

CHAPTER 3

DEATH AND SURVIVAL ON DIALYSIS

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SECTION 3.1: DEATH ON DIALYSIS

The annual crude death rate on dialysis in 2024 was 13% (Table 3.1.1). The annual crude death rate among haemodialysis patients was 12% and that of chronic peritoneal dialysis patients was 16%. Besides the small peak during the pandemic period, the annual death rates have been relatively constant in the past ten years for total dialysis, HD and PD patients.

It has been observed that the death rate of PD patients has been consistently higher than that of HD patient (Figure 3.1.1). Mortality constitutes a major reason for PD drop out. These differences likely reflect variations in patient selections and comorbidity profiles rather than modality-related effects.

Table 3.1.1: Deaths on dialysis 2015-2024

Year	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015
Number of dialysis patients at risk	55448	54173	51823	50209	50206	47425	44769	42600	40626	38042
Dialysis deaths	7608	7553	8039	9103	6358	6496	6155	5949	5402	5004
Dialysis death rate %	13	13	15	17	12	13	13	13	13	13
Number of HD patients at risk	48806	47789	45953	44679	44898	42527	40222	38318	36568	34165
HD deaths	6457	6438	6855	7934	5476	5603	5336	5174	4671	4373
HD death rate %	12	13	14	16	12	13	13	13	12	12
Number of PD patients at risk	6642	6384	5870	5530	5308	4898	4547	4282	4058	3877
PD deaths	1151	1115	1184	1169	882	893	819	775	731	631
PD death rate %	16	17	19	19	16	18	17	17	17	16

Figure 3.1.1: Death rates on dialysis 2005-2025

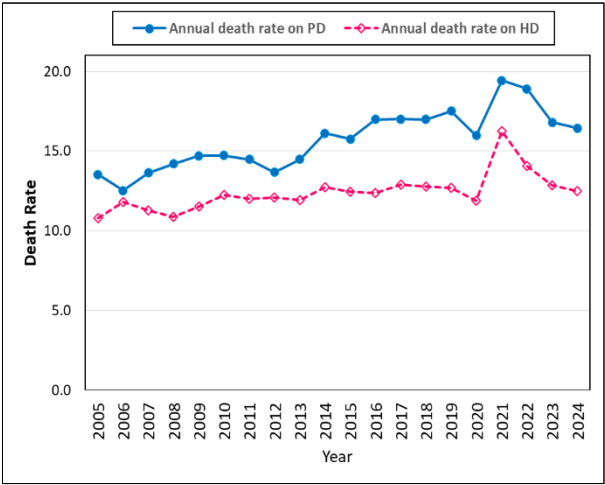


Table 3.1.2 demonstrates a shift in the leading cause of death among dialysis patients, with infection overtaking cardiovascular disease as the predominant contributor to mortality in 2024 (30.3% vs 24.2%). This trend has been evident in recent years and is observed across both dialysis modalities. Additionally, catheter-related blood stream infection (CRBSI) (5.0%) and PD peritonitis (2.7%) also contributed significantly to the overall mortality of our dialysis patients.

Notably, deaths attributed to CRBSI have shown a progressive increase over the past decade. This observation is consistent with the continued high reliance on central venous catheters for haemodialysis access, with 25.7% of HD patients currently dialysing via cuffed or non-cuffed catheters.

Prior to 2023, peritonitis-related deaths in PD patients were defined based on the cause of death as documented by the attending doctor. However, starting in December 2022, the definition was broadened to include any PD patient who died within one month of the onset of a peritonitis episode, regardless of the stated cause of death. This change, reflected in the ISPD guidelines on peritonitis and supported by published studies on PD, has led to a significant increase in the reported rates of peritonitis-related deaths.

Table 3.1.2: Causes of death on dialysis 2015-2024

Year	2024		2023		2022		2021		2020	
	n	%	n	%	n	%	n	%	n	%
Causes of Death (Dialysis)										
Cardiovascular	1843	24.2	1772	23.5	1746	21.7	1893	20.8	1741	27.4
Died at home	760	10.0	788	10.4	920	11.4	982	10.8	802	12.6
Infection	2302	30.3	2354	31.2	2917	36.3	3375	37.1	1600	25.2
CRBSI	378	5.0	177	2.3	181	2.3	125	1.4	105	1.7
PD peritonitis	207	2.7	204	2.7	98	1.2	82	0.9	74	1.2
GIT bleed	111	1.5	105	1.4	117	1.5	113	1.2	90	1.4
Cancer	169	2.2	183	2.4	180	2.2	160	1.8	140	2.2
Liver disease	25	0.3	19	0.3	16	0.2	23	0.3	36	0.6
Withdrawal	140	1.8	185	2.5	52	0.7	87	1.0	67	1.1
Accidental Death	66	0.9	54	0.7	57	0.7	51	0.6	48	0.8
Pulmonary Causes	204	2.7	195	2.6	223	2.8	488	5.4	426	6.7
Others	541	7.1	641	8.5	564	7.0	633	7.0	508	8.0
Unknown	862	11.3	876	11.6	968	12.0	1091	12.0	721	11.3
Total	7608	100	7553	100	8039	100	9103	100	6358	100
Causes of Death (HD)										
Cardiovascular	1627	25.2	1559	24.2	1503	21.9	1702	21.5	1528	27.9
Died at home	548	8.5	609	9.5	701	10.2	699	8.8	584	10.7
Infection	1952	30.2	2046	31.8	2518	36.7	2955	37.2	1377	25.2
CRBSI	378	5.9	177	2.8	181	2.6	125	1.6	105	1.9
GIT bleed	97	1.5	96	1.5	100	1.5	99	1.3	81	1.5
Cancer	163	2.5	172	2.7	167	2.4	150	1.9	135	2.5
Liver disease	24	0.4	19	0.3	16	0.2	23	0.3	33	0.6
Withdrawal	130	2.0	172	2.7	45	0.7	83	1.1	66	1.2
Accidental Death	64	1.0	52	0.8	48	0.7	45	0.6	45	0.8
Pulmonary Causes	180	2.8	168	2.6	194	2.8	445	5.6	402	7.3
Others	516	8.0	598	9.3	529	7.7	606	7.6	478	8.7
Unknown	778	12.1	770	12.0	853	12.4	1002	12.6	642	11.7
Total	6457	100	6438	100	6855	100	7934	100	5476	100

Year	2024		2023		2022		2021		2020	
	n	%	n	%	n	%	n	%	n	%
Causes of Death (PD)										
Cardiovascular	216	18.8	213	19.1	243	20.5	191	16.3	213	24.2
Died at home	212	18.4	179	16.1	219	18.5	283	24.2	218	24.7
Infection	350	30.4	308	27.6	399	33.7	420	35.9	223	25.3
PD peritonitis	207	18.0	204	18.3	98	8.3	82	7.0	74	8.4
GIT bleed	14	1.2	9	0.8	17	1.4	14	1.2	9	1.0
Cancer	6	0.5	11	1.0	13	1.1	10	0.9	5	0.6
Liver disease	1	0.1	0	0.0	0	0.0	0	0.0	3	0.3
Withdrawal	10	0.9	13	1.2	7	0.6	4	0.3	1	0.1
Accidental Death	2	0.2	2	0.2	9	0.8	6	0.5	3	0.3
Pulmonary Causes	24	2.1	27	2.4	29	2.5	43	3.7	24	2.7
Others	25	2.2	43	3.9	35	3.0	27	2.3	30	3.4
Unknown	84	7.3	106	9.5	115	9.7	89	7.6	79	9.0
Total	1151	100	1115	100	1184	100	1169	100	882	100

Year	2019		2018		2017		2016		2015	
	n	%	n	%	n	%	n	%	n	%
Causes of Death (Dialysis)										
Cardiovascular	1837	28.3	1706	27.7	1730	29.1	1644	30.4	1561	31.2
Died at home	1016	15.6	1019	16.6	965	16.2	774	14.3	724	14.5
Infection	1448	22.3	1545	25.1	1475	24.8	1502	27.8	1287	25.7
CRBSI	102	1.6	94	1.5	87	1.5	55	1.0	58	1.2
PD peritonitis	70	1.1	69	1.1	77	1.3	57	1.1	49	1.0
GIT bleed	98	1.5	107	1.7	94	1.6	91	1.7	86	1.7
Cancer	166	2.6	154	2.5	168	2.8	156	2.9	123	2.5
Liver disease	21	0.3	23	0.4	24	0.4	27	0.5	24	0.5
Withdrawal	99	1.5	52	0.8	76	1.3	66	1.2	59	1.2
Accidental Death	62	1.0	52	0.8	55	0.9	50	0.9	41	0.8
Pulmonary Causes	561	8.6	446	7.3	276	4.6	146	2.7	124	2.5
Others	420	6.5	408	6.6	353	5.9	226	4.2	204	4.1
Unknown	596	9.2	480	7.8	569	9.6	608	11.3	664	13.3
Total	6496	100	6155	100	5949	100	5402	100	5004	100
Causes of Death (HD)										
Cardiovascular	1642	29.3	1520	28.5	1558	30.1	1491	31.9	1409	32.2
Died at home	745	13.3	790	14.8	729	14.1	560	12.0	540	12.4
Infection	1255	22.4	1335	25.0	1300	25.1	1289	27.6	1139	26.1
CRBSI	102	1.8	94	1.8	87	1.7	55	1.2	58	1.3
GIT bleed	81	1.5	95	1.8	82	1.6	83	1.8	75	1.7
Cancer	157	2.8	148	2.8	161	3.1	151	3.2	117	2.7
Liver disease	21	0.4	23	0.4	23	0.4	27	0.6	24	0.6
Withdrawal	88	1.6	48	0.9	58	1.1	56	1.2	53	1.2
Accidental Death	57	1.0	50	0.9	53	1.0	47	1.0	40	0.9
Pulmonary Causes	534	9.5	419	7.9	262	5.1	129	2.8	116	2.7
Others	379	6.8	377	7.1	332	6.4	213	4.6	191	4.4
Unknown	542	9.7	437	8.2	529	10.2	570	12.2	611	14.0
Total	5603	100	5336	100	5174	100	4671	100	4373	100

Year	2019		2018		2017		2016		2015	
	n	%	n	%	n	%	n	%	n	%
Causes of Death (PD)										
Cardiovascular	195	21.8	186	22.7	172	22.2	153	20.9	152	24.1
Died at home	271	30.4	229	28.0	236	30.5	214	29.3	184	29.2
Infection	193	21.6	210	25.6	175	22.6	213	29.1	148	23.5
PD peritonitis	70	7.8	69	8.4	77	9.9	57	7.8	49	7.8
GIT bleed	17	1.9	12	1.5	12	1.6	8	1.1	11	1.7
Cancer	9	1.0	6	0.7	7	0.9	5	0.7	6	1.0
Liver disease	0	0.0	0	0.0	1	0.1	0	0.0	0	0.0
Withdrawal	11	1.2	4	0.5	18	2.3	10	1.4	6	1.0
Accidental Death	5	0.6	2	0.2	2	0.3	3	0.4	1	0.2
Pulmonary Causes	27	3.0	27	3.3	14	1.8	17	2.3	8	1.3
Others	41	4.6	31	3.8	21	2.7	13	1.8	13	2.1
Unknown	54	6.1	43	5.3	40	5.2	38	5.2	53	8.4
Total	893	100	819	100	775	100	731	100	631	100

SECTION 3.2: PATIENT SURVIVAL ON DIALYSIS

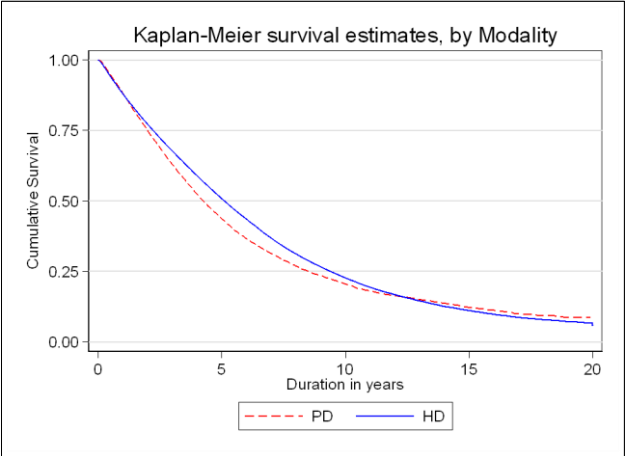
3.2.1: Patient survival by type of dialysis modality

The overall unadjusted 5 years and 10 years patient survival on dialysis; analysed as per ITT (patient not censored for change in dialysis modality) were 50% and 22% respectively (Table 3.2.1). The unadjusted patient survival for those on haemodialysis appeared to be superior compared to those on PD at 5 years with separation of survival curves observed from the second year after dialysis initiation. However, this difference diminished over time, with narrowing of the survival gap by ten years.

Table 3.2.1: Patient survival by dialysis modality (not censored for change of modality), 2005-2024

Dialysis modality Interval (year)	PD			HD			All		
	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	20877	100		123546	100		144423	100	
1	16695	88	0	100967	88	0	117662	88	0
2	12560	75	0	81645	77	0	94205	77	0
3	9318	63	0	65911	68	0	75229	67	0
4	6835	52	0	52748	59	0	59583	58	0
5	5002	44	0	41599	51	0	46601	50	0
6	3668	37	0	32248	43	0	35916	43	0
7	2805	31	0	24719	37	0	27524	36	0
8	2128	27	0	18897	31	0	21025	31	0
9	1671	24	0	14408	27	0	16078	26	0
10	1262	21	0	10873	23	0	12129	22	0
11	950	18	0	8148	19	0	9097	19	0
12	734	16	0	6094	17	0	6828	17	0
13	572	15	0	4489	15	0	5060	15	0
14	446	14	0	3228	13	0	3671	13	0
15	319	12	0	2317	11	0	2635	11	0
16	222	11	0	1618	10	0	1839	10	0
17	140	10	0	1043	9	0	1182	9	0
18	89	9	0	632	8	0	720	8	0
19	41	9	0	282	7	0	322	7	0
20	1	9	0	6	6	0	6	6	0

Figure 3.2.1: Patient survival by dialysis modality analysis (not censored for change of modality), 2005-2024



3.2.2: Patient survival by age at starting dialysis

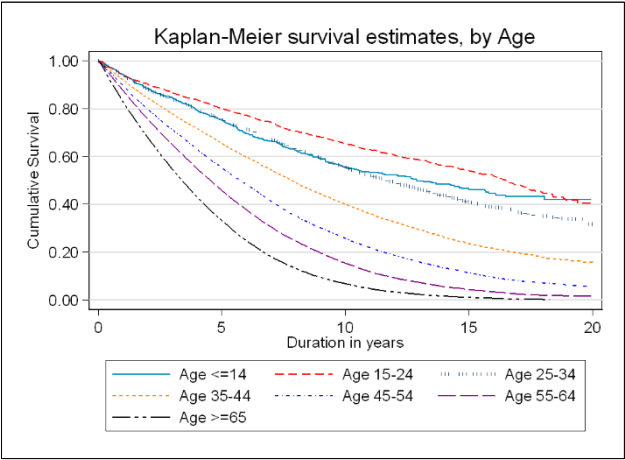
Age at starting dialysis has a major impact on survival with patients in the age group of 15 - 24 having the best outcome (Table 3.2.2 and Figure 3.2.2). Unadjusted 5 years survival and 10-years survival of patients who started dialysis after 65 years old is 33% and 7% respectively.

Table 3.2.2: Unadjusted patient survival by age, 2005-2024

Age group (years) Interval (year)	≤14			15-24			25-34			35-44		
	n	% survival	SE	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	1020	100		3669	100		9066	100		16935	100	
1	909	94	0	3240	94	0	7829	94	0	14227	92	0
2	790	88	0	2898	90	0	6670	88	0	11763	84	0
3	704	85	0	2572	87	0	5771	84	0	9802	78	0
4	617	79	0	2290	84	0	5028	80	0	8209	72	0
5	546	75	0	2029	80	0	4345	76	0	6781	65	0
6	455	70	0	1798	77	0	3725	72	0	5513	60	0
7	402	66	0	1592	74	0	3164	67	0	4530	54	0
8	349	63	0	1379	71	0	2683	63	0	3676	49	0
9	305	59	0	1210	68	0	2234	59	0	3001	44	0
10	259	55	0	1049	65	0	1868	56	0	2379	40	0
11	226	53	0	887	63	0	1537	52	0	1880	36	0
12	198	52	0	736	61	0	1236	49	0	1473	33	0
13	169	50	0	607	58	0	980	46	0	1137	29	0
14	138	49	0	501	56	0	779	44	0	859	26	0
15	102	46	0	397	54	0	582	41	0	645	24	0
16	75	45	0	297	52	0	430	39	0	474	21	0
17	51	43	0	207	48	0	299	37	0	311	20	0
18	35	43	0	124	45	0	182	35	0	198	18	0
19	20	42	0	57	42	0	89	34	0	96	17	0
20	1	42	0	2	41	0	4	32	0	2	16	0

Age group (years) Interval (year)	45-54			55-64			≥65		
	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	33427	100		44005	100		36849	100	
1	27923	90	0	35856	88	0	28164	83	0
2	22933	80	0	28500	76	0	21088	68	0
3	18856	71	0	22506	65	0	15407	55	0
4	15472	63	0	17329	55	0	11000	43	0
5	12489	55	0	13099	46	0	7658	33	0
6	9946	48	0	9726	38	0	5064	25	0
7	7757	41	0	7052	30	0	3311	18	0
8	5989	35	0	5066	25	0	2137	13	0
9	4596	30	0	3593	20	0	1375	9	0
10	3485	26	0	2451	15	0	854	7	0
11	2614	22	0	1620	12	0	523	5	0
12	1929	19	0	1097	9	0	322	3	0
13	1386	16	0	737	7	0	184	2	0
14	967	13	0	446	5	0	99	2	0
15	664	11	0	288	4	0	57	1	0
16	444	9	0	172	3	0	26	1	0
17	277	8	0	90	2	0	4	0	0
18	174	7	0	50	2	0	2	0	0
19	69	6	0	23	2	0	1	0	0
20	1	6	0	1	2	0	1	0	0

Figure 3.2.2: Unadjusted patient survival by age, 2005-2024

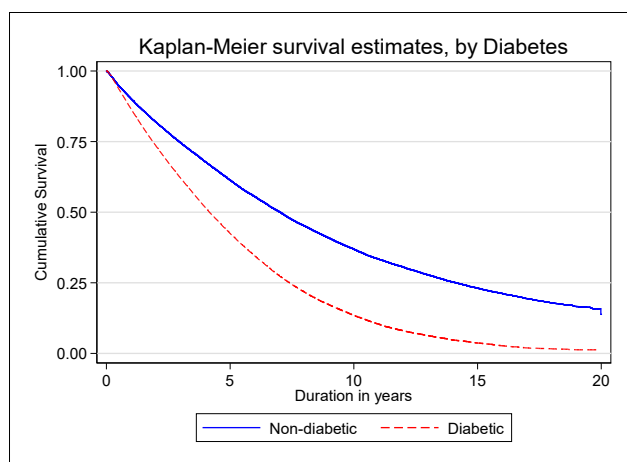


3.2.3: Patient survival by diabetic status

Similar to age at starting dialysis, the presence of diabetes mellitus has a significant impact on patient survival (Table 3.2.3 and Figure 3.2.3). Unadjusted patient survival curves for diabetic and non-diabetic patients begin to diverge within the first 12 months following initiation of dialysis. By five years after dialysis initiation, 58% of patients with diabetes had died. By 10 years and 20 years, unadjusted patient survival was markedly lower among diabetic patients compared with non-diabetic patients (14% vs 37%) and (1% vs 13%).

Table 3.2.3: Unadjusted patient survival by diabetes mellitus status, 2005-2024

Diabetes status Interval (year)	n	Non-diabetic % survival	SE	n	Diabetic % survival	SE
0	58886	100		85653	100	
1	48651	90	0	69158	86	0
2	40157	82	0	54169	73	0
3	32986	75	0	42344	62	0
4	27020	68	0	32658	52	0
5	22054	61	0	24654	42	0
6	17829	55	0	18192	34	0
7	14659	50	0	12980	27	0
8	11975	45	0	9158	22	0
9	9808	41	0	6391	17	0
10	7897	37	0	4356	13	0
11	6329	33	0	2884	10	0
12	5025	31	0	1910	8	0
13	3905	28	0	1256	6	0
14	2981	25	0	779	5	0
15	2221	23	0	489	4	0
16	1627	21	0	275	3	0
17	1091	19	0	132	2	0
18	682	18	0	72	2	0
19	316	17	0	29	1	0
20	6	14	0	1	1	0

Figure 3.2.3: Unadjusted patient survival by diabetes mellitus status, 2005-2024

3.2.4: Patient survival by 5 years era of starting dialysis

When unadjusted patient survival was analysed by 5 years era of starting dialysis, patient survival has not improved over the last 20 years. In fact, it seemed to have deteriorated slightly, with patients starting dialysis in the 2005-2009 era having the best outcome (Table 3.2.4 and Figure 3.2.4a). Despite adjusting for age and DM (major change in patient demography over the last 2 decades), the difference in patient survival persisted (Figure 3.2.4b). The overall mean age of patients starting dialysis remained almost same in the past 10 years (refer Table 2.1.4(a)).

Table 3.2.4: Unadjusted patient survival by 4 Era, 2005-2024

Year Interval (year)	2005-2009			2010-2014			2015-2019			2020-2024		
	n	% survival	SE	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	20588	100		32736	100		42434	100		49213	100	
1	18081	88	0	28454	87	0	37324	89	0	34289	88	0
2	15921	78	0	24806	76	0	32259	77	0	21654	77	0
3	14028	69	0	21662	67	0	27750	67	0	12177	67	0
4	12333	60	0	18759	58	0	23623	57	0	5230	59	0
5	10787	53	0	16142	50	0	19911	48	0	106	50	0
6	9441	46	0	13761	43	0	13024	41	0			
7	8119	40	0	11673	36	0	8014	34	0			
8	6997	34	0	9805	31	0	4474	29	0			
9	6121	30	0	8262	26	0	1926	24	0			
10	5339	26	0	6920	22	0	80	21	0			
11	4629	23	0	4655	19	0						
12	4069	20	0	2918	16	0						
13	3553	18	0	1642	14	0						
14	3086	16	0	699	12	0						
15	2721	14	0	9	11	0						
16	1912	12	0									
17	1232	11	0									
18	759	10	0									
19	348	9	0									
20	6	8	0									

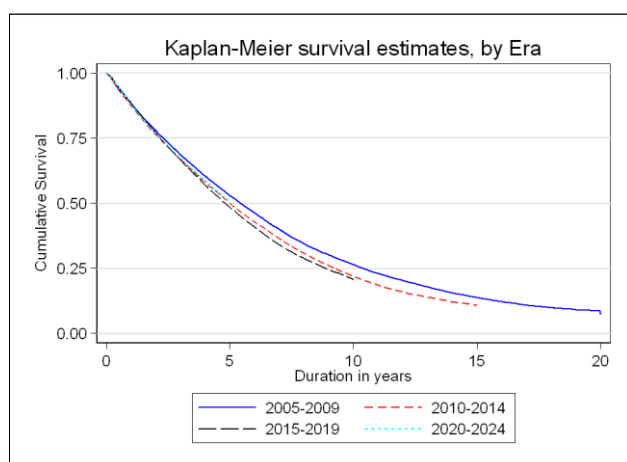
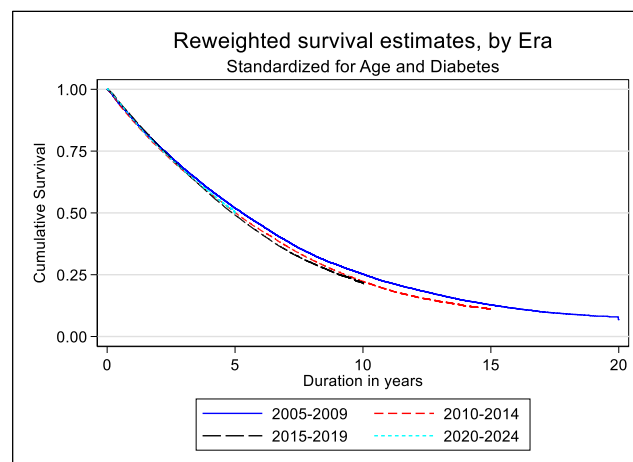
Figure 3.2.4(a): Unadjusted patient survival by 4 Era, 2005-2024**Figure 3.2.4(b): Adjusted for Age and Diabetes patient survival by 4 Era, 2005-2024**

Table 3.2.5: Unadjusted HD patient survival by 4 Era, 2005-2024

Year Interval (year)	2005-2009			2010-2014			2015-2019			2020-2024		
	n	% survival	SE	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	18080	100		28921	100		36362	100		40183	100	
1	15903	88	0	25099	87	0	31977	89	0	27988	88	0
2	14037	78	0	21968	77	0	27779	77	0	17861	77	0
3	12404	69	0	19284	67	0	24024	67	0	10199	68	0
4	10947	61	0	16758	59	0	20599	58	0	4444	60	0
5	9604	54	0	14457	51	0	17443	49	0	95	51	0
6	8412	47	0	12333	43	0	11503	42	0			
7	7199	40	0	10445	37	0	7075	35	0			
8	6191	35	0	8744	31	0	3962	29	0			
9	5383	30	0	7343	26	0	1682	25	0			
10	4680	26	0	6121	22	0	72	21	0			
11	4036	23	0	4112	18	0						
12	3524	20	0	2570	16	0						
13	3051	17	0	1438	14	0						
14	2624	15	0	604	12	0						
15	2310	13	0	9	11	0						
16	1618	12	0									
17	1043	10	0									
18	632	9	0									
19	282	9	0									
20	6	7	0									

Figure 3.2.5(a): Unadjusted HD patient survival by 4 Era, 2005-2024

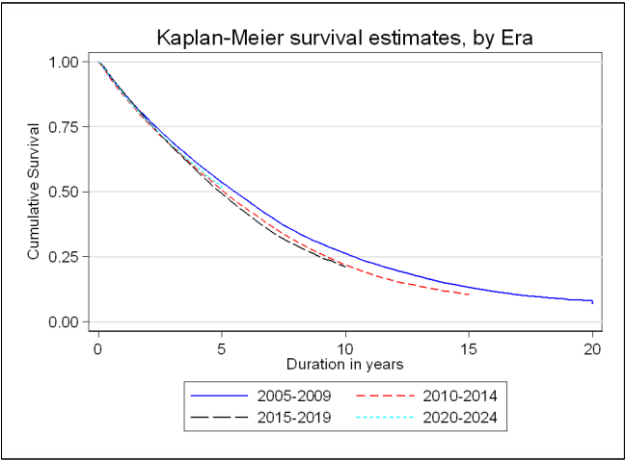


Figure 3.2.5(b): Adjusted for Age and Diabetes HD patient survival by 4 Era, 2005-2024

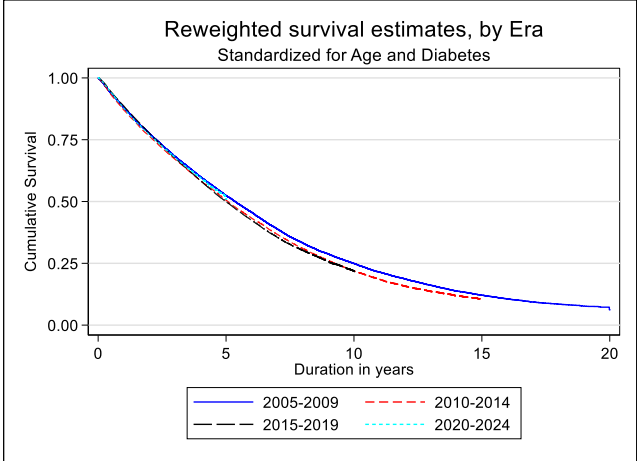


Table 3.2.6: Unadjusted PD patient survival by 4 Era, 2005-2024

Year Interval (year)	2005-2009			2010-2014			2015-2019			2020-2024		
	n	% survival	SE	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	2346	100		3693	100		5940	100		8898	100	
1	2020	86	0	3240	88	0	5226	88	0	6209	88	0
2	1731	74	0	2726	74	0	4368	75	0	3735	75	0
3	1474	63	0	2269	62	0	3621	62	0	1954	64	0
4	1241	54	0	1893	52	0	2923	51	0	778	54	0
5	1040	45	0	1581	44	0	2371	42	0	11	44	0
6	890	38	0	1326	37	0	1454	35	0			
7	786	34	0	1130	32	0	889	29	0			
8	676	29	0	971	27	0	482	24	0			
9	611	27	0	831	24	0	231	21	0			
10	537	24	0	715	20	0	12	17	0			
11	478	21	0	473	18	0						
12	433	19	0	302	16	0						
13	398	18	0	175	14	0						
14	364	16	0	83	13	0						
15	319	15	0	1	13	0						
16	222	13	0									
17	140	12	0									
18	89	11	0									
19	41	10	0									
20	1	10	0									

Figure 3.2.6(a): Unadjusted PD patient survival by 4 Era, 2005-2024

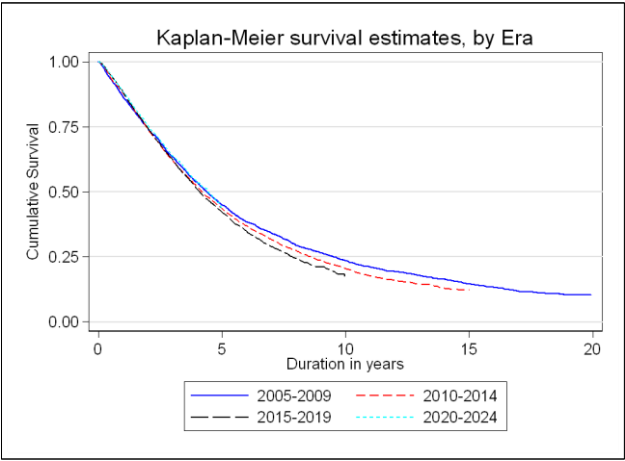
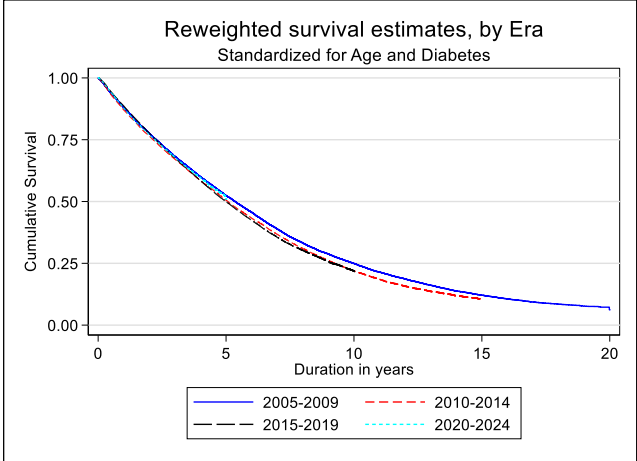


Figure 3.2.6(b): Adjusted for Age and Diabetes PD patient survival by 4 Era, 2005-2024



3.3.1: Adjusted hazard ratio for mortality of dialysis patients

The mortality and hazard ratio of the 2005-2024 cohort, adjusted for age, gender, primary diagnosis, year commencing dialysis, dialysis modality, body mass index (BMI), serum albumin, serum cholesterol, diastolic blood pressure, haemoglobin, serum calcium, serum phosphate, viral hepatitis status, and presence of cardiovascular disease were showed in Table 3.4.1.

Patient characteristics significantly associated with mortality included age, sex, primary kidney disease, year of dialysis initiation, dialysis modality, body mass index (BMI), and diastolic blood pressure. In contrast, the presence of cardiovascular disease was not independently associated with an increased risk of mortality ($p = 0.096$).

The biochemical variables associated with a significant risk factor for mortality were serum albumin, serum LDL cholesterol, haemoglobin, calcium, and phosphate.

Diastolic blood pressure [Figure 3.4.1(a)], low haemoglobin [Figure 3.1.1(b)], low serum phosphate [Figure 3.4.1(c)] was of higher risk for mortality. A non-linear, U-shaped relationship was observed between serum phosphate levels and mortality,

Female patients have 21% lower risk of mortality compared to their male counterpart while patients with diabetes mellitus as the primary aetiology of kidney failure has the highest mortality risk when compared to other causes of end stage kidney failure. Patients initiating dialysis in this era (2020 - 2024) has the highest risk of mortality compared to those who started dialysis in the earlier years (2005-2009).

PD patients have 8% higher mortality risk compared to HD patients.

Table 3.3.1: Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality (2005-2024)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	1,013	0.55	(0.43 - 0.71)	< 0.001
Age 15-24	3,622	0.73	(0.66 - 0.81)	< 0.001
Age 25-34 (ref*)	8,970	1.00		
Age 35-44	16,797	1.61	(1.52 - 1.71)	< 0.001
Age 45-54	33,294	2.40	(2.27 - 2.54)	< 0.001
Age 55-64	43,904	3.36	(3.17 - 3.55)	< 0.001
Age ≥65	36,823	4.81	(4.54 - 5.10)	< 0.001
Gender				
Male (ref*)	79,261	1.00		
Female	65,162	0.79	(0.78 - 0.81)	< 0.001
Primary diagnosis				
Unknown primary	15,404	1.11	(1.03 - 1.20)	0.007
Diabetes mellitus	85,521	2.13	(1.98 - 2.29)	< 0.001
GN/SLE (ref*)	4,682	1.00		
Polycystic kidney	910	1.03	(0.89 - 1.20)	0.680
Obstructive nephropathy	1,896	1.38	(1.23 - 1.54)	< 0.001
Toxic nephropathy	779	1.45	(1.26 - 1.68)	< 0.001
Hypertension	30,964	1.37	(1.28 - 1.48)	< 0.001
Others	4,267	1.30	(1.18 - 1.43)	< 0.001
Year start dialysis				
2005-2009 (ref*)	20,426	1.00		
2010-2014	32,614	2.74	(2.62 - 2.87)	< 0.001
2015-2019	42,302	6.67	(6.35 - 7.02)	< 0.001
2020-2024	49,081	9.10	(8.60 - 9.62)	< 0.001

Factors	n	Hazard ratio	95% CI	P-value
Modality				
HD ^(ref*)	123,546	1.00		
PD	20,877	0.92	(0.89 - 0.95)	< 0.001
BMI				
BMI <18.5	6,685	1.38	(1.32 - 1.45)	< 0.001
BMI 18.5-25 ^(ref*)	59,192	1.00		
BMI 25-30	40,447	0.93	(0.91 - 0.95)	< 0.001
BMI ≥30	19,247	0.99	(0.96 - 1.02)	0.429
Albumin (g/L)				
<25	2,976	6.88	(6.46 - 7.33)	< 0.001
25-<30	7,031	4.10	(3.92 - 4.28)	< 0.001
30-<35	21,263	2.36	(2.29 - 2.44)	< 0.001
35-<40	47,695	1.39	(1.35 - 1.43)	< 0.001
≥40 ^(ref*)	30,521	1.00		
LDL cholesterol (mmol/L)				
<1.8	23,680	1.14	(1.11 - 1.17)	< 0.001
1.8-<2.6 ^(ref*)	42,898	1.00		
≥2.6	39,625	1.09	(1.06 - 1.11)	< 0.001
Diastolic BP (mmHg)				
<70	30,694	0.88	(0.85 - 0.91)	< 0.001
70-<80	60,257	0.87	(0.85 - 0.90)	< 0.001
80-<90 ^(ref*)	38,267	1.00		
90-<100	8,867	1.35	(1.28 - 1.42)	< 0.001
≥100	1,360	2.25	(1.98 - 2.56)	< 0.001
Haemoglobin (g/dL)				
<10	59,689	1.83	(1.80 - 1.87)	< 0.001
10-<12 ^(ref*)	70,038	1.00		
≥12	8,224	0.95	(0.91 - 1.00)	0.030
Serum calcium (mmol/L)				
<2.1	17,418	1.02	(0.99 - 1.04)	0.316
2.1-≤2.37 ^(ref*)	63,670	1.00		
>2.37	28,184	0.94	(0.92 - 0.96)	< 0.001
Serum phosphate (mmol/L)				
<0.8	541	1.69	(1.48 - 1.92)	< 0.001
0.8-<1.3 ^(ref*)	13,524	1.00		
1.3-<1.8	48,430	0.94	(0.91 - 0.96)	< 0.001
1.8-<2.2	31,241	1.01	(0.98 - 1.05)	0.524
≥2.2	15,702	1.25	(1.20 - 1.30)	< 0.001
HBsAg				
Negative ^(ref*)	138,347	1.00		
Positive	4,769	0.93	(0.88 - 0.98)	0.007
Anti-HCV				
Negative ^(ref*)	139,935	1.00		
Positive	3,181	1.05	(0.98 - 1.12)	0.144
Cardiovascular disease (CVD)				
No CVD ^(ref*)	105,118	1.00		
CVD	15,791	1.02	(1.00 - 1.05)	0.096

Figure 3.3.1(a): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by diastolic blood pressure (2005-2024 cohort)

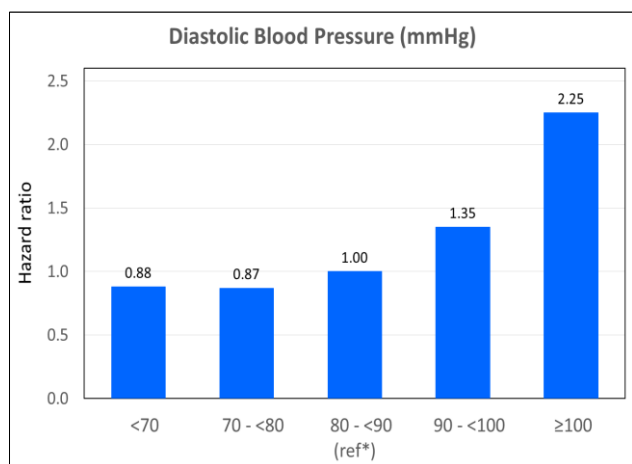


Figure 3.3.1(b): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by haemoglobin (2005-2024 cohort)

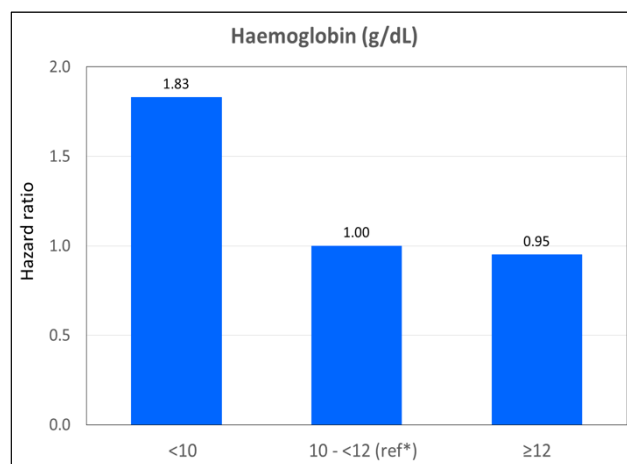


Figure 3.3.1(c): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by serum phosphate (2005-2024 cohort)

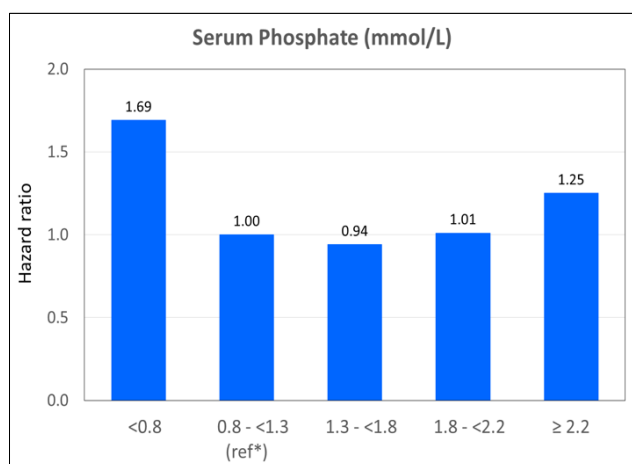
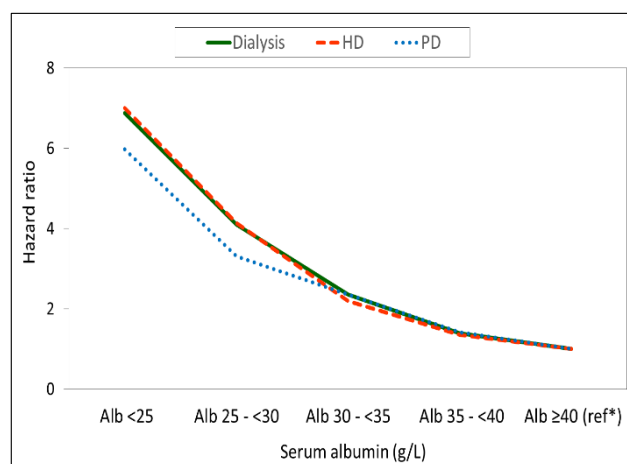


Figure 3.3.1(d): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by serum albumin (2005-2024 cohort)



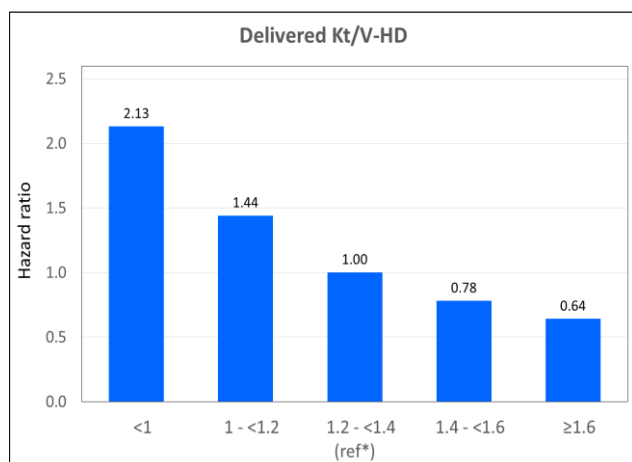
3.3.2: Adjusted hazard ratio for mortality of haemodialysis patients

The adjusted hazard ratio for mortality of haemodialysis patients [Table 3.4.2] demonstrated identical pattern with the whole cohort of 2005-2024 dialysis patients since almost 90% of the dialysis population consisted of haemodialysis patients. Higher dose of delivered Kt/V seems to be associated with reduced mortality risk. [Figure 3.4.2].

Table 3.3.2: Adjusted hazard ratio for mortality of HD patients (2005-2024 cohort)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	254	0.62	(0.35 - 1.10)	0.103
Age 15-24	2,316	0.74	(0.65 - 0.85)	< 0.001
Age 25-34 (ref*)	6,928	1.00		
Age 35-44	13,991	1.69	(1.57 - 1.81)	< 0.001
Age 45-54	28,902	2.49	(2.32 - 2.66)	< 0.001
Age 55-64	38,365	3.52	(3.28 - 3.77)	< 0.001
Age ≥65	32,790	5.08	(4.73 - 5.46)	< 0.001
Gender				
Male (ref*)	68,255	1.00		
Female	55,291	0.97	(0.94 - 0.99)	0.014
Primary diagnosis				
Unknown primary	13,315	1.13	(1.03 - 1.25)	0.010
Diabetes mellitus	74,137	2.06	(1.89 - 2.25)	< 0.001
GN/SLE (ref*)	3,242	1.00		
Polycystic kidney	809	1.05	(0.89 - 1.25)	0.550
Obstructive nephropathy	1,524	1.34	(1.17 - 1.53)	< 0.001
Toxic nephropathy	643	1.47	(1.23 - 1.76)	< 0.001
Hypertension	26,554	1.37	(1.25 - 1.50)	< 0.001
Others	3,322	1.28	(1.13 - 1.44)	< 0.001
Year start dialysis				
2005-2009 (ref*)	18,080	1.00		
2010-2014	28,921	2.70	(2.56 - 2.85)	< 0.001
2015-2019	36,362	6.43	(6.07 - 6.80)	< 0.001
2020-2024	40,183	8.97	(8.40 - 9.57)	< 0.001
BMI				
BMI <18.5	5,409	1.48	(1.40 - 1.57)	< 0.001
BMI 18.5-25 (ref*)	50,660	1.00		
BMI 25-30	34,602	0.84	(0.81 - 0.86)	< 0.001
BMI ≥30	16,844	0.77	(0.74 - 0.80)	< 0.001
Albumin (g/L)				
<25	1,286	7.00	(6.34 - 7.73)	< 0.001
25-<30	3,882	4.14	(3.91 - 4.38)	< 0.001
30-<35	15,960	2.19	(2.11 - 2.26)	< 0.001
35-<40	42,974	1.35	(1.31 - 1.39)	< 0.001
≥40 (ref*)	28,886	1.00		
LDL cholesterol (mmol/L)				
<1.8	21,278	1.12	(1.09 - 1.15)	< 0.001
1.8-<2.6 (ref*)	37,626	1.00		
≥2.6	31,723	1.10	(1.07 - 1.13)	< 0.001

Factors	n	Hazard ratio	95% CI	P-value
Kt/V				
<1	3,616	2.13	(2.00 - 2.27)	< 0.001
1-<1.2	12,277	1.44	(1.38 - 1.49)	< 0.001
1.2-<1.4 (ref*)	27,329	1.00		
1.4-<1.6	24,344	0.78	(0.76 - 0.81)	< 0.001
≥1.6	25,556	0.64	(0.61 - 0.66)	< 0.001
Diastolic BP (mmHg)				
<70	28,377	0.91	(0.88 - 0.94)	< 0.001
70-<80	52,087	0.90	(0.87 - 0.92)	< 0.001
80-<90 (ref*)	30,141	1.00		
90-<100	7,135	1.31	(1.23 - 1.39)	< 0.001
≥100	1,173	1.90	(1.62 - 2.24)	< 0.001
Haemoglobin (g/dL)				
<10	52,148	1.82	(1.78 - 1.87)	< 0.001
10-<12 (ref*)	58,886	1.00		
≥12	6,553	0.92	(0.87 - 0.97)	0.002
Serum calcium (mmol/L)				
<2.1	15,728	0.98	(0.95 - 1.02)	0.304
2.1-≤2.37 (ref*)	55,479	1.00		
>2.37	21,670	0.95	(0.92 - 0.97)	< 0.001
Serum phosphate (mmol/L)				
<0.8	436	1.62	(1.38 - 1.89)	< 0.001
0.8-<1.3 (ref*)	10,611	1.00		
1.3-<1.8	41,225	0.91	(0.88 - 0.94)	< 0.001
1.8-<2.2	27,163	0.94	(0.91 - 0.98)	0.005
≥2.2	13,576	1.12	(1.07 - 1.18)	< 0.001
HBsAg				
Negative (ref*)	118,585	1.00		
Positive	4,062	0.94	(0.89 - 1.00)	0.047
Anti-HCV				
Negative (ref*)	119,914	1.00		
Positive	2,733	1.08	(1.00 - 1.16)	0.048
Cardiovascular disease (CVD)				
No CVD (ref*)	92,066	1.00		
CVD	13,032	0.99	(0.96 - 1.02)	0.560

Figure 3.3.2: Adjusted hazard ratio for mortality of HD patients uncensored for change of modality by Kt/V (2005-2024 cohort)**3.3.3: Adjusted hazard ratio for mortality of peritoneal dialysis patients**

The adjusted hazard ratio for peritoneal dialysis patients [Table 3.4.3] showed some similarity to the whole cohort of 2015-2024 dialysis patients. Patients with diabetes mellitus as their primary kidney disease fare worst compared to others. A 'U curve' phenomenon is seen for diastolic blood pressure, serum phosphate, and haemoglobin levels.

Table 3.3.3: Adjusted hazard ratio for mortality of PD patients (2005-2024 cohort)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	759	0.44	(0.32 - 0.60)	< 0.001
Age 15-24	1,306	0.72	(0.60 - 0.86)	< 0.001
Age 25-34 (ref*)	2,042	1.00		
Age 35-44	2,806	1.31	(1.14 - 1.49)	< 0.001
Age 45-54	4,392	1.89	(1.66 - 2.14)	< 0.001
Age 55-64	5,539	2.59	(2.28 - 2.95)	< 0.001
Age ≥65	4,033	3.69	(3.21 - 4.24)	< 0.001
Gender				
Male (ref*)	11,006	1.00		
Female	9,871	0.83	(0.79 - 0.88)	< 0.001
Primary diagnosis				
Unknown primary	2,089	1.06	(0.88 - 1.26)	0.545
Diabetes mellitus	11,384	2.32	(1.99 - 2.69)	< 0.001
GN/SLE (ref*)	1,440	1.00		
Polycystic kidney	101	0.90	(0.56 - 1.44)	0.656
Obstructive nephropathy	372	1.58	(1.24 - 2.02)	< 0.001
Toxic nephropathy	136	1.32	(0.95 - 1.84)	0.100
Hypertension	4,410	1.32	(1.14 - 1.54)	< 0.001
Others	945	1.35	(1.08 - 1.70)	0.009

Factors	n	Hazard ratio	95% CI	P-value
Year start dialysis				
2005-2009 (ref*)	2,346	1.00		
2010-2014	3,693	2.86	(2.42 - 3.37)	< 0.001
2015-2019	5,940	6.97	(5.86 - 8.29)	< 0.001
2020-2024	8,898	8.06	(6.70 - 9.70)	< 0.001
BMI				
BMI <18.5	1,276	1.41	(1.24 - 1.61)	< 0.001
BMI 18.5-25 (ref*)	8,532	1.00		
BMI 25-30	5,845	1.00	(0.94 - 1.06)	0.910
BMI ≥30	2,403	1.11	(1.02 - 1.21)	0.016
Albumin (g/L)				
<25	1,690	5.97	(5.16 - 6.91)	< 0.001
25-<30	3,149	3.31	(2.90 - 3.78)	< 0.001
30-<35	5,303	2.35	(2.07 - 2.66)	< 0.001
35-<40	4,721	1.42	(1.25 - 1.62)	< 0.001
≥40 (ref*)	1,635	1.00		
LDL cholesterol (mmol/L)				
<1.8	2,402	1.11	(1.03 - 1.20)	0.009
1.8-<2.6 (ref*)	5,272	1.00		
≥2.6	7,902	1.13	(1.07 - 1.20)	< 0.001
Diastolic BP (mmHg)				
<70	2,317	1.03	(0.93 - 1.13)	0.612
70-<80	8,170	0.87	(0.82 - 0.93)	< 0.001
80-<90 (ref*)	8,126	1.00		
90-<100	1,732	1.28	(1.13 - 1.46)	< 0.001
≥100	187	2.38	(1.61 - 3.52)	< 0.001
Haemoglobin (g/dL)				
<10	7,541	1.40	(1.31 - 1.49)	< 0.001
10-<12 (ref*)	11,152	1.00		
≥12	1,671	1.18	(1.06 - 1.32)	0.004
Serum calcium (mmol/L)				
<2.1	1,690	1.05	(0.95 - 1.17)	0.325
2.1-≤2.37 (ref*)	8,191	1.00		
>2.37	6,514	0.94	(0.89 - 1.00)	0.042
Serum phosphate (mmol/L)				
<0.8	105	2.00	(1.46 - 2.74)	< 0.001
0.8-<1.3 (ref*)	2,913	1.00		
1.3-<1.8	7,205	0.85	(0.79 - 0.92)	< 0.001
1.8-<2.2	4,078	0.92	(0.84 - 1.00)	0.057
≥2.2	2,126	1.10	(0.98 - 1.22)	0.097
HBsAg				
Negative (ref*)	19,762	1.00		
Positive	707	0.96	(0.83 - 1.12)	0.633
Anti-HCV				
Negative (ref*)	20,021	1.00		
Positive	448	1.08	(0.90 - 1.29)	0.404
Cardiovascular disease (CVD)				
No CVD (ref*)	13,052	1.00		
CVD	2,759	1.08	(1.01 - 1.16)	0.031