuoka prefecture	9 549	2 226	0	303	6	12 084
Saga prefecture	1 509	292	0	14	0	1 815
Nagasaki prefecture	2 770	470	1	134	3	3 378
Kumamoto prefecture	4 409	953	0	143	0	5 506
Oita prefecture	2 864	374	2	114	0	3 352
Miyazaki prefecture	2 774	557	0	59	0	3 390
Kagoshima prefecture	4 074	514	2	97	1	4 690
Okinawa prefecture	2 882	714	0	80	0	3 678
Total	213 454	41 641	147	9003	220	264 473

†The total number of chronic dialysis patients is the total of the column for the number of patients in Sheet I, and does not necessarily agree with the total number of patients counted according to the method of treatment. CAPD, continuous ambulatory peritoneal dialysis; IPD, intermittent peritoneal dialysis.

Table 8 shows a summary of the primary renal diseases of the prevalent patients in 2006.

Table 9 shows changes in the percentage of patients according to the main primary renal disease of the new patients started on dialysis in 2006. Since 1983, when the patient survey was first conducted, the number of patients with diabetic nephropathy as a primary renal disease has continuously increased. By 1997 the number of patients with chronic glomerulonephritis as the primary renal disease causing end-stage renal disease (ESRD) among the new patients started on dialysis each year was the largest. However, patients with diabetic nephropathy as the primary renal disease made up the largest number of new patients started on dialysis in 1998. The number of patients with diabetic nephropathy has since continuously increased. The percentage of patients with diabetic nephropathy newly started on dialysis reached 42.2% in 2006. In contrast, the percentage of patients with chronic glomerulonephritis as the

TABLE 3. *Changes in the number of patients per million*

Year	Patients per million	Year	Patients per million
1983	443.7	1995	1229.7
1984	497.5	1996	1328.4
1985	547.8	1997	1394.9
1986	604.4	1998	1472.5
1987	658.8	1999	1556.7
1988	721.1	2000	1624.1
1989*	790.0	2001	1721.9
1990	835.7	2002	1801.2
1991	937.6	2003	1862.7
1992	995.8	2004	1943.5
1993	1076.4	2005	2017.6
1994	1149.4	2006	2069.9

*Adjusted at the response rate of 86%; the figures are rounded out at 5 to the nearest 1000.

primary renal disease decreased yearly, down to 25.6% in 2006. The percentage of patients with an "undetermined" primary renal disease increased yearly. In clarifying the distribution of the primary renal diseases of new patients started on dialysis, the increase in the number of patients with an "undetermined" primary renal disease is problematic. Patients with an "undetermined" primary renal disease accounted for 9.9% of new patients started on dialysis in 2006, and were the third largest in number

TABLE 4. *Changes in the annual number of patients newly started on dialysis and in the mean age of patients at the end of the year*

	Mean age of patients newly started on dialysis treatment		Mean age of patients at the end of each year	
Year	Mean	SD	Mean	SD
1983	51.9	15.5	48.3	13.8
1984	53.2	15.3	49.2	13.8
1985	54.4	15.4	50.3	13.7
1986	55.1	15.2	51.1	13.6
1987	55.9	14.9	52.1	13.7
1988	56.9	14.9	52.9	13.6
1989	57.4	14.7	53.8	13.5
1990	58.1	14.6	54.5	13.5
1991	58.1	14.6	55.3	13.5
1992	59.5	14.5	56.0	13.5
1993	59.8	14.4	56.6	13.5
1994	60.4	14.3	57.3	13.5
1995	61.0	14.2	58.0	13.4
1996	61.5	14.2	58.6	13.4
1997	62.2	14.0	59.2	13.4
1998	62.7	13.9	59.9	13.3
1999	63.4	13.9	60.6	13.3
2000	63.8	13.9	61.2	13.2
2001	64.2	13.7	61.6	13.1
2002	64.7	13.6	62.2	13.0
2003	65.4	13.5	62.8	12.9
2004	65.8	13.4	63.3	12.9
2005	66.2	13.4	63.9	12.8
2006	66.4	13.4	64.4	12.8

TABLE 5. *Patients newly started on dialysis in 2006 and their age and sex*

Age of the patients when newly started on dialysis (years)	Male (%)†	Female (%)†	Subtotal (%)†	No information available	Total (%)†
0–4	9 (0.0)	4 (0.0)	13 (0.0)	0	13 (0.0)
5–9	7 (0.0)	5 (0.0)	12 (0.0)	0	12 (0.0)
10–14	8 (0.0)	3 (0.0)	11 (0.0)	0	11 (0.0)
15–19	33 (0.1)	19 (0.2)	52 (0.1)	0	52 (0.1)
20–24	60 (0.3)	27 (0.2)	87 (0.2)	0	87 (0.2)
25–29	111 (0.5)	75 (0.6)	186 (0.5)	1	187 (0.5)
30–34	277 (1.2)	148 (1.2)	425 (1.2)	1	426 (1.2)
35–39	467 (2.1)	227 (1.8)	694 (2.0)	0	694 (2.0)
40–44	637 (2.8)	318 (2.5)	955 (2.7)	0	955 (2.7)
45–49	928 (4.1)	415 (3.3)	1 343 (3.9)	0	1 343 (3.9)
50–54	1 521 (6.8)	745 (6.0)	2 266 (6.5)	0	2 266 (6.5)
55–59	2 698 (12.1)	1 184 (9.5)	3 882 (11.1)	2	3 884 (11.1)
60–64	2 734 (12.2)	1 305 (10.5)	4 039 (11.6)	3	4 042 (11.6)
65–69	3 168 (14.2)	1 609 (12.9)	4 777 (13.7)	3	4 780 (13.7)
70–74	3 650 (16.3)	1 855 (14.9)	5 505 (15.8)	3	5 508 (15.8)
75–79	3 110 (13.9)	1 956 (15.7)	5 066 (14.5)	2	5 068 (14.5)
80–84	2 007 (9.0)	1 579 (12.7)	3 586 (10.3)	2	3 588 (10.3)
85–89	745 (3.3)	767 (6.1)	1 512 (4.3)	2	1 514 (4.3)
90–94	195 (0.9)	209 (1.7)	404 (1.2)	0	404 (1.2)
≥95	23 (0.1)	26 (0.2)	49 (0.1)	0	49 (0.1)
Subtotal	22 388 (100.0)	12 476 (100.0)	34 864 (100.0)	19	34 883 (100.0)
No information available	196	104	300	9	309
Total	22 584	12 580	35 164	28	35 192
Mean (years)	65.59	67.84	66.40	66.58	66.40
SD (years)	13.15	13.73	13.40	15.26	13.40

†The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the subtotal of the column.

TABLE 6. *Number of new patients started on dialysis in 2006 and their age and sex*

Age (years)	Male (%)†	Female (%)†	Subtotal (%)†	No information available	Total (%)†
0–4	17 (0.0)	18 (0.0)	35 (0.0)	0	35 (0.0)
5–9	11 (0.0)	12 (0.0)	23 (0.0)	0	23 (0.0)
10–14	19 (0.0)	13 (0.0)	32 (0.0)	0	32 (0.0)
15–19	81 (0.1)	56 (0.1)	137 (0.1)	0	137 (0.1)
20–24	301 (0.2)	178 (0.2)	479 (0.2)	0	479 (0.2)
25–29	769 (0.5)	404 (0.4)	1 173 (0.5)	1	1 174 (0.5)
30–34	1 919 (1.3)	1 015 (1.0)	2 934 (1.2)	1	2 935 (1.2)
35–39	3 602 (2.4)	1 834 (1.9)	5 436 (2.2)	0	5 436 (2.2)
40–44	5 076 (3.3)	2 779 (2.9)	7 855 (3.1)	1	7 856 (3.1)
45–49	7 500 (4.9)	4 172 (4.3)	11 672 (4.7)	2	11 674 (4.7)
50–54	12 667 (8.3)	7 491 (7.7)	20 158 (8.1)	4	20 162 (8.1)
55–59	23 208 (15.2)	13 335 (13.8)	36 543 (14.6)	6	36 549 (14.6)
60–64	21 065 (13.8)	12 422 (12.8)	33 487 (13.4)	5	33 492 (13.4)
65–69	23 315 (15.3)	14 143 (14.6)	37 458 (15.0)	11	37 469 (15.0)
70–74	22 370 (14.6)	13 477 (13.9)	35 847 (14.3)	15	35 862 (14.4)
75–79	16 813 (11.0)	11 731 (12.1)	28 544 (11.4)	8	28 552 (11.4)
80–84	9 448 (6.2)	8 524 (8.8)	17 972 (7.2)	9	17 981 (7.2)
85–89	3 622 (2.4)	4 057 (4.2)	7 679 (3.1)	3	7 682 (3.1)
90–94	937 (0.6)	1 187 (1.2)	2 124 (0.9)	0	2 124 (0.8)
≥95	109 (0.1)	130 (0.1)	239 (0.1)	0	239 (0.1)
Subtotal	152 849 (100.0)	96 978 (100.0)	249 827 (100.0)	66	249 893 (100.0)
No information available	39	25	64	0	64
Total	152 888	97 003	249 891	66	249 957
Mean (years)	63.70	65.44	64.38	67.70	64.38
SD (years)	12.56	12.98	12.75	12.37	12.75

†The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the subtotal of the column.

TABLE 7. *Numbers and mean ages of new patients started on dialysis in 2006 in terms of primary disease*

Primary disease	Number of patients (%)	No information available (%)	Total (%)	Mean age (years)	SD (years)
Chronic glomerulonephritis	8 853 (25.6)	61 (23.7)	8 914 (25.6)	65.94	14.48
Chronic pyelonephritis	294 (0.8)	1 (0.4)	295 (0.8)	65.20	14.96
Rapidly progressive glomerulonephritis	418 (1.2)	3 (1.2)	421 (1.2)	69.24	14.36
Nephropathy of pregnancy/Pregnancy toxemia	44 (0.1)	0 (0.0)	44 (0.1)	57.20	15.21
Other nephritides that cannot be classified	148 (0.4)	1 (0.4)	149 (0.4)	63.10	19.03
Polycystic kidney	825 (2.4)	2 (0.8)	827 (2.4)	60.70	12.65
Renal sclerosis	3 243 (9.4)	19 (7.4)	3 262 (9.4)	73.75	11.24
Malignant hypertension	267 (0.8)	2 (0.8)	269 (0.8)	62.38	17.37
Diabetic nephropathy	14 874 (43.0)	94 (36.6)	14 968 (42.9)	65.18	11.56
Systemic lupus erythematosus nephritis	264 (0.8)	4 (1.6)	268 (0.8)	60.91	15.16
Amyloidal kidney	168 (0.5)	0 (0.0)	168 (0.5)	65.70	11.16
Gouty kidney	113 (0.3)	0 (0.0)	113 (0.3)	65.23	12.45
Renal failure due to congenital abnormality of metabolism	30 (0.1)	0 (0.0)	30 (0.1)	44.43	24.74
Kidney and urinary tract tuberculosis	19 (0.1)	0 (0.0)	19 (0.1)	72.47	11.20
Kidney and urinary tract stone	75 (0.2)	0 (0.0)	75 (0.2)	70.89	9.24
Kidney and urinary tract tumor	155 (0.4)	3 (1.2)	158 (0.5)	70.80	11.78
Obstructive urinary tract disease	126 (0.4)	2 (0.8)	128 (0.4)	65.64	16.45
Myeloma	134 (0.4)	3 (1.2)	137 (0.4)	68.69	9.77
Hypoplastic kidney	51 (0.1)	0 (0.0)	51 (0.1)	39.33	27.18
Undetermined	3 410 (9.8)	44 (17.1)	3 454 (9.9)	69.13	13.80
Reintroduction after transplantation	219 (0.6)	5 (1.9)	224 (0.6)	54.24	16.29
Others	890 (2.6)	13 (5.1)	903 (2.6)	65.47	16.54
Subtotal	34 620 (100.0)	257 (100.0)	34 877 (100.0)	66.38	13.41
No information available	263	52	315	68.68	12.41
Total	34 883	309	35 192	66.40	13.40

The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the subtotal of the column.

TABLE 8. *Number of all dialysis patients in 2006 according to primary disease and mean age*

Primary disease	Number of patients (%)	No information available (%)	Total (%)	Mean age	SD
Chronic glomerulonephritis	105 227 (42.2)	14 (48.3)	105 241 (42.2)	63.00	12.90
Chronic pyelonephritis	3 044 (1.2)	0 (0.0)	3 044 (1.2)	62.31	14.31
Rapidly progressive glomerulonephritis	1 600 (0.6)	0 (0.0)	1 600 (0.6)	64.38	14.34
Nephropathy of pregnancy/Pregnancy toxemia	1 737 (0.7)	1 (3.4)	1 738 (0.7)	59.26	9.89
Other nephritides that cannot be classified	1 112 (0.4)	0 (0.0)	1 112 (0.4)	57.17	16.92
Polycystic kidney	8 433 (3.4)	0 (0.0)	8 433 (3.4)	62.52	10.99
Renal sclerosis	15 349 (6.2)	3 (10.3)	15 352 (6.2)	72.74	11.92
Malignant hypertension	1 862 (0.7)	0 (0.0)	1 862 (0.7)	62.18	14.40
Diabetic nephropathy	80 534 (32.3)	9 (31.0)	80 543 (32.3)	65.37	10.92
Systemic lupus erythematosus nephritis	2 125 (0.9)	0 (0.0)	2 125 (0.9)	56.22	13.56
Amyloidal kidney	478 (0.2)	0 (0.0)	478 (0.2)	64.56	11.52
Gouty kidney	1 220 (0.5)	0 (0.0)	1 220 (0.5)	65.14	11.50
Renal failure due to congenital abnormality of metabolism	250 (0.1)	0 (0.0)	250 (0.1)	46.51	18.29
Kidney and urinary tract tuberculosis	396 (0.2)	0 (0.0)	396 (0.2)	68.83	9.97
Kidney and urinary tract stone	534 (0.2)	0 (0.0)	534 (0.2)	67.62	11.13
Kidney and urinary tract tumor	584 (0.2)	0 (0.0)	584 (0.2)	68.68	11.91
Obstructive urinary tract disease	673 (0.3)	0 (0.0)	673 (0.3)	60.33	18.30
Myeloma	216 (0.1)	0 (0.0)	216 (0.1)	69.02	11.73
Hypoplastic kidney	520 (0.2)	1 (3.4)	521 (0.2)	40.12	19.14
Undetermined	17 471 (7.0)	1 (3.4)	17 472 (7.0)	66.65	13.55
Reintroduction after transplantation	1 751 (0.7)	0 (0.0)	1 751 (0.7)	52.19	12.62
Others	4 330 (1.7)	0 (0.0)	4 330 (1.7)	61.97	16.40
Subtotal	249 446 (100.0)	29 (100.0)	249 475 (100.0)	64.37	12.75
No information available	447	35	482	66.89	12.95
Total	249 893	64	249 957	64.38	12.75

The value in parentheses on the right-hand side of each number is the percentage of patients with respect to the subtotal of the column.

following those with diabetic nephropathy and chronic glomerulonephritis. Following these three, patients with nephrosclerosis as the primary renal disease accounted for 9.4%. The number of patients with nephrosclerosis as the primary renal disease has been increasing. It is considered that this increase is caused by the aging of the new dialysis patients. The percentages of patients with polycystic kidney disease, rapidly progressive glomerulonephritis, chronic pyelonephritis, and systemic lupus erythematosus (SLE) nephritis as the primary renal diseases were nearly the same as those in the previous years.

Table 10 shows changes in the percentage of patients according to the primary renal disease for the prevalent dialysis patients at the end of 2006. Reflecting the trend among new patients started on dialysis each year, the number of patients with chronic glomerulonephritis as the primary renal

TABLE 9. *Changes in the percentage of new patients started on dialysis each year according to primary disease*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Diabetic nephropathy	15.6	17.4	19.6	21.3	22.1	24.3	26.5	26.2	28.1	28.4	29.9	30.7
Chronic glomerulonephritis	60.5	58.7	56.0	54.8	54.2	49.9	47.4	46.1	44.2	42.2	41.4	40.5
Renal sclerosis	3.0	3.3	3.5	3.7	3.9	3.9	4.1	5.4	5.5	5.9	6.2	6.1
Polycystic kidney	2.8	2.8	3.1	2.9	3.2	3.1	3.1	2.9	3.0	2.7	2.6	2.5
Chronic pyelonephritis	2.4	2.2	2.1	2.0	1.8	1.8	1.5	1.5	1.7	1.6	1.1	1.4
Rapidly progressive glomerulonephritis	0.9	0.7	0.9	1.0	0.8	0.9	0.8	0.7	0.6	0.7	0.8	0.8
Systemic lupus erythematosus nephritis	1.1	1.1	1.1	1.2	0.9	0.9	1.0	1.1	1.3	1.3	1.2	1.2
Undetermined	4.4	4.0	4.8	4.2	4.1	3.8	4.0	3.3	3.7	3.7	3.3	3.9
Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Diabetic nephropathy	31.9	33.1	33.9	35.7	36.2	36.6	38.1	39.1	41.0	41.3	42.0	42.9
Chronic glomerulonephritis	39.4	38.9	36.6	35.0	33.6	32.5	32.4	31.9	29.1	28.1	27.4	25.6
Renal sclerosis	6.3	6.4	6.8	6.7	7.0	7.6	7.6	7.8	8.5	8.8	9.0	9.4
Polycystic kidney	2.4	2.5	2.4	2.4	2.2	2.4	2.3	2.4	2.3	2.7	2.3	2.4
Chronic pyelonephritis	1.2	1.1	1.2	1.1	1.1	1.0	1.1	0.9	1.0	0.9	1.0	0.8
Rapidly progressive glomerulonephritis	0.8	0.8	1.1	0.9	0.9	1.0	1.0	1.1	1.2	1.1	1.1	1.2
Systemic lupus erythematosus nephritis	1.1	1.3	1.0	1.1	1.2	0.9	1.0	0.9	0.7	0.8	0.8	0.8
Undetermined	4.5	5.0	5.5	5.6	6.1	7.6	9.0	8.4	8.8	9.3	9.5	9.9

TABLE 10. *Changes in the percentage of patients at the end of each year according to primary disease*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Diabetic nephropathy	7.4	8.4	9.4	10.5	11.7	12.8	14.0	14.9	16.4	17.1	18.2	19.2
Chronic glomerulonephritis	74.5	72.1	72.3	70.6	69.4	67.9	65.9	64.1	61.7	60.4	58.8	57.7
Renal sclerosis	1.5	1.7	1.9	2.0	2.1	2.1	2.3	2.6	2.9	3.1	3.4	3.6
Polycystic kidney	2.7	2.9	3.0	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.3	3.2
Chronic pyelonephritis	3.1	3.3	2.6	2.4	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.8
Rapidly progressive glomerulonephritis	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Systemic lupus erythematosus nephritis	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.1	1.1	1.1	1.1
Undetermined	2.2	2.3	2.3	2.5	2.6	2.5	2.6	2.6	2.9	2.9	2.9	3.1
Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Diabetic nephropathy	20.4	21.6	22.7	24.0	25.1	26.0	27.2	28.1	29.2	30.2	31.4	32.3
Chronic glomerulonephritis	56.6	55.4	54.1	52.5	51.1	49.7	49.6	48.2	46.6	45.1	43.6	42.2
Renal sclerosis	3.8	4.0	4.2	4.4	4.5	4.8	5.0	5.1	5.3	5.7	5.9	6.2
Polycystic kidney	3.2	3.2	3.2	3.2	3.2	3.2	3.3	3.3	3.3	3.4	3.3	3.4
Chronic pyelonephritis	1.7	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.3	1.3	1.2	1.2
Rapidly progressive glomerulonephritis	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Systemic lupus erythematosus nephritis	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.9
Undetermined	3.2	3.6	3.9	4.2	4.4	5.0	5.6	5.9	6.3	6.4	6.6	7.0

disease has continuously decreased year by year. Instead, the number of patients with diabetic nephropathy as the primary renal disease has continuously increased. Assuming that the dynamics of the dialysis patient population in Japan continues to show this trend, the percentage of patients with chronic glomerulonephritis as the primary renal disease and that with diabetic nephropathy will reverse; it is considered that the percentage of patients with diabetic nephropathy as the primary renal disease will become the largest. Patients with an "undetermined" primary renal disease accounted for 9.4% of all the dialysis patients and were the third largest in number following those with chronic glomerulonephritis and diabetic nephropathy. Following these three, the number of patients with nephrosclerosis as the primary renal disease was large, and it has been increasing steadily. The percentage of patients with other primary renal diseases was similar to those in the previous years.

4. Causes of death

Table 11 shows the classification of the causes of death of new patients who were started on dialysis in 2006 and who died by the end of 2006. Table 12 shows the classification of the causes of death of patients who died in 2006 in the whole dialysis patient population. Table 13 shows the changes in the percentages of the leading causes of death. The classification of the causes of death was changed on the basis of the

TABLE 11. *Classification of the causes of death of patients started on dialysis in 2006*

Cause of death	Male (%)	Female (%)	Total (%)	No information available	Total (%)
Cardiac failure	380 (21.1)	280 (25.7)	660 (22.8)	0	660 (22.8)
Cerebrovascular disease	98 (5.4)	73 (6.7)	171 (5.9)	0	171 (5.9)
Infectious disease	494 (27.4)	270 (24.8)	764 (26.4)	0	764 (26.4)
Hemorrhage	39 (2.2)	22 (2.0)	61 (2.1)	0	61 (2.1)
Malignant tumor	221 (12.3)	80 (7.3)	301 (10.4)	0	301 (10.4)
Cachexia/Uremia	45 (2.5)	44 (4.0)	89 (3.1)	0	89 (3.1)
Cardiac infarction	59 (3.3)	33 (3.0)	92 (3.2)	0	92 (3.2)
Potassium poisoning/Moribund	68 (3.8)	28 (2.6)	96 (3.3)	0	96 (3.3)
Chronic hepatitis/Cirrhosis	29 (1.6)	18 (1.7)	47 (1.6)	0	47 (1.6)
Encephalopathy	2 (0.1)	0 (0.0)	2 (0.1)	0	2 (0.1)
Suicide/Refusal of treatment	20 (1.1)	8 (0.7)	28 (1.0)	0	28 (1.0)
Intestinal obstruction	9 (0.5)	16 (1.5)	25 (0.9)	0	25 (0.9)
Lung thrombus/Pulmonary embolus	4 (0.2)	7 (0.6)	11 (0.4)	0	11 (0.4)
Death due to disaster	3 (0.2)	2 (0.2)	5 (0.2)	0	5 (0.2)
Others	207 (11.5)	123 (11.3)	330 (11.4)	0	330 (11.4)
Undetermined	125 (6.9)	85 (7.8)	210 (7.3)	0	210 (7.3)
Subtotal	1803 (100.0)	1089 (100.0)	2892 (100.0)	0	2892 (100.0)
No information available	8	9	17	0	17
Total	1811	1098	2909	0	2909

TABLE 12. *Classification of the causes of death of patients who died in 2006*

Cause of death	Male (%)	Female (%)	Total (%)	No information available	Total (%)
Cardiac failure	3 237 (23.4)	2 234 (27.4)	5 471 (24.9)	0	5 471 (24.9)
Cerebrovascular disease	1 249 (9.0)	823 (10.1)	2 072 (9.4)	1	2 073 (9.4)
Infectious disease	2 769 (20.1)	1 604 (19.7)	4 373 (19.9)	2	4 375 (19.9)
Hemorrhage	247 (1.8)	171 (2.1)	418 (1.9)	0	418 (1.9)
Malignant tumor	1 435 (10.4)	582 (7.1)	2 017 (9.2)	0	2 017 (9.2)
Cachexia/Uremia	367 (2.7)	315 (3.9)	682 (3.1)	0	682 (3.1)
Cardiac infarction	642 (4.6)	316 (3.9)	958 (4.4)	0	958 (4.4)
Potassium poisoning/Moribund	755 (5.5)	363 (4.4)	1 118 (5.1)	0	1 118 (5.1)
Chronic hepatitis/Cirrhosis	213 (1.5)	82 (1.0)	295 (1.3)	0	295 (1.3)
Encephalopathy	9 (0.1)	8 (0.1)	17 (0.1)	0	17 (0.1)
Suicide/Refusal of treatment	137 (1.0)	52 (0.6)	189 (0.9)	0	189 (0.9)
Intestinal obstruction	143 (1.0)	99 (1.2)	242 (1.1)	0	242 (1.1)
Lung thrombus/Pulmonary embolus	37 (0.3)	21 (0.3)	58 (0.3)	0	58 (0.3)
Death due to disaster	103 (0.7)	42 (0.5)	145 (0.7)	0	145 (0.7)
Others	1 273 (9.2)	817 (10.0)	2 090 (9.5)	0	2 090 (9.5)
Undetermined	1 192 (8.6)	629 (7.7)	1 821 (8.3)	0	1 821 (8.3)
Total	13 808 (100.0)	8 158 (100.0)	21 966 (100.0)	3	21 969 (100.0)
No information available	111	65	176	0	176
Total	13 919	8 223	22 142	3	22 145

ICD-10 classification starting with the survey at the end of 2003.

The causes of death of new patients started on dialysis in 2006 were infectious diseases (26.4%), cardiac failure (22.8%), malignant tumors (10.4%), cerebrovascular disease (5.9%), and hyperkalemia/sudden death (3.3%). The percentage of myocardial infarction, which has been the fifth cause of death until 2005, was 3.2% in 2006, and was the sixth cause of death in 2006. The percentage of dialysis patients who died of infectious diseases has increased continuously since 1990. This percentage was equivalent to that of dialysis patients who died of cardiac failure between 2003 and 2005; however, the percentage of dialysis patients who died of infectious diseases was markedly higher by 3% or more than the percentage of dialysis patients who died of cardiac failure. The increases in the numbers of elderly patients and diabetic patients who easily develop infectious diseases are considered to account for the largest percentage of patients who died of infectious diseases. On the basis of these findings, for new patients started on dialysis, measures against cardiac failure and infectious diseases are therefore of particular importance.

The leading cause of death among the prevalent dialysis patient population was cardiac failure, accounting for 24.9% of all patients deaths. The percentage of deaths from cardiac failure among all the patients who died decreased between 1990 and around 1996, and remained nearly constant afterwards. The second leading cause of death was infectious diseases, accounting for 19.9% of all patients deaths. The percentage of deaths from infectious diseases has tended to increase since 1990. These ten-

TABLE 13. *Changes in the primary diseases in patients started on dialysis annually*

Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Cardiac failure	30.3	30.5	31.3	33.2	32.7	36.5	33.4	30.4	30.5	31.1	29.9	28.2
Infectious disease	11.0	11.5	11.5	12.0	12.0	12.2	11.7	11.6	12.1	11.3	12.2	12.6
Cerebrovascular disease	14.2	15.4	14.2	14.0	14.2	12.9	13.2	13.9	13.7	13.6	13.5	14.1
Malignant tumor	7.7	6.9	6.4	6.9	5.8	6.9	7.6	8.2	7.6	7.1	7.4	7.3
Cardiac infarction	5.3	4.8	5.3	6.1	6.0	5.4	5.3	5.8	5.8	5.8	5.7	7.1
Others	5.1	4.9	5.7	4.7	5.2	4.8	4.4	4.6	4.4	4.5	4.1	4.5
Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cardiac failure	25.4	24.1	23.9	24.1	24.3	23.2	25.5	25.1	25.0	25.1	25.8	24.9
Infectious disease	13.8	14.6	14.9	15.0	16.3	16.6	16.3	15.9	18.5	18.8	19.2	19.9
Cerebrovascular disease	13.5	12.9	12.6	12.1	11.3	11.3	11.6	11.2	10.7	10.6	9.8	9.4
Malignant tumor	7.2	7.7	8.1	7.7	7.6	8.3	8.5	8.5	8.5	9.0	9.0	9.2
Cardiac infarction	7.5	7.4	8.4	7.9	7.4	7.0	7.4	7.4	6.2	5.4	5.1	4.4
Others	5.8	6.3	6.7	7.0	7.7	7.9	9.1	9.0	9.7	10.3	9.1	9.5

TABLE 14. *Changes in the annual crude mortality rate*

Year	Crude mortality rate (%)	Year	Crude mortality rate (%)
1983	9.0	1995	9.7
1984	8.9	1996	9.4
1985	9.1	1997	9.4
1986	9.0	1998	9.2
1987	8.5	1999	9.7
1988	9.2	2000	9.2
1989	7.9	2001	9.3
1990	9.6	2002	9.2
1991	8.9	2003	9.3
1992	9.7	2004	9.4
1993	9.4	2005	9.5
1994	9.5	2006	9.2

dencies were similar to those observed for the causes of death of new patients started on dialysis, which was mentioned before. The increases in the number of elderly patients, who are weak from comorbid conditions, and in the number of diabetic patients are considered to have contributed to the increase in the percentage of deaths from infections diseases.

Following the causes of death mentioned above, the percentages of patients who died of cerebrovascular disease and malignant tumors were high, 9.4% and 9.2%, respectively. The percentage of patients who died of cerebrovascular disease has tended to decrease since 1994.

The percentage of patients who died of myocardial infarction has clearly decreased since 2002, and it was 4.4% in 2006. This may indicate the good outcome of the widespread use of improved therapies for ischemic cardiac disease, including catheter intervention and coronary artery bypass grafting (CABG).

5. Annual crude mortality rate

The annual crude mortality rate (%) was calculated from the facility survey data. It is the ratio of the number of patients who died divided by the mean number of prevalent patients at the end of 2005 and 2006. The annual crude mortality rate in 2006 was 9.2%. Table 14 shows the annual crude mortality rates from 1983, which ranged between 9.2% to 9.7% from 1992. Despite the increase in the numbers of diabetic patients, who have a low life expectancy, and elderly patients, the annual crude mortality rate remains nearly constant, suggesting an improvement in the overall management of dialysis patients in Japan.

6. Cumulative survival rate of new patients started on dialysis each year

The cumulative survival rates of new patients started on dialysis from 1983 are summarized by introduction year in Table 15. The survival rates were calculated actuarially (2).

TABLE 15. *Survival rates of patients on dialysis since 1983*

Year when patients were started on dialysis	Number of patients	1-year survival rate	2-year survival rate	3-year survival rate	4-year survival rate	5-year survival rate	6-year survival rate	7-year survival rate	8-year survival rate	9-year survival rate	10-year survival rate	11-year survival rate	12-year survival rate	13-year survival rate	14-year survival rate	15-year survival rate	16-year survival rate	17-year survival rate	18-year survival rate	19-year survival rate	20-year survival rate	21-year survival rate	22-year survival rate	23-year survival rate
1983	9 920	0.819	0.748	0.683	0.634	0.590	0.557	0.525	0.486	0.457	0.426	0.397	0.373	0.349	0.330	0.309	0.290	0.274	0.257	0.243	0.228	0.215	0.201	0.191
1984	10 792	0.818	0.737	0.673	0.622	0.579	0.541	0.501	0.468	0.439	0.411	0.382	0.357	0.333	0.312	0.292	0.275	0.257	0.243	0.231	0.216	0.203	0.193	
1985	11 708	0.797	0.723	0.664	0.613	0.567	0.525	0.489	0.449	0.417	0.390	0.365	0.341	0.316	0.294	0.276	0.258	0.241	0.227	0.213	0.197	0.185		
1986	12 713	0.800	0.726	0.668	0.620	0.567	0.523	0.482	0.448	0.411	0.382	0.355	0.331	0.309	0.287	0.270	0.254	0.237	0.224	0.212	0.200			
1987	13 655	0.816	0.739	0.673	0.610	0.559	0.510	0.465	0.429	0.396	0.368	0.342	0.318	0.298	0.276	0.257	0.242	0.225	0.208	0.196				
1988	14 863	0.826	0.742	0.668	0.606	0.550	0.502	0.459	0.422	0.387	0.356	0.329	0.306	0.284	0.262	0.245	0.228	0.214	0.199					
1989	14 695	0.850	0.762	0.689	0.620	0.565	0.516	0.471	0.432	0.397	0.365	0.339	0.314	0.292	0.272	0.254	0.238	0.223						
1990	16 641	0.840	0.751	0.677	0.612	0.558	0.505	0.462	0.423	0.388	0.357	0.329	0.304	0.282	0.264	0.247	0.231							
1991	18 375	0.829	0.737	0.664	0.600	0.542	0.492	0.448	0.411	0.379	0.349	0.322	0.297	0.277	0.259	0.241								
1992	20 076	0.823	0.730	0.654	0.592	0.535	0.487	0.443	0.405	0.373	0.345	0.320	0.296	0.277	0.255									
1993	21 073	0.834	0.745	0.670	0.601	0.546	0.495	0.451	0.413	0.381	0.351	0.324	0.300	0.277										
1994	21 625	0.831	0.745	0.673	0.608	0.549	0.497	0.455	0.417	0.381	0.350	0.321	0.299											
1995	23 180	0.843	0.757	0.684	0.615	0.559	0.511	0.468	0.430	0.395	0.363	0.335												
1996	25 241	0.834	0.752	0.678	0.615	0.561	0.515	0.465	0.427	0.392	0.361													
1997	25 902	0.840	0.755	0.685	0.625	0.569	0.520	0.476	0.434	0.399														
1998	27 240	0.847	0.768	0.701	0.641	0.581	0.531	0.484	0.443															
1999	28 305	0.853	0.777	0.711	0.646	0.589	0.538	0.493																
2000	29 769	0.858	0.781	0.716	0.654	0.598	0.546																	
2001	31 614	0.858	0.780	0.713	0.649	0.597																		
2002	32 361	0.862	0.786	0.720	0.660																			
2003	33 526	0.864	0.789	0.725																				
2004	34 594	0.870	0.796																					
2005	35 530	0.867																						

TABLE 16. *Measurement frequencies of endotoxin concentration in the dialysate solution*

	Measurement frequency of endotoxin concentration										
	Every day	Every week	Every two weeks	Every month	Several times per year	Once a year	None	Subtotal	Unspecified	No information available	Total
Number of facilities	15	85	164	689	1372	548	615	3488	185	312	3985
(%)	(0.4)	(2.4)	(4.7)	(19.8)	(39.3)	(15.7)	(17.6)	(100.0)			

The one-year survival rate of new patients started on dialysis in 2005 was 0.867. The one-year survival rate of new patients started on dialysis has been improving since 1983, despite the aging of new patients started on dialysis and the increase in the number of diabetic patients. However, the one-year survival rate of new patients started on dialysis in 2005, which was obtained in this study, was lower than that in 2004.

The five-year and 10-year survival rates of new patients started on dialysis have been increasing slightly since the introduction year of 1992; however, the 15-year and 20-year survival rates of new patients started on dialysis tend to decrease. In the survey next year, the 15-year survival rate of new patients started on dialysis after 1992 will be calculated. It will be interesting to determine is the 15-year survival rate will also increase for the new patients started on dialysis after 1992.

II. Tabulation of data on new items surveyed

A. Current status of dialysate quality control

1. Endotoxin concentration in the dialysate. There were 3488 facilities (87.5% of 3985 facilities responded to questions in Sheet I) that answered questions regarding the measurement frequency of endotoxin concentration in the dialysate (Table 16). The endotoxin concentration in the dialysate was also determined in the same survey conducted at the end of 1999. According to this survey result (3), the number of facilities that measured endotoxin concentration in the dialysate was 1788 out of the 2908 facilities that responded to the questionnaire (61.5%). In the latest survey conducted at the end of 2006, the number of facilities that measured the concentration was 2873 out of the 3488 facilities that responded to the related questions (82.4%). The percentage of facilities that measured endotoxin concentration in the dialysate increased significantly in the past seven years. This finding indicates that the practice of measuring endotoxin concentration has spread among facilities.

The endotoxin concentration in the dialysate is measured more than once a month at 953 facilities (27.3%) and more than twice a year at 2325 facilities (66.7%). Measured endotoxin concentrations were obtained from 2746 facilities (Table 17). The target endotoxin concentration in the dialysate recommended by the Japanese Society for Dialysis Therapy in 2004 was <50 EU/L. The number of facilities that satisfied this target level of <50 EU/L was 2444 facilities (89.0%). Furthermore, the number of facilities with endotoxin concentrations <1 EU/L was 817 facilities (29.8%). When the number of facilities was divided by the total number of facilities that responded to the questionnaire on the measurement frequency of endotoxin concentration in the dialysate, the percentage of facilities with <50 EU/L was 70.1%, and that with <1 EU/L was 23.4%.

According to the results of the survey conducted at the end of 1999 (3), the number of facilities that achieved endotoxin concentrations in the dialysate of <50 EU/L was 1229 out of the 1616 facilities (76.1%) that responded to the questionnaire. These results indicate that the endotoxin concentration in the dialysate at dialysis facilities in Japan has significantly improved in the past seven years.

2. Dialysate bacteria count. Presently, the bacteria count in the dialysate has been used as an indicator of the cleanliness of the dialysate. It was pointed out that the bacteria count in the dialysate is not always in proportion to the endotoxin concentration in the dialysate; therefore, decreasing the bacteria count in

TABLE 17. *Endotoxin concentrations in the dialysate solution*

	Endotoxin concentration (EU/L) in the dialysate solution											
	<1	1–9	10–49	50–99	100–249	250–499	>500	Subtotal	Unspecified	Total	Mean	SD
Number of facilities	817	1100	527	152	94	28	28	2746	1239	3985	41.07	344.10
(%)	(29.8)	(40.1)	(19.2)	(5.5)	(3.4)	(1.0)	(1.0)	(100.0)				

TABLE 18. *Measurement frequencies of bacterial count in the dialysate solution*

	Measurement frequency of bacterial count in the dialysate solution										
	Every day	Every week	Every two weeks	Every month	Several times per year	Once a year	None	Subtotal	Unspecified	No information available	Total
Number of facilities	2	29	63	277	532	294	2031	3228	386	371	3985
(%)	(0.1)	(0.9)	(2.0)	(8.6)	(16.5)	(9.1)	(62.9)	(100.0)			

the dialysate as much as possible has been emphasized to improve the cleanliness of the dialysate. Under such circumstances, items related to the bacteria count of the dialysate were also added in this survey.

There were 3228 facilities (81.0% of 3985 facilities responded to questions in Sheet I) that answered questions regarding the measurement frequency of the bacteria count in the dialysate (Table 18). Out of the 3228 facilities, 1197 (37.1%) measured the bacteria count in the dialysate at least once a year. Among them, 903 (28.0%) measured the bacteria count in the dialysate more than twice yearly, and 371 (11.5%) more than once a month. Compared with the number of facilities that measured endotoxin concentration in the dialysate, the number of facilities that measured the bacteria count remained low.

The target bacteria count in the dialysate of less than 100 cfu/mL was recommended by the Japanese Society for Dialysis Therapy in 1995. The number of facilities that satisfied this target was 1017 (96.9% of 1049 facilities). According to the control standard of the dialysate, a bacteria count of <0.1 cfu/mL is specified as "ultrapure dialysate." The number of facilities that satisfied this definition was 508 (48.4%; Table 19).

In the dialysate, heterotrophic bacteria, which adapt to the oligotrophic environment, exist. In general, a medium containing high concentrations of organic components such as agar is used to cultivate common bacteria; however, heterotrophic bacteria existing in the dialysate are difficult to proliferate in a medium containing high concentrations of organic components. Therefore, the use of an oligotrophic medium, which is suitable for the detection of heterotrophic bacteria, is recommended for the cultivation of bacteria in the dialysate.

Reasoner's No. 2 agar (R2A) and tryptone glucose extract agar (TGEA) are examples of oligotrophic media. They are cultivation media suitable for the detection of bacteria in the dialysate and are frequently used. In contrast, common agar media, blood agar, and tryptic soy agar (TSA medium) contain high concentrations of organic components and are not necessarily suitable for the detection of bacteria in the dialysate.

Among the 1106 facilities that responded to the questionnaire on the medium used for bacterial cultivation of dialysate, 782 (70.7%) used the R2A or TGEA medium. In particular, the number of facilities that used R2A medium was the largest (746 facilities, 67.5%). In contrast, 222 facilities (20.1%) used common agar media, blood agar, or TSA medium, which contain high concentrations of organic components (Table 20).

TABLE 19. *Bacterial counts in the dialysate solution*

	Bacterial count in the dialysate solution (cfu/mL)								
	<0.1	0.1–0.9	1–9	10–99	>100	Subtotal	Unspecified	No information available	Total
Number of facilities	508	181	209	119	32	1049	2036	900	3985
(%)	(48.4)	(17.3)	(19.9)	(11.3)	(3.1)	(100.0)			

TABLE 20. *Media used for bacterial cultivation of the dialysate solution*

	Media used for bacterial cultivation of the dialysate solution									
	General agar medium	R2A medium	TGEA medium	Blood agar medium	TSA medium	Other media	Subtotal	Unspecified	No information available	Total
Number of facilities	170	746	36	48	4	102	1106	2023	856	3985
(%)	(15.4)	(67.5)	(3.3)	(4.3)	(0.4)	(9.2)	(100.0)			

R2A, Reasoner's No. 2 agar; TGEA, tryptone glucose extract agar; TSA, tryptic soy agar.

TABLE 21. *Installation of an endotoxin cut filter (ETCF)*

	ETCF				
	With	Without	Subtotal	Unspecified or no information available	Total
Number of facilities	2772	758	3530	455	3985
(%)	(78.5)	(21.5)	(100.0)		

3. Installation of an endotoxin cut filter. The installation of an endotoxin cut filter (ETCF) in the dialysis console was surveyed (Table 21). There were 3530 facilities (89.6% of 3985 facilities that responded to questions in Sheet I) that answered regarding the installation of ETCF. Out of the 3530 facilities, 2772 (78.5%) responded that they installed ETCF.

In this survey, the number of dialysis consoles in which ETCF is installed was also counted (Table 22). According to the results there are 95 947 dialysis consoles in total at the 3530 facilities, among which an ETCF has been installed in 51 213 consoles (53.4%).

B. Current status of renal anemia therapy

1. Hemoglobin concentration. Table 23 shows the distribution of hemoglobin concentrations in all chronic dialysis patients at the end of 2005 and 2006 (1). All patients treated by all dialysis modalities are included as the subjects in Table 23. The number of patients in 2005 was smaller than that in 2006, because in 2005 the hemoglobin concentration was surveyed only at the facilities that participated in the survey using floppy disks.

TABLE 22. *Number of dialysis consoles in which an endotoxin cut filter (ETCF) was installed*

	ETCF		
	With	Without	Total
Number of consoles	51 213	44 734	95 947
(%)	(53.4)	(46.6)	(100.0)

The mean hemoglobin concentrations in the prevalent patients at the end of 2005 and 2006 were similar, 10.23 ± 1.37 g/dL and 10.23 ± 1.33 g/dL, respectively. The only difference is that the percentage of patients with hemoglobin concentrations <8.0 g/dL decreased by 0.4%, and those with a hemoglobin concentration of ≥11.0 g/dL decreased by 0.8% in 2006, compared with those in 2005.

In April 2006 the NHI system was revised and the price of erythropoietin administered to hemodialysis patients was included in the chronic dialysis management fee. In relation to this, it is suspected that this revision may affect the renal anemia condition of chronic dialysis patients and their therapy. However, as far as the survey results are concerned, no significant change in the hemoglobin level of the chronic dialysis patients was observed.

The hemoglobin concentrations of chronic dialysis patients in terms of gender and age range are shown in Tables 24 and 25. The mean hemoglobin concentration of all the male dialysis patients was 10.33 ± 1.35 g/dL. As the age of the patients increased, the percentage of patients with hemoglobin concentrations <10 g/dL increased. On the other hand, the mean hemoglobin concentration of all the female dialysis patients was 10.06 ± 1.29 g/dL, which was slightly lower than that of the male patients. For female patients aged 15 years or older, as the age of the patients increased, the percentage of patients with low hemoglobin concentrations increased.

Table 26 shows a summary of the relationship between primary renal disease and hemoglobin concentration. The percentages of patients with hemoglobin concentrations <10 g/dL for four leading primary renal diseases were 38.1% (chronic glomerulonephritis), 41.3% (diabetic nephropathy), 42.4% (nephrosclerosis), and 34.6% (polycystic kidney disease).

2. Erythropoietin dose. The distributions of patients according to erythropoietin dose in 2005 and

TABLE 23. *Hemoglobin concentration in 2005 and 2006 (entire dialysis patient population)*

	Hemoglobin concentration (g/dL)										
	<8.0	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	≥12.0	Subtotal	Unspecified	Total	Mean	SD
Number of patients in 2005	6564	12 707	33 785	45 231	26 608	11 298	136 193	31 919	168 112	10.23	1.37
(%)	(4.8)	(9.3)	(24.8)	(33.2)	(19.5)	(8.3)	(100.0)				
Number of patients in 2006	9529	21 622	54 878	71 654	40 619	17 876	216 178	33 779	249 957	10.23	1.33
(%)	(4.4)	(10.0)	(25.4)	(33.1)	(18.8)	(8.3)	(100.0)				

TABLE 24. *Hemoglobin concentrations in male dialysis patients*

	Hemoglobin concentration (g/dL)										
Age (years)	<8.0	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	≥12.0	Subtotal	No information available	Total	Mean	SD
<15	2	4	8	3	3	6	26	21	47	10.53	2.63
(%)	(7.7)	(15.4)	(30.8)	(11.5)	(11.5)	(23.1)	(100.0)				
15–29	38	71	187	356	222	99	973	178	1 151	10.45	1.31
(%)	(3.9)	(7.3)	(19.2)	(36.6)	(22.8)	(10.2)	(100.0)				
30–44	236	595	1 777	3 141	2 162	1 278	9 189	1 408	10 597	10.61	1.35
(%)	(2.6)	(6.5)	(19.3)	(34.2)	(23.5)	(13.9)	(100.0)				
45–59	1260	2 868	8 222	12 335	8 435	4 540	37 660	5 715	43 375	10.48	1.37
(%)	(3.3)	(7.6)	(21.8)	(32.8)	(22.4)	(12.1)	(100.0)				
60–74	2429	5 279	14 095	19 394	11 490	5 142	57 829	8 921	66 750	10.29	1.34
(%)	(4.2)	(9.1)	(24.4)	(33.5)	(19.9)	(8.9)	(100.0)				
75–89	1383	2 966	6 838	8 466	4 432	1 678	25 763	4 120	29 883	10.10	1.31
(%)	(5.4)	(11.5)	(26.5)	(32.9)	(17.2)	(6.5)	(100.0)				
≥90	60	108	263	268	138	44	881	165	1 046	9.93	1.27
(%)	(6.8)	(12.3)	(29.9)	(30.4)	(15.7)	(5.0)	(100.0)				
Subtotal	5408	11 891	31 390	43 963	26 882	12 787	132 321	20 528	152 849	10.33	1.35
(%)	(4.1)	(9.0)	(23.7)	(33.2)	(20.3)	(9.7)	(100.0)				
No information available	0	1	4	4	2	0	11	28	39	9.91	1.00
(%)	(0.0)	(9.1)	(36.4)	(36.4)	(18.2)	(0.0)	(100.0)				
Total	5 408	11 892	31 394	43 967	26 884	12 787	132 332	20 556	152 888	10.33	1.35
(%)	(4.1)	(9.0)	(23.7)	(33.2)	(20.3)	(9.7)	(100.0)				
Mean	66.18	65.84	64.88	63.60	62.39	60.70	63.68	63.82	63.70		
SD	12.30	12.30	12.30	12.52	12.49	12.42	12.51	12.84	12.56		

2006 are shown in Table 27 (1). The survey on erythropoietin dose at the end of 2005 was carried out only at the facilities that participated in the survey using floppy disks, similarly to the case of hemoglobin concentration. The percentage of dialysis patients administered erythropoietin at a dose of ≥6000 U/week was 35.6% in 2005 and decreased to 26.3% in 2006. On the other hand, the percentage of dialysis patients administered erythropoietin at a dose of <6000 U/week (including those who were not administered erythropoietin) increased in 2006.

In the latest survey conducted at the end of 2006, data on specific erythropoietin doses were not collected. In the questionnaire used in the latest survey,

TABLE 25. *Hemoglobin concentrations in female dialysis patients*

	Hemoglobin concentration (g/dL)										
Age (years)	<8.0	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	≥12.0	Subtotal	No information available	Total	Mean	SD
<15	1	3	0	7	6	5	22	21	43	10.71	1.69
(%)	(4.5)	(13.6)	(0.0)	(31.8)	(27.3)	(22.7)	(100.0)				
15–29	23	55	132	196	93	41	540	98	638	10.20	1.29
(%)	(4.3)	(10.2)	(24.4)	(36.3)	(17.2)	(7.6)	(100.0)				
30–44	201	475	1 167	1 625	966	348	4 782	846	5 628	10.23	1.28
(%)	(4.2)	(9.9)	(24.4)	(34.0)	(20.2)	(7.3)	(100.0)				
45–59	909	2170	5 911	7 679	3 622	1359	21 650	3 348	24 998	10.14	1.26
(%)	(4.2)	(10.0)	(27.3)	(35.5)	(16.7)	(6.3)	(100.0)				
60–74	1661	4110	9 870	11 340	5 662	2076	34 719	5 323	40 042	10.07	1.28
(%)	(4.8)	(11.8)	(28.4)	(32.7)	(16.3)	(6.0)	(100.0)				
75–89	1250	2746	6 061	6 515	3 223	1203	20 998	3 314	24 312	9.99	1.32
(%)	(6.0)	(13.1)	(28.9)	(31.0)	(15.3)	(5.7)	(100.0)				
≥90	72	164	337	317	160	56	1 106	211	1 317	9.90	1.29
(%)	(6.5)	(14.8)	(30.5)	(28.7)	(14.5)	(5.1)	(100.0)				
Subtotal	4117	9723	23 478	27 679	13 732	5088	83 817	13 161	96 978	10.08	1.29
(%)	(4.9)	(11.6)	(28.0)	(33.0)	(16.4)	(6.1)	(100.0)				
No information available	0	1	1	3	0	0	5	20	25	10.00	0.90
(%)	(0.0)	(20.0)	(20.0)	(60.0)	(0.0)	(0.0)	(100.0)				
Total	4117	9724	23 479	27 682	13 732	5088	83 822	13 181	97 003	10.08	1.29
(%)	(4.9)	(11.6)	(28.0)	(33.0)	(16.4)	(6.1)	(100.0)				
Mean	67.23	66.84	66.00	64.85	64.66	64.61	65.48	65.24	65.44		
SD	13.01	12.80	12.65	12.86	13.14	13.29	12.90	13.50	12.98		

TABLE 26. *Hemoglobin concentrations according to primary disease (entire dialysis patient population)*

	Hemoglobin concentration (g/dL)										
Primary disease	<8.0	8.0–8.9	9.0–9.9	10.0–10.9	11.0–11.9	≥12.0	Subtotal	Not available	Total	Mean	SD
Chronic glomerulonephritis	3577	8 678	22 672	30 856	17 855	7 933	91 571	13 670	105 241	10.28	1.32
(%)	(3.9)	(9.5)	(24.8)	(33.7)	(19.5)	(8.7)	(100.0)				
Chronic pyelonephritis	118	259	663	868	472	215	2 595	449	3 044	10.22	1.31
(%)	(4.5)	(10.0)	(25.5)	(33.4)	(18.2)	(8.3)	(100.0)				
Rapidly progressive glomerulonephritis	63	137	350	455	234	94	1 333	267	1 600	10.16	1.25
(%)	(4.7)	(10.3)	(26.3)	(34.1)	(17.6)	(7.1)	(100.0)				
Nephropathy of pregnancy/pregnancy toxemia	68	175	408	534	253	100	1 538	200	1 738	10.13	1.25
(%)	(4.4)	(11.4)	(26.5)	(34.7)	(16.4)	(6.5)	(100.0)				
Other nephritides that cannot be classified	58	80	224	314	193	89	958	154	1 112	10.27	1.37
(%)	(6.1)	(8.4)	(23.4)	(32.8)	(20.1)	(9.3)	(100.0)				
Polycystic kidney	217	625	1 745	2 545	1 494	842	7 468	965	8 433	10.44	1.36
(%)	(2.9)	(8.4)	(23.4)	(34.1)	(20.0)	(11.3)	(100.0)				
Renal sclerosis	621	1 398	3 653	4 460	2 345	886	13 363	1 989	15 352	10.15	1.28
(%)	(4.6)	(10.5)	(27.3)	(33.4)	(17.5)	(6.6)	(100.0)				
Malignant hypertension	80	163	352	531	271	154	1 551	311	1 862	10.25	1.39
(%)	(5.2)	(10.5)	(22.7)	(34.2)	(17.5)	(9.9)	(100.0)				
Diabetic nephropathy	3374	7 365	18 114	22 612	12 818	5 554	69 837	10 706	80 543	10.18	1.35
(%)	(4.8)	(10.5)	(25.9)	(32.4)	(18.4)	(8.0)	(100.0)				
Systemic lupus erythematosus nephritis	85	201	523	573	324	121	1 827	298	2 125	10.11	1.28
(%)	(4.7)	(11.0)	(28.6)	(31.4)	(17.7)	(6.6)	(100.0)				
Amyloidal kidney	19	51	109	120	61	37	397	81	478	10.12	1.38
(%)	(4.8)	(12.8)	(27.5)	(30.2)	(15.4)	(9.3)	(100.0)				
Gouty kidney	45	93	270	341	222	108	1 079	141	1 220	10.34	1.39
(%)	(4.2)	(8.6)	(25.0)	(31.6)	(20.6)	(10.0)	(100.0)				
Renal failure due to congenital abnormality of metabolism	14	15	42	69	44	26	210	40	250	10.39	1.53
(%)	(6.7)	(7.1)	(20.0)	(32.9)	(21.0)	(12.4)	(100.0)				
Kidney and urinary tract tuberculosis	14	31	93	123	48	30	339	57	396	10.23	1.34
(%)	(4.1)	(9.1)	(27.4)	(36.3)	(14.2)	(8.8)	(100.0)				
Kidney and urinary tract stone	26	64	119	139	84	30	462	72	534	10.08	1.32
(%)	(5.6)	(13.9)	(25.8)	(30.1)	(18.2)	(6.5)	(100.0)				
Kidney and urinary tract tumor	35	57	139	167	81	26	505	79	584	9.97	1.33
(%)	(6.9)	(11.3)	(27.5)	(33.1)	(16.0)	(5.1)	(100.0)				
Obstructive urinary tract disease	30	58	148	189	103	51	579	94	673	10.20	1.32
(%)	(5.2)	(10.0)	(25.6)	(32.6)	(17.8)	(8.8)	(100.0)				
Myeloma	28	34	30	37	21	13	163	53	216	9.58	1.64
(%)	(17.2)	(20.9)	(18.4)	(22.7)	(12.9)	(8.0)	(100.0)				
Hypoplastic kidney	18	34	99	173	94	43	461	60	521	10.35	1.26
(%)	(3.9)	(7.4)	(21.5)	(37.5)	(20.4)	(9.3)	(100.0)				
Undetermined	724	1 529	3 753	4 799	2 606	1 061	14 472	3 000	17 472	10.17	1.34
(%)	(5.0)	(10.6)	(25.9)	(33.2)	(18.0)	(7.3)	(100.0)				
Reintroduction after transplantation	75	124	375	509	289	126	1 498	253	1 751	10.25	1.34
(%)	(5.0)	(8.3)	(25.0)	(34.0)	(19.3)	(8.4)	(100.0)				
Others	217	411	913	1 150	664	317	3 672	658	4 330	10.16	1.40
(%)	(5.9)	(11.2)	(24.9)	(31.3)	(18.1)	(8.6)	(100.0)				
Subtotal	9506	21 582	54 794	71 564	40 576	17 856	215 878	33 597	249 475	10.23	1.33
(%)	(4.4)	(10.0)	(25.4)	(33.2)	(18.8)	(8.3)	(100.0)				
Not available	23	40	84	90	43	20	300	182	482	9.93	1.47
(%)	(7.7)	(13.3)	(28.0)	(30.0)	(14.3)	(6.7)	(100.0)				
Total	9529	21 622	54 878	71 654	40 619	17 876	216 178	33 779	249 957	10.23	1.33
(%)	(4.4)	(10.0)	(25.4)	(33.1)	(18.8)	(8.3)	(100.0)				