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ORIGINAL RESEARCH

One-year Survival of End-Stage Kidney Disease Patients Undergoing Hemodialysis in Indonesia

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Background: Chronic Kidney Disease (CKD) represents a significant global health challenge, with Indonesia experiencing the highest surge in End-Stage Kidney Disease (ESKD) prevalence over the past decade. Kidney registries are essential for reporting health outcomes, evaluating healthcare services, advocating for policy change, and informing health infrastructure development. Survival rates in ESKD patients undergoing hemodialysis (HD) are a critical outcome measure. However, there is a lack of survival analysis data for ESKD patients receiving HD in Indonesia.

Objective: This study aims to assess the one-year survival rate of ESKD patients undergoing HD in Indonesia, while examining risk factors associated with survival, including age, gender, CKD etiology, and dialysis adequacy.

Methods: This analytical observational study employed a retrospective cohort design, utilizing patient data from Indonesia Renal Registry between 2016 and 2019. Kaplan-Meier survival curves were generated, and Log rank test was applied to assess the significance of survival differences across subgroups based on age, gender, CKD etiology, and dialysis adequacy.

Results: A total of 122,449 ESKD patients on HD were analyzed, with a mean age of 52 years; majority (55.5%) were male, and hypertensive kidney disease was the leading cause of CKD (43.7%). The overall one-year survival rate was 91.5% (95% CI: 91.3–91.6). Survival decreased significantly with advancing age ($p < 0.01$), and female patients exhibited lower survival rates compared to males ($p < 0.01$). Patients with diabetic nephropathy had the lowest survival rate among CKD etiologies ($p < 0.01$). Dialysis adequacy, assessed in 11,633 patients, revealed that 69.2% had a Kt/V below 1.8. Those with inadequate dialysis had significantly lower survival rates (p=0.00015).

Conclusion: The one-year survival rate for ESKD patients undergoing HD in Indonesia is 91.5%. Increased age, female, diabetic nephropathy as the underlying CKD etiology, and inadequate dialysis adequacy are associated with reduced survival rates.

Keywords: chronic kidney disease, hemodialysis, one-year survival, Indonesian renal registry

Introduction

Chronic Kidney Disease (CKD) has become a significant and rapidly growing global health challenge, placing a considerable burden on healthcare systems worldwide.[1–3] A substantial treatment gap persists, with an estimated 2.2 to 7 million CKD patients dying annually due to inadequate access to kidney replacement therapy (KRT).[4,5] Indonesia has experienced the highest increase in CKD prevalence over the past decade.[6] Addressing this growing public health concern requires the initial step of accurately mapping and quantifying the burden of CKD and End-Stage Kidney Disease (ESKD) through a robust and comprehensive health information system.[4]

A kidney registry is a vital tool in this effort, providing a systematic and continuous collection of key data, including demographics, incidence, prevalence, and clinical outcomes of kidney disease patients.[7–11] However, many countries, particularly low- and middle-income nations, still lack a national kidney registry.[12,13] The Indonesia Renal Registry

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(IRR) was established by the Indonesian Society of Nephrology (PERNEFRI) in 2007. Despite this, epidemiological research utilizing IRR data remains limited.[14]

Mortality and survival rates are key epidemiological indicators and primary outcomes for ESKD patients.[7,15,16] Patients undergoing hemodialysis (HD) often exhibit lower survival rates compared to those receiving other KRT modalities, particularly during the early years following HD initiation.[4,17–19] Survival rates for HD patients vary significantly across different regions.[6,20–27] However, no national-level data on the one-year survival rate of ESKD patients on HD has been reported in Indonesia.

Several factors influence survival in ESKD patients on HD, including age, gender, CKD etiology, and dialysis adequacy.[25] Age at HD initiation is consistently identified as a key determinant of survival, with older patients experiencing lower survival rates.[6,20,22,24,26,28] Gender differences in survival remain a topic of debate, as the survival advantage of female ESKD patients undergoing HD is still inconclusive.[6,22,26,29–32] The underlying etiology of CKD is also closely linked to patient survival, with diabetic kidney disease particularly associated with poorer clinical outcomes.[29,33,34] Dialysis adequacy, commonly measured by Kt/V, is another critical determinant of survival in ESKD patients undergoing HD.[35–38] In Indonesia, where HD is typically performed twice a week, a different Kt/V target (≥1.8) is used.[39] However, no comprehensive survival analysis based on Kt/V values has been conducted in Indonesia, highlighting a significant research gap in dialysis adequacy and patient outcomes.

This study aims to assess the one-year survival rate of ESKD patients undergoing HD in Indonesia and examine the associated risk factors, including age, gender, CKD etiology, and dialysis adequacy.

Materials and Method

Design and Setting

This study utilized an analytical observational approach with a retrospective cohort design, based on data from all patients with ESKD undergoing HD in Indonesia. The data were extracted from the IRR between January 2016 and December 2019.

Study Population

Inclusion criteria were determined as subjects diagnosed with ESKD undergoing hemodialysis who are older than 18 years old. Subjects were excluded if demographic information, etiology of chronic kidney disease, time of starting hemodialysis, and time of death or dropout were not recorded.

Data Collection

Demographic and clinical data were retrieved from IRR records for the period 2016–2019. The initial dataset included 125,014 patients aged ≥18 years diagnosed with ESKD and commencing hemodialysis during this period. Patients with incomplete demographic or etiology data, as well as those with anomalous hemodialysis start dates or missing death or loss-to-follow-up information, were excluded. The final dataset consisted of 122,499 subjects. These were further categorised into four groups based on the year hemodialysis was initiated: 2016, 2017, 2018, and 2019. The selection process is illustrated in Figure 1.

Statistical Analysis

Univariate analysis was used to describe the basic characteristics of the study population, with results presented in a descriptive format. Kaplan-Meier survival curves were constructed to analyze time-to-event data (death), allowing the determination of median survival for ESKD patients undergoing hemodialysis in Indonesia. The Log rank test was employed to assess significant differences between survival curves based on age, gender, CKD etiology, and dialysis adequacy.

Ethical Consideration

This study was conducted in accordance with the Declaration of Helsinki and received approval from the Research Ethics Committee of the Faculty of Medicine, Universitas Padjadjaran, under ethical approval letter No. 084/UN6.KEP/EC/

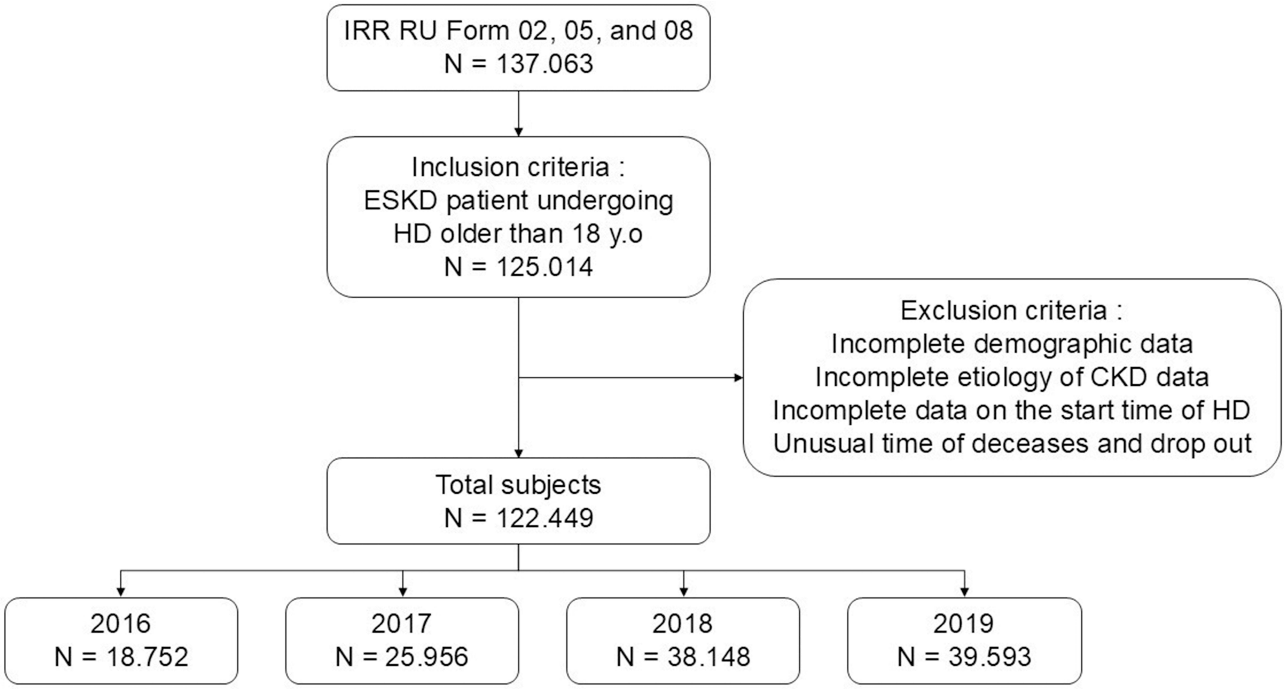

Figure 1 Subject Selection Process.

2022, issued on October 19, 2022. The study exclusively utilized secondary data obtained from the IRR and did not involve any direct intervention or contact with patients. To ensure strict confidentiality, all subject data were anonymized. Given the use of anonymized secondary data, informed consent for participation was not required.

Result

Characteristics of Subjects

The study included a total of 122,449 subjects, with an annual increase in the number of patients, peaking in 2019 with 39,593 patients (32.3%). The average age of the cohort was 52 years. The age group with the largest proportion of subjects was 50–59 years, comprising 41,131 subjects (33.6%), followed by 40–49 years with 29,067 subjects (23.7%), and 60–69 years with 24,730 subjects (20.2%). The age distribution remained relatively consistent across the years. The majority of subjects were male (67,987, or 55.5%). Hypertensive kidney disease was the most common etiology of CKD, affecting 43.7% of the cohort, followed by diabetic nephropathy (23.8%). The distribution of CKD etiologies remained stable across the study period. Kt/V values were available for 11,633 subjects (9.5%), with 69.2% of these subjects having a Kt/V < 1.8. The detailed characteristics of the study population are provided in Table 1.

Events

A total of 10,376 deaths were recorded within the first year of the study, accounting for 8.5% of the cohort. The highest mortality rate was observed in the 2019 cohort, with 3,733 deaths, representing 9.4% of that group. Furthermore, 1,059 participants (0.9%) were lost to follow-up. These data are summarized in Table 2.

One-Year Survival Rate of ESKD Patients on Hemodialysis

The Kaplan-Meier curve (Figure 2) illustrates the overall one-year survival rate, which was 91.5% (95% Confidence Interval [CI]: 91.3–91.6%). The one-year survival rates for the cohorts from 2016, 2017, 2018, and 2019 were 93.2% (95% CI: 92.9–93.6%), 92% (95% CI: 91.7–92.4%), 91.3% (95% CI: 91.0–91.5%), and 90.5% (95% CI: 90.2–90.8%), respectively. The Kaplan-Meier curve in Figure 3 highlights the survival rates for each cohort, with a significant difference ($p < 0.01$) observed across the years. The 2019 cohort demonstrated the lowest survival rate compared to

Table 1 Baseline Characteristics

	Total (n=122.449)	**2016 (n=18.752)**	**2017 (n=25.956)**	**2018 (n=38.148)**	**2019 (n=39.593)**
Age (year), Mean(SD)	52,12 (12,45)	51,38 (12, 34)	51,72 (12,37)	52,05 (12,41)	52,81 (12,56)
Age categories, n(%)					
18–29	6.103 (5%)	994 (5,3%)	1.387 (5,3%)	1.899 (5%)	1.823 (4,6%)
30–39	12.621 (10,3%)	1.995 (10,6%)	2.798 (10,8%)	3.945 (10,3%)	3.883 (9,8%)
40–49	29.067 (23,7%)	4.782 (25,5%)	6.183 (23,8%)	9.119 (23,9%)	8.983 (22,7%)
50–59	41.131 (33,6%)	6.222 (33,2%)	8.913 (34,3%)	12.907 (33,8%)	13.089 (33,1%)
60–69	24.730 (20,2%)	3.546 (18,9%)	4.987 (19,2%)	7.573 (19,9%)	8.624 (21,8%)
70–79	7.385 (6%)	1.042 (5,6%)	1.440 (5,5%)	2.243 (5,9%)	2.660 (6,7%)
≥ 80	1.412	171	248	462	531
Gender, n(%)	(1,2%)	(0,9%)	(1%)	(1,2%)	(1,3%)
Female	54.462 (44,5%)	8.155 (43,5%)	11.407 (43,9%)	17.134 (44,9%)	17.766 (44,9%)
Male	67.987 (55.5%)	10.597 (56.5%)	14.549 (56.1%)	21.014 (55.1%)	21.827 (55,1%)
Etiology of CKD n(%)	6.832 (5,6%)	1.268 (6,8%)	1.741 (6,7%)	2.031 (5,3%)	1.792 (4,5%)
Diabetic Nephropathy	29.093 (23,8%)	4.264 (22,7%)	5.883 (22,7%)	9.224 (24,2%)	9.722 (24,6%)
Lupus Nephropathy	607 (0,5%)	92 (0,5%)	109 (0,4%)	225 (0,6%)	181 (0,5%)
Hypertension Kidney Disease	53.479 (43,7%)	7.216 (38,5%)	10.198 (39,3%)	17.085 (44,8%)	18.980 (47,9%)
Polycystic Kidney Disease	995 (0,8%)	186 (1%)	245 (0,9%)	266 (0,7%)	298 (0,8%)
Uric Acid Nephropathy	1.393 (1,1%)	215 (1,1%)	277 (1,1%)	440 (1,2%)	461 (1,2%)
Obstructive Nephropathy	4.749 (3,9%)	791 (4,2%)	984 (3,8%)	1.336 (3,5%)	1.638 (4,1%)
Chronic Pyelonephritis	4.544 (3,7%)	767 (4,1%)	1.342 (5,2%)	1.328 (3,5%)	1.107 (2,8%)
Others	6.795 (5,5%)	1.045 (5,6%)	1.688 (6,5%)	2.068 (5,4%)	1.994 (5%)
Unknown	13.962 (11,4%)	2.908 (15,5%)	3.489 (13,4%)	4.145 (10,9%)	3.420 (8,6%)
Kt/V[a], n (%)					
≥ 1.8	3.585 (30,8%)	425 (35,2%)	608 (32,9%)	1.238 (32,6%)	1.314 (27,6%)
< 1.8	8.048 (69,2%)	784 (64,8%)	1.242 (67,1%)	2.565 (67,4%)	3.457 (72,4%)

Note: [a]n=11.633.
Abbreviations: CKD, Chronic Kidney Disease; SD, Standard Deviation.

Table 2 Event

Total	Total (n=122.449)	2016 (n=18.752)	2017 (n=25.956)	2018 (n=38.148)	2019 (n=39.593)
Event, n(%)					
Deceased	10.376 (8,5%)	1.267 (6.8%)	2.060 (7,9%)	3.316 (8,7%)	3.733 (9,4%)
Loss to follow up	1.059 (0,9%)	66 (0,4%)	187 (0,7%)	497 (1,3%)	309 (0,8%)

the earlier years. Table 3 shows the complete one-year survival data of ESKD patients based on the characteristics of the study population for each year.

One-Year Survival Rate of ESKD Patients on Hemodialysis Based on Age

Figure 4 presents the Kaplan-Meier curve showing the one-year survival rate stratified by age. A significant difference ($p < 0.01$) was found among the age categories, with elderly patients (> 60 years) exhibiting a notably lower survival rate compared to younger groups.

One-Year Survival Rate of ESKD Patients on Hemodialysis Based on Gender

Figure 5 illustrates the one-year survival rates stratified by gender. A significant difference ($p < 0.01$) was observed between male and female patients.

One-Year Survival Rate of ESKD Patients on Hemodialysis Based on Etiology of CKD

Figure 6 shows the Kaplan-Meier curve for one-year survival rates based on the etiology of chronic kidney disease (CKD). There was a significant difference ($p < 0.01$) among the various CKD etiologies, with diabetic nephropathy being associated with the lowest survival rate.

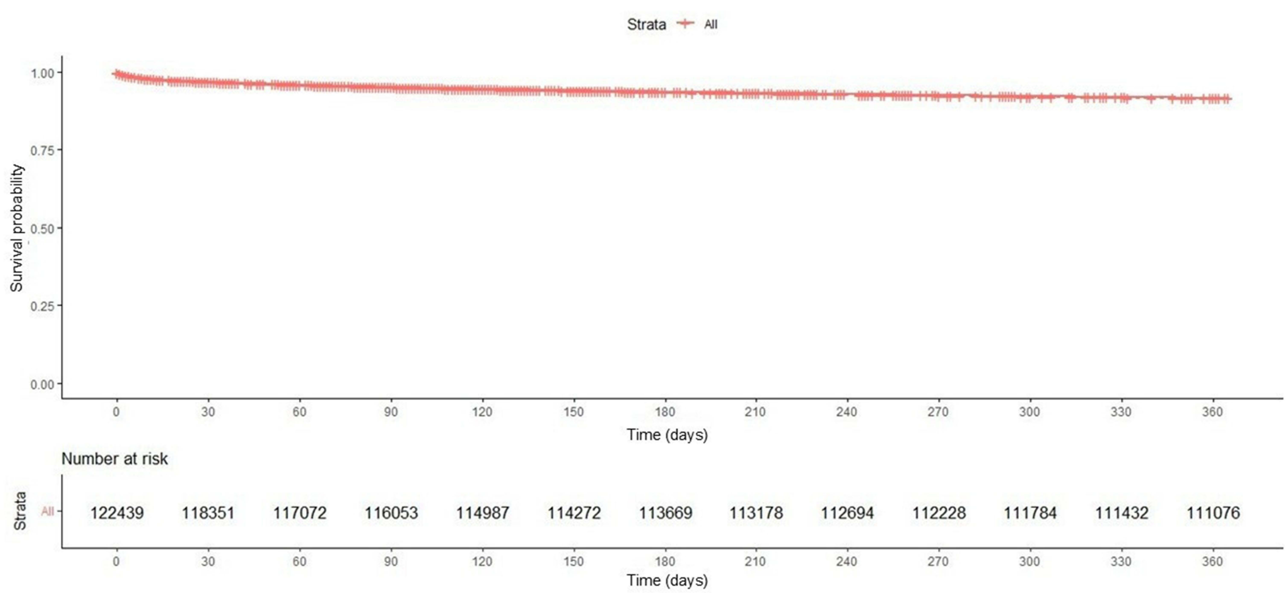

Figure 2 Kaplan-Meier One-Year Survival Curve.

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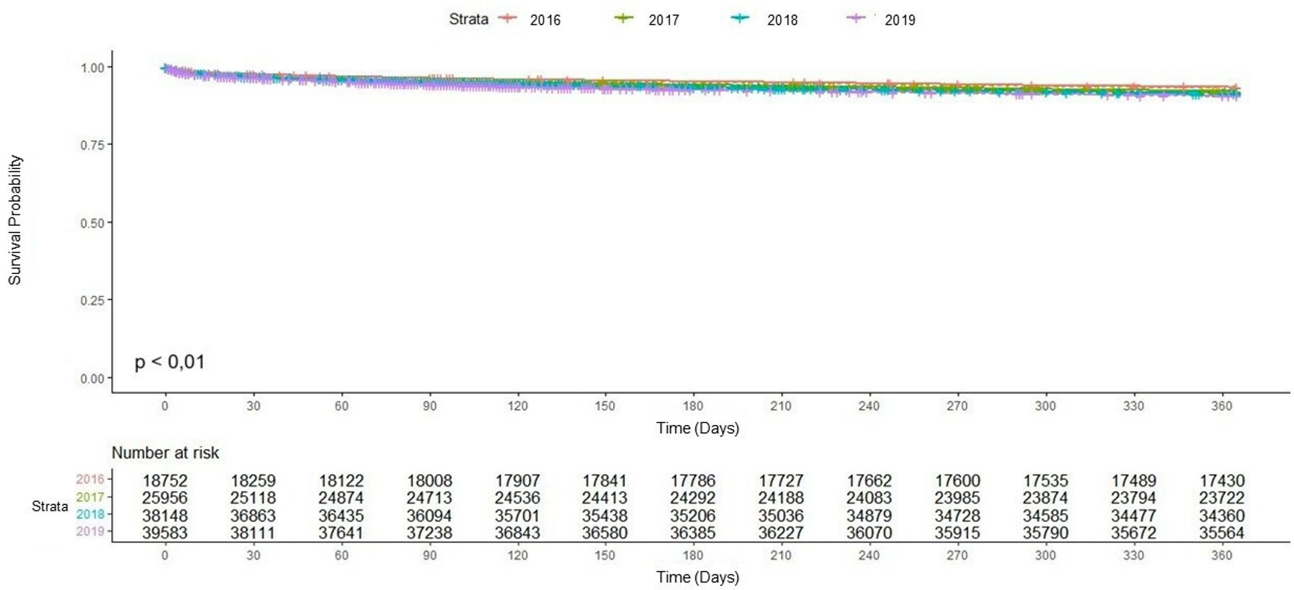

Figure 3 Kaplan-Meier One-Year Survival Curve in a 4-Year Study Groups.

One-Year Survival Rate of ESKD Patients on Hemodialysis Based on Dialysis Adequacy

The one-year survival rates based on dialysis adequacy, measured by Kt/V, are depicted in Figure 7. A significant difference ($p < 0.01$) was found between the groups with different Kt/V values.

Discussion

The number of patients initiating HD in Indonesia continues to rise annually.[40,41] The rapid increase in ESKD prevalence has positioned Indonesia (306 per million population, pmp) as the country with the highest global growth rate, and the fifth highest in Asia, following Taiwan (529 pmp), Thailand (377 pmp), South Korea (360 pmp), and Singapore (337 pmp), based on USRD data from 2019.[6] Over the past decade, the prevalence of ESKD has surged by 35-fold, from

Table 3 One-Year Survival of ESKD Patients With HD Based on Basic Characteristics

	Total (CI 95%)	2016 (CI 95%)	2017 (CI 95%)	2018 (CI 95%)	2019 (CI 95%)
Age (years)					
18–29	93% (92,3–93,6)	93,5% (91,8–94.9)	93,4% (92–94,6)	92,9% (91,6–94)	92,5% (91,2–93,6)
30–39	93,7% (93,2–94,1)	95,2% (95,2–94,1)	94,2% (93,2–95)	92,9% (92–93,6)	93,4% (92,6–94,1)
40–49	92,5% (92,2–92,8)	94,4% (93,7–95)	92,8% (92,1–93,4)	92,4% (91,8–92,9)	91,5% (90,9–92)
50–59	91,5% (91,2–91,7)	92,8% (92,1–93,4)	92,2% (91,7–92,8)	91,3% (90,8–91,8)	90,5% (89,9–90,9)
60–69	90% (89,6–90,4)	92,4% (91,5–93,3)	90,7% (89,8–91,4)	89,8% (89–90,4)	88,9% (88,2–89,5)
70–79	88,7% (87,9–89,4)	90,7% (88,8–92,3)	88,1% (86.3–89,7)	88,3% (86,9–89,6)	88,5% (87,2–89,6)
≥ 80	86% (84-1 – 87.7)	85,4% (79,1–89,9)	85.8% (80,7–89,6)	86,3% (82,8–89,1)	86% (82,8–88,7)

(*Continued*)

Table 3 (Continued).

	Total (CI 95%)	2016 (CI 95%)	2017 (CI 95%)	2018 (CI 95%)	2019 (CI 95%)
Gender					
Female	91,1% (90,8–91,3)	92,7% (92,1–93,3)	91,7% (91,2–92,2)	90,8% (90,3–91,2)	90,2% (89,7–90,6)
Male	91,8% (91,6–92)	93,6% (93,1–94,1)	92.3% (91,9–92,7)	91,6% (91,3–92)	90,8% (90,4–91,2)
Etiology of CKD					
Primary Glomerulopathy	92,1% (91,5–92,7)	92,9% (91,3–94,2)	93.2% (91,9–94,3)	90,7% (89,4–91,9)	92,1% (90,7–93,2)
Diabetic Nephropathy	88,6% (88,2–89)	91% (90,1–91,9)	89,3% (88,5–90,1)	88,2% (87,5–88,8)	87,5% (86,9–88,2)
Lupus Nephropathy	91,5% (88,9–93,5)	91,3% (83,4–95,6)	88% (80,2–92,8)	91,3% (86,6–94,3)	93,9% (89,2–96,6)
Hypertensive Kidney Disease	92,3% (92–92,5)	94% (93,4–94,5)	92,5% (92–93)	92,3% (91,9–92,7)	91,5% (91–91,8)
Polycystic Kidney Disease	92,7% (90,9–94,2)	94,1% (89,6–96,7)	91,4% (87,1–94,3)	92,8% (88,9–95,3)	92,9% (89,4–95,3)
Uric Acid Nephropathy	90,8% (89,1–92,2)	93,5% (89,3–96,1)	90,9% (86,9–93,8)	89,9% (86,7–92,4)	90,2% (87,1–92,6)
Obstructive Nephropathy	92,8% (92–93,5)	93,7% (91,7–95,2)	92,7% (90,8–94,1)	91,5% (89,8–92,9)	93,5% (92,2–94,6)
Chronic Pyelonephritis	91,4% (90,5–92,2)	91,3% (89–93,1)	93,6% (92,1–94,8)	91,7% (90,1–93,1)	88,5% (88,5–86,4)
Others	90,6% (89,8–91,2)	90,7% (88,8–92,3)	90,2% (88,7–91,5)	91,4% (90,1–92,5)	90% (88,6–91,2)
Unknown	94,2% (93,8–94,6)	96% (95,3–96,7)	95,1% (94,3–95,7)	93,8% (93–94,5)	92,4% (91,5–93,2)
Kt/V[a], n (%)					
≥ 1.8	96,3% (95,6–96,9)	97,9% (96–98,9)	99.2% (98–99,7)	96% (94,8–97)	94,7% (93,4–95,8)
< 1.8	94,1% (93,6–94,6)	98,1% (96,8–98,9)	96,7% (95,5–97,6)	92,9% (91,9–93,9)	93,2% (92,3–94)

Note: [a]n=11.633.
Abbreviations: CKD, Chronic Kidney Disease; SD, Standard Deviation.

28 per million people in 2009 to 973 per million people in 2019.[6] Several factors contribute to this escalation, including the expansion of dialysis units and the broader reporting coverage in the Indonesian Renal Registry.[14]

The largest proportion of ESKD patients undergoing HD falls within the 50–59 age group, with a mean age of 52 years. This younger age of initiation is attributed to the limited availability of alternative KRT options.[42] In 2018, only 2% (n=765) of patients underwent peritoneal dialysis, while kidney transplantation accounted for just 0.03% (n=142).[14,42] From 2016 to 2019, there was a noticeable rise in patients aged over 60 years. A similar trend has been observed in Southeast Asian countries such as Malaysia, Brunei Darussalam, and Singapore.[22,26,43] In contrast, in many developed nations, the highest percentage of ESKD patients are aged 75 years and above.[6] This increase is driven by improved survival rates in older populations, greater acceptance of elderly patients for dialysis, and lower rates of kidney transplantation in this demographic.[44]

The proportion of male patients with ESKD consistently exceeds that of female. This trend has been observed annually and is consistent across several Southeast Asian countries.[22,26] Similarly, in Europe, the proportion of male patients receiving kidney replacement therapy is higher (62%) compared to female patients (38%).[32] It is postulated that the progression of kidney disease is slower in women than in men, possibly due to the protective effects of estrogen in

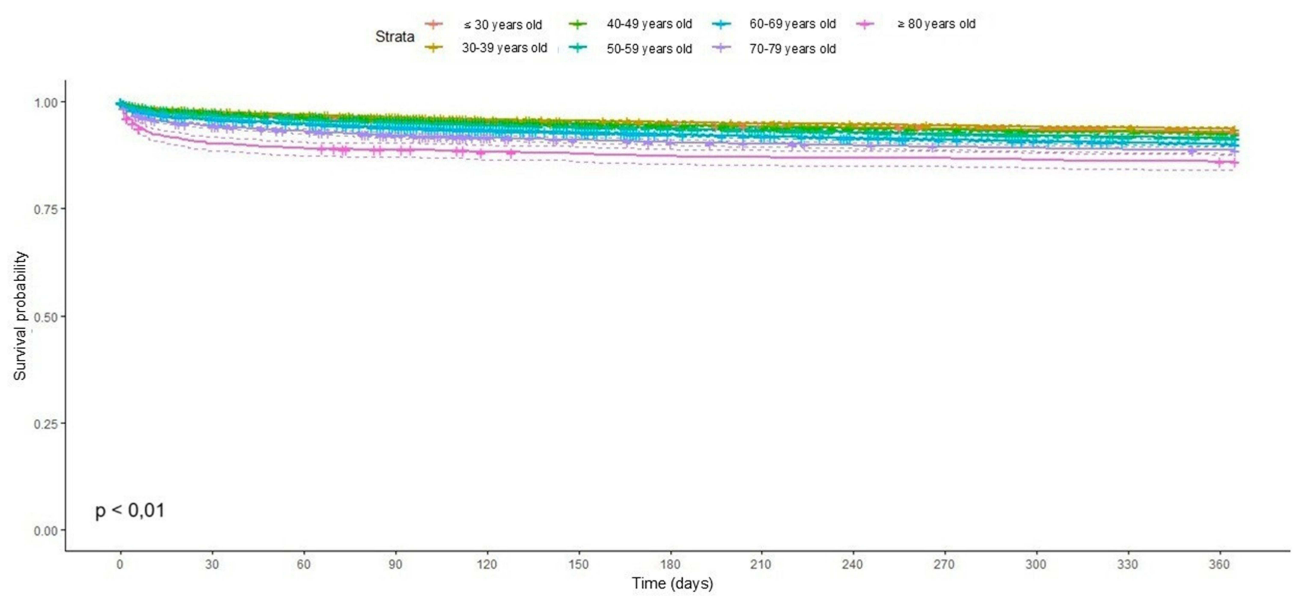

Figure 4 Kaplan-Meier One-Year Survival Curve based on Age.

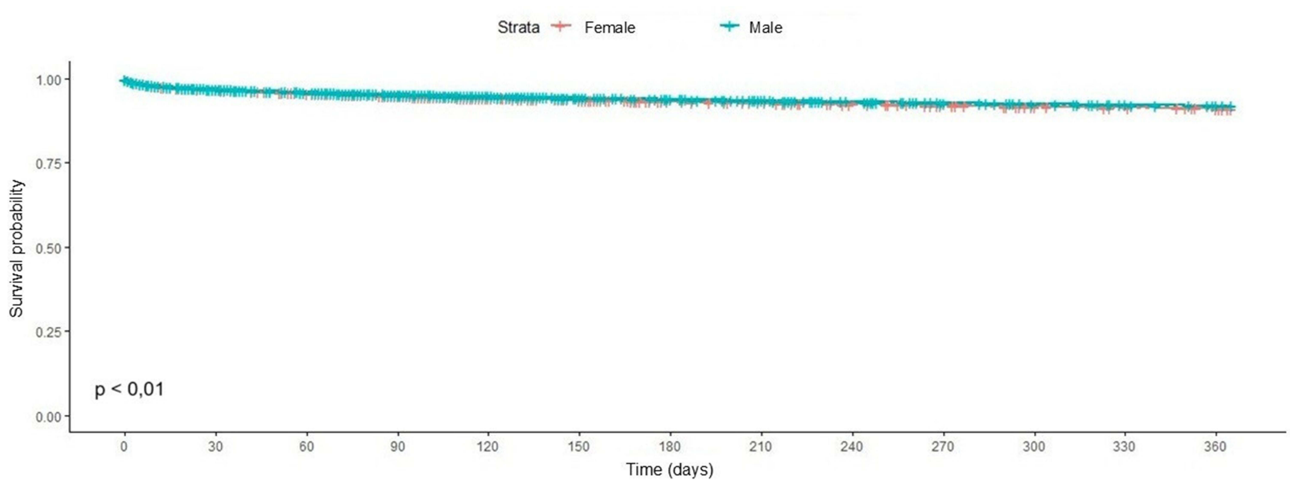

Figure 5 Kaplan-Meier One-Year Survival Curve based on Gender.

females and the detrimental effects of testosterone in males.[45] Another contributing factor could be disparities in access to healthcare services, with men being more likely to receive KRT in Western ESKD populations.[46]

Hypertensive kidney disease is the most common cause of ESKD requiring HD. Similar findings have been reported in other lower-middle-income countries in Africa, South America, and parts of the Middle East.[47–52] Conversely, in many developed countries, diabetic nephropathy remains the leading cause of ESKD.[20,53,54] In Asia, hypertensive kidney disease and diabetic nephropathy continue to be the most common etiologies among dialysis patients.[55] According to the 2018 Indonesian Basic Health Research Data (RISKESDAS), the prevalence of hypertension (34.1%) significantly exceeds that of diabetes mellitus (8.5%).[56]

Kt/V values, which measure dialysis adequacy, were recorded for 11,633 subjects (9.5%). This lower reporting rate is likely due to the non-mandatory nature of laboratory data collection within the Indonesian Renal Registry. According to the Indonesian National Medical Service Guidelines for ESKD, a Kt/V value exceeding 1.8 is considered the target for dialysis adequacy.[39] However, 69.2% of patients did not meet this threshold. Studies in more developed countries, such as Japan, the United States, Canada, and the United Kingdom, report much higher dialysis adequacy rates, with over 90%

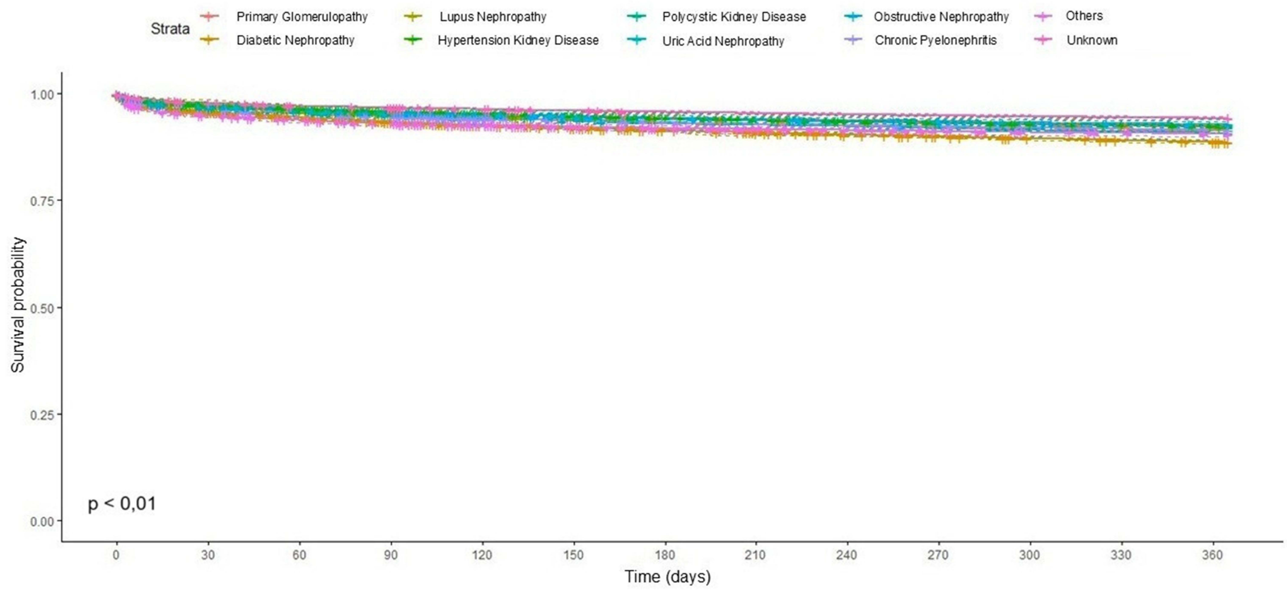

Figure 6 Kaplan-Meier One-Year Survival Curve based on Etiology of CKD.

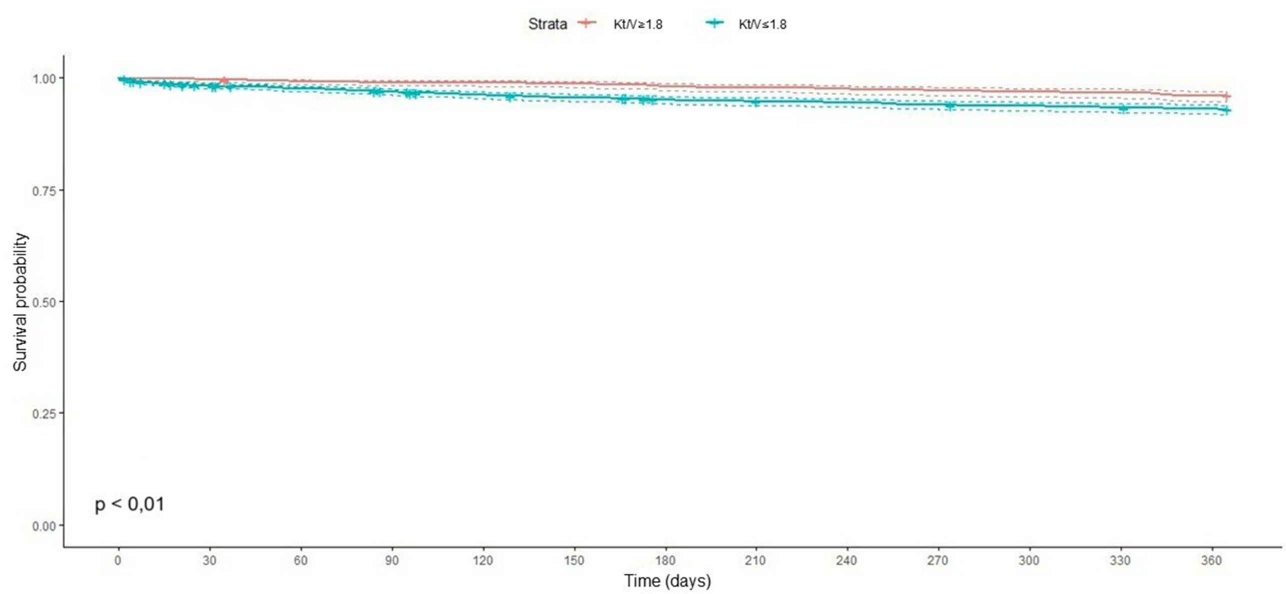

Figure 7 Kaplan-Meier One-Year Survival Curve based on Dialysis Adequacy.

of patients achieving the target Kt/V values.[57] Singapore has an especially high dialysis adequacy rate (96.7%), while Malaysia reports that 81% of ESKD patients on HD meet the adequacy target.[22,26]

Data on dialysis adequacy in lower-middle-income and low-income countries are less frequently available, primarily due to the limited number of kidney registries in these regions. Iran reported that 43.3% of ESKD patients on HD meet the adequacy target, while a tertiary hospital in India reports a dialysis adequacy rate of only 28%.[58,59] Nepal has an even lower coverage rate, with just 17% of patients reaching the target.[60] Several factors contribute to the low rates of dialysis adequacy, including insufficient dialysis time per session and constraints related to infrastructure and staffing. The imbalance between the number of patients and the availability of dialysis nurses remains a persistent challenge.[14]

One-Year Survival Rate of ESKD Patients Undergoing Hemodialysis

The one-year survival rate for patients with ESKD undergoing HD is 91.5% (95% CI: 91.3–91.6). This figure is comparable to survival rates observed in other Southeast Asian countries, such as Malaysia (88%), Singapore (90%), and Brunei (89%), and is superior to those reported in countries like Iran (85.7%) and Brazil (82%).[22,25–27,43] The survival rate in this study surpasses that of Afiatin et al, who reported an 82% one-year survival rate for ESKD patients on HD in West Java.[29]

The data from this study demonstrate a declining trend in one-year survival rates among ESKD patients undergoing HD. Several factors contribute to this decline. One is the rising number of ESKD patients receiving HD, which can be attributed in part to increased coverage under the national health insurance scheme.[61] National health insurance accounts for 90–92% of funding for HD procedures, a key driver of the growing number of ESKD patients on HD in Indonesia.[14] Nevertheless, disparities in claim payments based on hospital classification persist. Hospitals receive varying amounts for similar HD procedures, resulting in uneven service quality.[61] A second contributing factor is the limited availability and unequal distribution of HD facilities and trained personnel across provinces.[14] Consequently, the quality of HD services often fails to meet national standards.

The lowest recorded survival rate for ESKD patients on HD occurred in 2019, with follow-up continuing into 2020. This coincides with the outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the subsequent COVID-19 pandemic declared by the World Health Organization in March 2020.[62] The pandemic likely exacerbated the survival rate decline among HD patients, who are particularly vulnerable to severe COVID-19 due to their immuno-compromised state, multiple comorbidities, and frequent visits to dialysis centres.[63] In addition, the pandemic-induced shortage of healthcare personnel further compromised HD services, as the Ministry of Health suspended all training for dialysis nurses, general practitioners, and internal medicine specialists. This has resulted in a stagnation in the number of dialysis staff, limiting the capacity to expand HD services.

One-Year Survival Rate of ESKD Patients Undergoing Hemodialysis Based on Age

The study identified a significant difference in one-year survival rates based on age, with elderly patients (>60 years) experiencing lower survival compared to younger cohorts. This finding is consistent with various international registries. For example, the Singaporean registry reports a one-year survival rate of 88.4% for ESKD patients aged over 60, compared to 93.6% for those under 60. A similar trend is observed over longer periods, with five-year survival rates of 50.7% for patients over 60 versus 71.9% for younger patients, and ten-year survival rates of 19.1% versus 46.8%.[22] Data from Malaysia reveal comparable results, with one-year survival rates of 94% for patients aged 15–25 and progressively lower rates for older age groups (81% for patients over 65).[26] Similar findings have been documented in registries from the United States, United Kingdom, Australia, Korea, and Europe.[6,20,24,28,64]

With advances in healthcare, global life expectancy has increased, leading to a rise in the number of elderly ESKD patients requiring HD. In many developed countries, elderly individuals now represent the majority of ESKD patients undergoing HD. In Europe, for example, the average age of HD patients is 61–63 years, and there has been a twofold increase in HD patients aged over 75 in the past decade, now constituting one-third of the HD population. A similar trend is seen in the United States, particularly among those over 80.[6,20,34]

Canaud et al analysed outcomes for elderly HD patients across 12 countries participating in the DOPPS. The study found that median survival was significantly lower for patients over 75 years of age (average 3 years; Europe 3.3 years; Australia-New Zealand 1.6 years; Japan 5.4 years; North America 2.5 years) compared to those aged 45–75 years (average 6 years) and under 45 years (average 12 years).[44] Elderly patients often have more comorbidities, are more susceptible to malnutrition, and are more likely to suffer from acute conditions such as falls, fractures, strokes, and delirium.[65–67] These factors, coupled with diminished functional status and limited social support, contribute to the higher mortality rate in this population.[44,68]

One-Year Survival Rate of ESKD Patients Undergoing Hemodialysis Based on Gender

A significant difference in one-year survival between male and female patients was found in this study. In some registries, the survival difference between genders varies. Females have a higher one-year survival rate compared to males (91% versus 90.5%) in Singapore.[22] On the other hand, In Australia and New Zealand, females have a lower one-year survival rate compared to males (82% versus 83%).[64] The DOPPS study found that males had better survival compared to females.[44]

The controversy over whether females have better survival compared to males continues. Males are found to be more vulnerable to hyperuricemia and inflammation-related anorexia in EKSD.[68] Based on Stenvinkel et al, females with high inflammatory markers had lower mortality compared to males.[69] Fernandez-Prado analysed registry reports from European countries and found equal survival between females and males during the first three months after dialysis initiation. After this period, females had better survival compared to males.[32] Different results were found in a systematic review by Hazara which included 21 studies evaluating the relationship between gender and mortality risk in ESKD undergoing HD. Mortality risk was found to be higher in females in three studies, and higher in males in two studies, and 16 other studies showed no significant risk difference between genders.[70]

In another study by Carrero et al, differences in mortality by gender were associated with age category, diabetes status, and cause of death. In patients under 45 years old, female mortality was higher compared to males. However, in older age groups, the situation reversed.[71] The differences in survival among ESKD patients undergoing HD are thought to be due to various internal and environmental factors. Internal factors include hormonal differences, inflammatory mediators, endothelial dysfunction, and arterial stiffness, which vary between female and male ESKD patients undergoing HD. Environmental factors include socio-cultural differences, disparities in healthcare access, different health perceptions, and varying adherence to therapy.[45,46,72]

One-Year Survival Rate of ESKD Patients Undergoing Hemodialysis Based on Etiology of CKD

This study found that ESKD undergoing HD with diabetic nephropathy as the etiology had a lower one-year survival rate compared to other etiologies of CKD. This finding is consistent with several other registries and studies related to CKD etiology and survival in ESKD undergoing HD. The annual reports from the renal registry in Malaysia indicate that the one-year survival rate for diabetic nephropathy patients is lower (86%) compared to other etiologies of CKD (90%), with 50% of diabetic patients dying within 4 years of starting HD.[26] A similar finding was observed in Singapore, where the one-year survival rate for ESKD undergoing HD was reported to be 89.7% for diabetic nephropathy and 92.5% for non-diabetic nephropathy.[22] Studies conducted on ESKD undergoing HD have found a 15-fold higher mortality rate among diabetics compared to non-diabetics.[33] Many studies have established a significant relationship between diabetes and mortality in ESKD undergoing HD.[73–76] A meta-analysis by Ma found that diabetes doubled the mortality risk for ESKD undergoing HD (RR: 2.00; 95% CI: 1.69–2.35; $P < 0.001$).[77]

Diabetes is now the most common cause of CKD worldwide, especially in developed countries and Asia.[55] Diabetes mellitus can cause kidney damage through various spectra, including diabetic nephropathy, diabetic kidney disease (DKD), and non-diabetic renal disease (NDRD). Research has shown that diabetic nephropathy has a worse renal prognosis compared to NDRD.[78]

Despite various efforts and improvements in CKD management, the progression and risk of ESKD in diabetes remain high. In the past decade, several new medications, such as sodium-glucose cotransporter-2 inhibitors (SGLT2), glucagon-like peptide-1 receptor agonists (GLP-1 RA), and non-steroidal mineralocorticoid receptor antagonists (MRA), with renoprotective effects, have been introduced to slow the progression of CKD in diabetes. KDIGO recommends comprehensive management for diabetes with CKD to improve renal and cardiovascular outcomes in this population.[79]

One-Year Survival Rate of ESKD Patients Undergoing Hemodialysis Based on Dialysis Adequacy

A significant difference in one-year survival was found among patients with dialysis adequacy achieving the target ($Kt/V > 1.8$) in this study. KDOQI recommends a target $spKt/V \geq 1.2$ for patients undergoing HD twice a week.[80] This recommendation is based on the results of the HEMO study, which compared outcomes between patients receiving high-dose dialysis (target Kt/V

≥ 1.65) and those receiving standard-dose dialysis (target Kt/V ≥ 1.2).[81] In Indonesia, due to limitations in infrastructure, resources, and funding, most ESKD undergoing HD receive two sessions per week.

The relationship between dialysis adequacy and survival in ESKD undergoing HD remains controversial. Some studies have found that low Kt/V levels may increase mortality in ESKD undergoing HD. Based on Miller et al, in a 5-year cohort study of 88,000 ESKD undergoing HD, found the best survival rates in patients with Kt/V values between 1.6 and 1.8.[82] Another cohort study by Liu in China found that high-dose dialysis (Kt/V ≥ 1.4) reduced mortality risk by 33% (HR = 0.67, 95% CI: 0.47–0.98) compared to low-dose dialysis (Kt/V ≤ 1.2).[83] A different study by Marshall et al using ANZDATA sources, found the lowest mortality in patients with Kt/V ≥ 1.3 and HD sessions lasting ≥ 4.5 hours.[84] Variations in the results of these studies on dialysis adequacy and survival are likely due to differences in patient characteristics, race, monitoring duration, nutritional status, and other factors affecting Kt/V.[85]

Mendonca et al conducted a 3-year cohort study of 88 patients undergoing HD twice a week in India. The study found an average spKt/V of 1.38 ± 0.51 and an average standardized Kt/V of 1.57 ± 1.21. Despite only 10.5% of patients reaching the target standardized Kt/V > 2, the one-year survival rate in this study was 92%.[86] Lin et al, compared dialysis adequacy and survival between patients receiving HD twice a week and those receiving HD three times a week among 2,572 ESKD patients in Shanghai. The group with two HD sessions per week had a higher spKt/V (1.65 ± 0.45 vs 1.39 ± 0.47). No significant difference in two-year survival between the two groups was found (p=0.013). Over the 2-year monitoring period, mortality was lower in the group receiving HD twice a week (10.7% vs 12.8%).[87] Based on these findings, the practice of providing HD twice a week in Indonesia can be continued, provided that dialysis adequacy is monitored regularly.

Conclusion

The one-year survival rate of ESKD patients undergoing hemodialysis in Indonesia is 91.5%. Lower survival rates are significantly associated with older age, female, diabetic nephropathy, and inadequate dialysis adequacy. This study is the first to evaluate the survival rate of hemodialysis patients in Indonesia using a large sample from the IRR. Future studies should incorporate Kt/V data for a more comprehensive assessment of dialysis adequacy. Additionally, expanding the evaluation of comorbidities, nutritional status, and frailty is essential to improve the understanding of patient outcomes.

Consent for Publication

The authors declare that this manuscript is original, has not been published before, and is not currently being considered for publication. All authors consent to the publication of this manuscript.

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