Chapter 3

DEATH AND SURVIVAL ON DIALYSIS

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SECTION 3.1: DEATH ON DIALYSIS

The annual death rate on dialysis in 2014 was 12.0% (Table 3.1.1). The annual death rate among haemodialysis patients was 11.6% while peritoneal dialysis patients had an annual death rate of 16.1%.

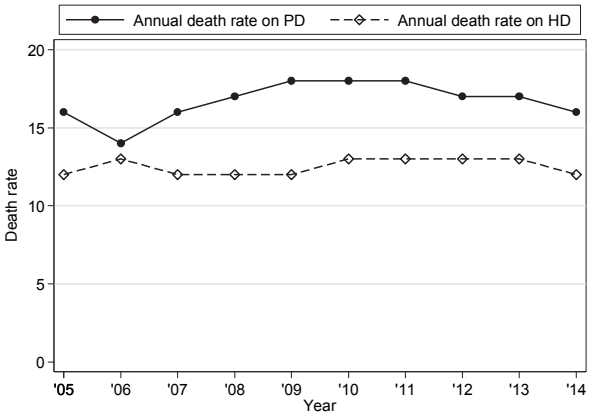
The annual death rate among haemodialysis patients remained relatively unchanged over the last 10 years and ranged from 12-13% (Figure 3.1.1). The annual death rate of patients on chronic peritoneal dialysis (PD) began to increase in mid 2000's and appeared to have improved over the last 3 years.

The difference in annual death rate between the two modalities persisted over the last 10 years and is partly contributed by the negative selection of patients for peritoneal dialysis.

Table 3.1.1: Deaths on dialysis 2005-2014

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of dialysis patients at risk	12600	14218	16082	18236	20489	22650	25019	27776	30625	33397
Dialysis deaths	1515	1820	1987	2191	2601	3047	3292	3645	4001	4015
Dialysis death rate %	12	13	12	12	13	13	13	13	13	12
Number of HD patients at risk	11451	12973	14649	16587	18671	20711	22935	25407	27927	30345
HD deaths	1333	1643	1756	1914	2280	2694	2918	3248	3530	3521
HD death rate %	12	13	12	12	12	13	13	13	13	12
Number of PD patients at risk	1149	1246	1433	1650	1819	1939	2084	2369	2698	3052
PD deaths	182	177	231	277	321	353	374	397	471	494
PD death rate %	16	14	16	17	18	18	18	17	17	16

Figure 3.1.1: Death rates on dialysis 2005-2014



Cardiovascular disease remained the main cause of death and in 2014 accounted for 37% of all death. Death at home accounted for another 16% and a majority of these deaths were probably due to cardiovascular events. Death from sepsis has increased over the last 6 years and has now became the second most common cause of death; accounting for 24% of all death in 2014.

Table 3.1.2: Causes of death on dialysis 2005-2014

Year	2005		2006		2007		2008		2009	
Causes of Death	n	%	n	%	n	%	n	%	n	%
Cardiovascular	499	33	608	33	630	32	738	34	908	35
Died at home	319	21	353	19	342	17	424	19	491	19
Sepsis	290	19	352	19	344	17	400	18	585	22
PD peritonitis	23	2	23	1	23	1	30	1	32	1
GIT bleed	35	2	31	2	39	2	47	2	49	2
Cancer	36	2	42	2	41	2	57	3	57	2
Liver disease	30	2	37	2	39	2	45	2	29	1
Withdrawal	14	1	24	1	27	1	24	1	36	1
Others	82	5	107	6	230	12	191	9	103	4
Unknown	187	12	243	13	272	14	235	11	311	12
TOTAL	1515	100	1820	100	1987	100	2191	100	2601	100

Year	2010		2011		2012		2013		2014	
Causes of Death	n	%	n	%	n	%	n	%	n	%
Cardiovascular	1023	34	1206	37	1278	35	1412	35	1475	37
Died at home	546	18	541	16	586	16	677	17	643	16
Sepsis	735	24	776	24	952	26	1002	25	983	24
PD peritonitis	37	1	28	1	18	0	42	1	49	1
GIT bleed	61	2	54	2	63	2	67	2	71	2
Cancer	79	3	88	3	81	2	86	2	90	2
Liver disease	33	1	35	1	30	1	37	1	51	1
Withdrawal	42	1	43	1	51	1	49	1	49	1
Others	64	2	78	2	69	2	97	2	186	5
Unknown	427	14	443	13	517	14	532	13	418	10
TOTAL	3047	100	3292	100	3645	100	4001	100	4015	100

SECTION 3.2: PATIENT SURVIVAL ON DIALYSIS

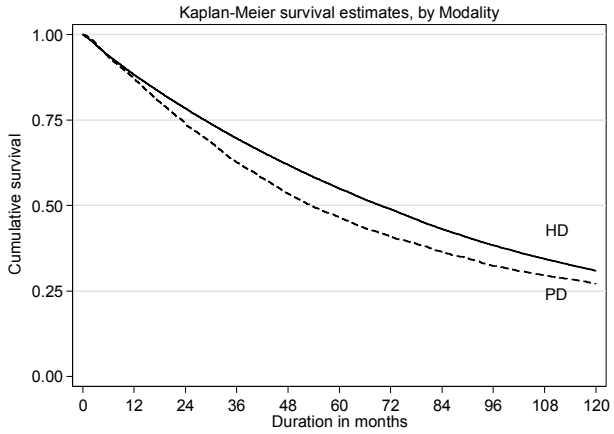
3.2.1 PATIENT SURVIVAL BY TYPE OF DIALYSIS MODALITY

The overall unadjusted 5 year and 10 year patient survival (analysed as per ITT (initial modality of dialysis)) on dialysis were 54% and 30% respectively (Table 3.2.1). The unadjusted patient survival was marginally superior for those on haemodialysis compared to those on PD and this survival difference began to widen after the first year. At 10 years the unadjusted patient survival on haemodialysis was 31% compared with 27% in those on PD (Figure 3.2.1).

Table 3.2.1: Patient survival by dialysis modality analysis

Dialysismodality	PD			HD			All		
Interval(month)	n	% survival	SE	n	%survival	SE	n	% survival	SE
0	8842	100		63886	100		72728	100	
6	7777	93	0	57227	94	0	65004	94	0
12	6842	87	0	50772	88	0	57614	88	0
24	5199	74	0	40220	78	0	45419	78	0
36	3939	63	1	31831	70	0	35770	69	0
48	3014	53	1	24959	62	0	27973	61	0
60	2388	47	1	19713	55	0	22101	54	0
72	1863	41	1	15530	49	0	17392	48	0
84	1480	36	1	12136	43	0	13615	42	0
96	1180	32	1	9499	38	0	10676	38	0
108	978	30	1	7494	34	0	8471	34	0
120	808	27	1	5955	31	0	6763	30	0

Figure 3.2.1(b): Patient survival by dialysis modality analysis (not censored for change of modality)



3.2.2 PATIENT SURVIVAL BY YEAR OF STARTING DIALYSIS

Patient survival by year of starting dialysis remained unchanged over the last 10 years with a 1 year and 5 year patient survival of 86-88% and 51-53% (Table 3.2.2 and Figure 3.2.2).

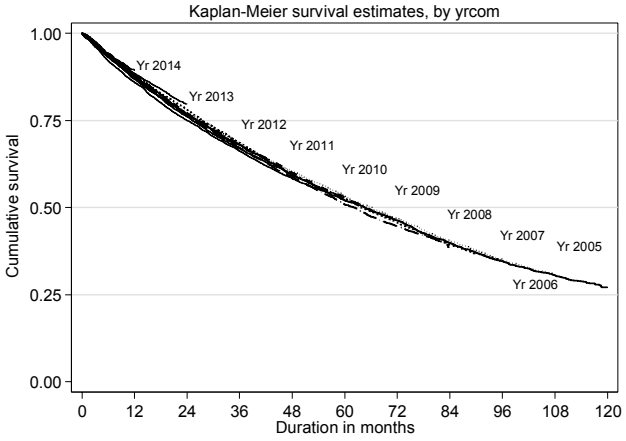
Table 3.2.2: Unadjusted patient survival by year of entry, 2005-2014

Year	2005			2006			2007			2008		
Interval (month)	n	% survival	SE	n	% survival	SE	n	%survival	SE	n	% survival	SE
0	2959	100		3421	100		3691	100		4207	100	
6	3054	93	0	3570	93	0	3984	94	0	4515	94	0
12	2805	87	1	3289	87	1	3681	88	0	4175	88	0
24	2413	77	1	2841	77	1	3186	78	1	3537	76	1
36	2091	68	1	2466	68	1	2737	69	1	3056	67	1
48	1800	59	1	2162	60	1	2340	60	1	2624	59	1
60	1552	52	1	1875	53	1	2028	53	1	2236	51	1
72	1362	46	1	1635	47	1	1745	46	1	1930	45	1
84	1165	40	1	1381	40	1	1483	39	1	56		
96	996	35	1	1178	35	1	25					
108	870	31	1	24								
120	8											

Year	2009			2010			2011			2012		
Interval (month)	n	% survival	SE	n	%survival	SE	n	% survival	SE	n	% survival	SE
0	4573	100		4960	100		5657	100		6109	100	
6	4852	94	0	5100	92	0	5885	93	0	6509	94	0
12	4475	88	0	4697	86	0	5433	87	0	6035	88	0
24	3839	77	1	3989	75	1	4672	76	1	5158	77	1
36	3313	68	1	3447	66	1	4040	67	1	139		
48	2867	60	1	2975	58	1	120					
60	2485	53	1	48			120					
72	58											

Year	2013			2014		
Interval (month)	n	% survival	SE	n	%survival	SE
0	6423	100		6353	100	
6	6837	94	0	3795	94	0
12	6339	88	0	281		
24	168					

Figure 3.2.2: Unadjusted patient survival by year of entry, 2005-2014



3.2.3 PATIENT SURVIVAL BY AGE AT STARTING DIALYSIS

Age at starting dialysis has major impact on survival with patients in the age group of 15 to 24 having the best outcome. Unadjusted 10 year survival of patients in this age group (15-24) was 10 fold better that those who were 65years and above.

Table 3.2.3: Unadjusted patient survival by age

Age group (years)	<=14			15-24			25-34			35-44		
Interval (month)	n	% survival	SE	n	% survival	SE	n	%survival	SE	n	% survival	SE
0	823	100		2937	100		5952	100		9570	100	
6	754	97	1	2593	97	0	5248	96	0	8586	96	0
12	682	95	1	2284	94	0	4713	94	0	7686	92	0
24	529	90	1	1808	89	1	3874	90	0	6287	86	0
36	400	87	1	1513	86	1	3280	86	0	5233	81	0
48	302	83	2	1285	83	1	2746	83	1	4379	76	0
60	227	78	2	1084	81	1	2313	80	1	3689	72	1
72	159	72	2	910	78	1	1965	77	1	3085	67	1
84	118	68	3	771	75	1	1686	74	1	2517	62	1
96	86	64	3	629	73	1	1419	71	1	2108	58	1
108	65	60	3	523	70	1	1212	68	1	1736	54	1
120	51	57	4	436	69	1	1041	66	1	1420	50	1

Age group (years)	45-54			55-64			>=65		
Interval (month)	n	% survival	SE	n	% survival	SE	n	% survival	SE
0	18686	100		22075	100		17516	100	
6	16724	95	0	19342	93	0	14823	90	0
12	14770	90	0	16756	87	0	12409	82	0
24	11634	81	0	12518	75	0	8765	67	0
36	9178	72	0	9303	65	0	6047	54	0
48	7154	65	0	6788	55	0	4029	42	0
60	5622	58	0	4933	47	0	2733	33	0
72	4410	52	0	3546	39	0	1785	26	0
84	3328	46	0	2518	33	0	1129	20	0
96	2503	40	1	1754	27	0	677	14	0
108	1870	35	1	1206	22	0	422	11	0
120	1413	31	1	821	18	0	253	8	0

Figure 3.2.3: Unadjusted patient survival by age

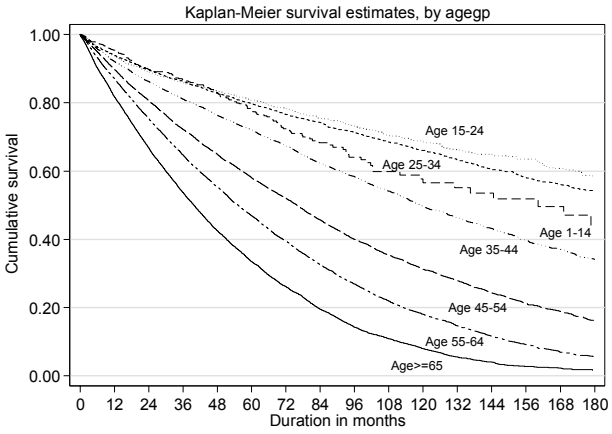
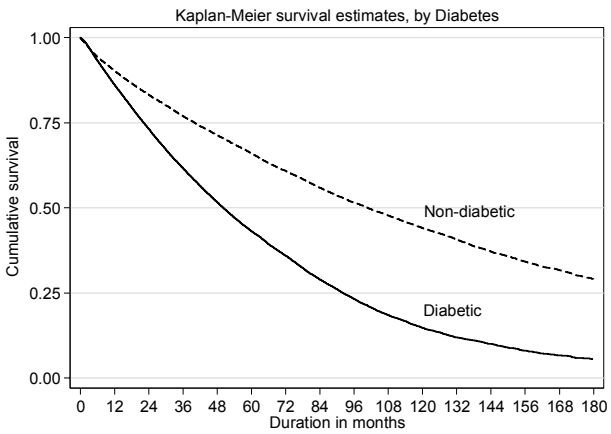


Figure 3.2.4: Unadjusted patient survival by diabetes mellitus status



3.2.4 PATIENT SURVIVAL BY DIABETIC STATUS

The presence of diabetes mellitus has major impact on patient survival (Table 3.2.4 and Figure 3.2.4). The difference in the unadjusted patient survival diverged as early as 6 months after initiation of dialysis. The 10 year unadjusted patient survival among diabetics and non-diabetics were 44% and 15% respectively, a three fold difference.

Table 3.2.4: Unadjusted patient survival by diabetes mellitus status

Diabetesstatus	Non-diabetic			Diabetic		
Interval(month)	n	% survival	SE	n	% survival	SE
0	35268	100		42291	100	
6	31184	94	0	36884	93	0
12	27707	90	0	31582	86	0
24	22442	83	0	22972	73	0
36	18352	77	0	16602	62	0
48	14871	71	0	11809	52	0
60	12197	66	0	8403	43	0
72	9972	61	0	5857	36	0
84	8110	56	0	3955	29	0
96	6569	52	0	2603	23	0
108	5365	48	0	1662	18	0
120	4349	44	0	1078	15	0

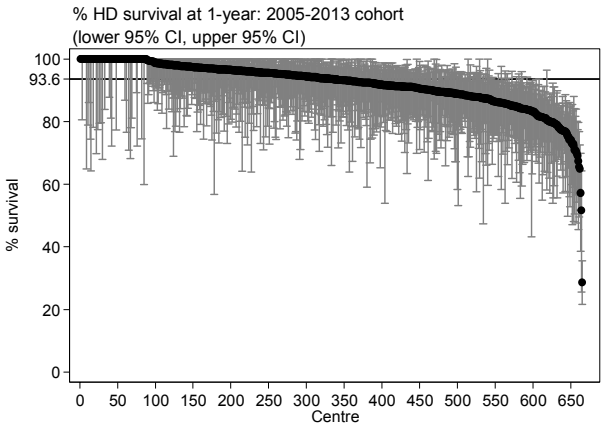
SECTION 3.3 SURVIVAL OF INCIDENCE PATIENTS BY CENTRE

3.3.1. SURVIVAL OF INCIDENT HAEMODIALYSIS PATIENTS 2005-2013 BY CENTRE

The mean patient survival at 1 year (adjusted for age and diabetes) among haemodialysis centres for the 2005-2013 cohort was 93.6% [Figure 3.3.1(a)]. There was marked centre variation and when the 1 year patient survival of the individual heamodialysis centres were illustrated in the funnel plots [Figure 3.3.1(b)], only 23.3% and 36.1% of the haemodialysis centres lay within the 2SD and 3SD of the mean respectively.

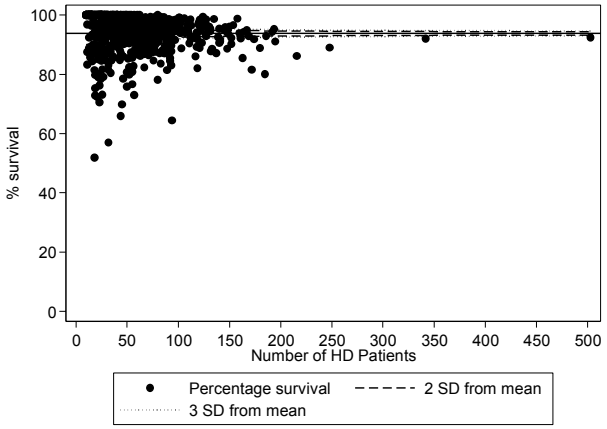
The 5 year mean patient survival (adjusted for age and diabetes) among haemodialysis centres for the 2005-2009 cohort was 68.1% [Figure 3.3.1(c)]. Similar to the 1 year patient survival, there was marked centre variation with only 27.2% and 39.1% of haemodialysis centres lay within 2SD and 3SD of the mean respectively [Figure 3.3.1(d)].

Figure 3.3.1(a): Variation in patient survival at 1-year among HD centres adjusted for age and diabetes mellitus status, 2005-2013



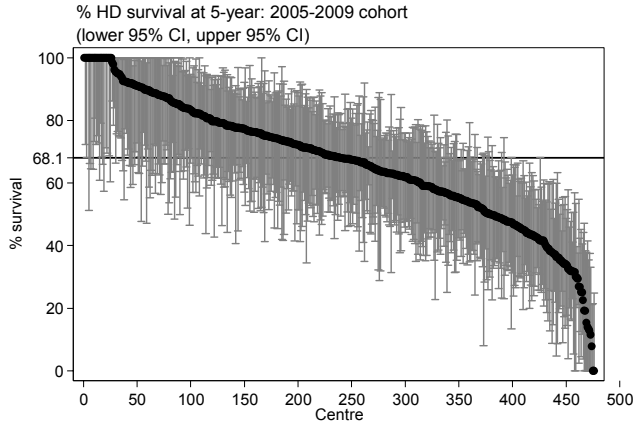
**Horizontal line represents the median % survival among HD centres*

Figure 3.3.1(b): Funnel plot at 1-year among HD centres adjusted for age and diabetes mellitus status, 2005-2013 cohort



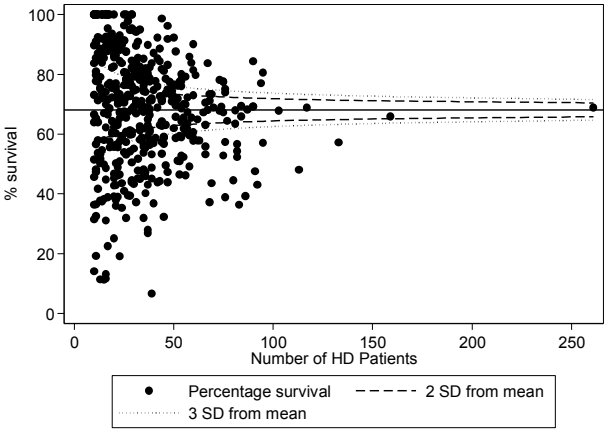
**Horizontal line represents the median % survival among HD centres*

Figure 3.3.1(c): Variation in patient survival at 5-years among HD centres adjusted for age and diabetes mellitus status, 2005-2009



**Horizontal line represents the median % survival among HD centres*

Figure 3.3.1(d): Funnel plot for patient survival at 5-years among HD centres adjusted age and diabetes mellitus, 2005-2009 cohort



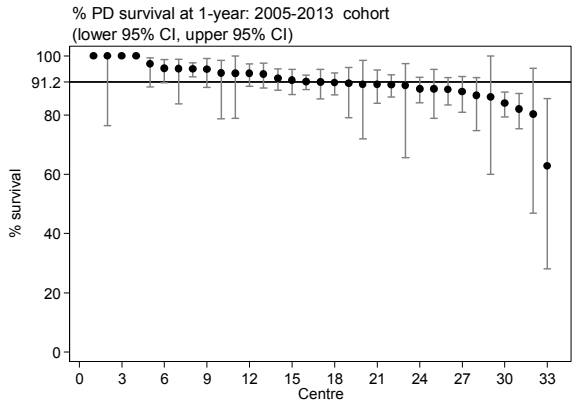
**Horizontal line represents the median % survival among HD centres*

3.3.2. SURVIVAL OF INCIDENCE PD PATIENTS BY CENTRE

The mean patient survival at 1 year (adjusted for age and diabetes mellitus) among peritoneal dialysis for the 2005-2013 cohort was 91.2% [Figure 3.3.2(a)]. Similar to haemodialysis centres, there was marked centre variation of 1-year patient survival among the peritoneal dialysis centres with only 33.3% and 39.4% of the peritoneal dialysis centres lay within the 2SD and 3SD of the mean respectively [Figure 3.3.2(b)].

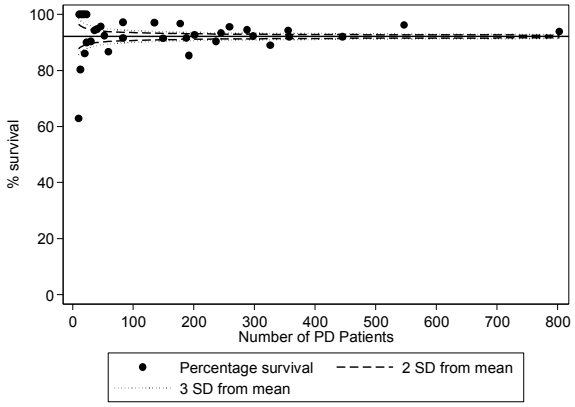
The 5 year mean patient survival (adjusted for age and diabetes mellitus) among peritoneal centres for the 2005-2009 cohort was 55.3% [Figure 3.3.2(c)]. Similar to the 1 year survival, there was a wide variation in the 5-year survival among PD centres with only 16.7% of PD centres lay within 3SD of the mean [Figure 3.3.2(d)].

Figure 3.3.2(a): Variation in patient survival at 1-year among PD centres adjusted for age and diabetes mellitus, 2005-2013



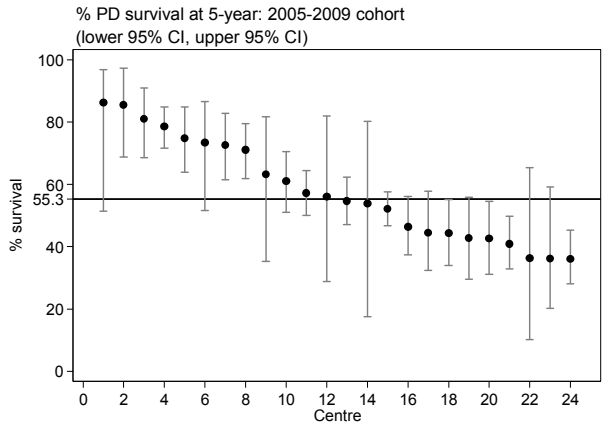
**Horizontal line represents the median % survival among PD centres*

Figure 3.3.2(b): Funnel plot at 1-year among PD centres adjusted for age and diabetes mellitus status, 2005-2013 cohort



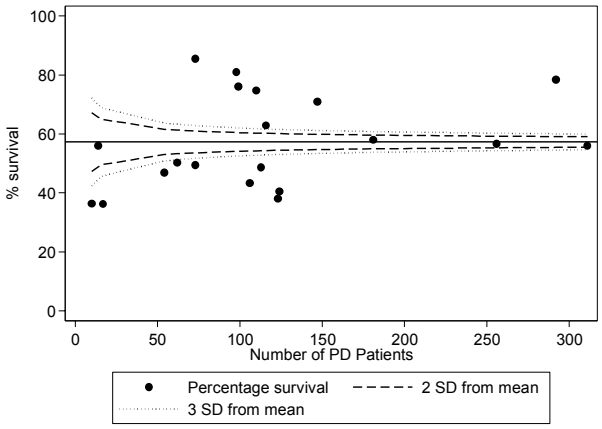
**Horizontal line represents mean of % survival among PD centres*

Figure 3.3.2(c): Variation in patient survival at 5-years among PD centres adjusted for age and diabetes mellitus, 2005-2009



**Horizontal line represents the median % survival among PD centres*

Figure 3.3.2(d): Funnel plot for patient survival at 5-years among PD centres adjusted age and diabetes mellitus, 2005-2009 cohort



**Horizontal line represents mean of % survival among PD centres*

3.4.1. ADJUSTED HAZARD RATIO FOR MORTALITY OF DIALYSIS PATIENTS

The hazard for mortality of the 2005-2014 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, calcium phosphate product, serum phosphate, viral hepatitis status and presence of cardiovascular disease and these adjusted are showed in Table 3.4.1.

Patient variables that had significant impact on mortality were age, gender, primary renal disease, dialysis modality, BMI, diastolic blood pressure and the presence cardiovascular disease. The biochemical variables associated with a significant risk factor for mortality were serum albumin, serum cholesterol, haemoglobin, calcium, calcium phosphate product, phosphate and hepatitis B status.

There were positive correlation between mortality and age of patient, serum cholesterol, diastolic blood pressure [Figure 3.4.1(a)], while BMI, serum albumin, serum phosphate [Figure 3.4.1(b)] and haemoglobin concentration [Figure 3.4.1(c)] were negatively correlated with mortality. There were J curve relationships of mortality with age of patient and with calcium phosphate product.

Female patients have 17% lower risk of mortality compared to their male counterpart while patients with diabetic nephropathy as the primary aetiology of renal failure has the highest mortality risk when compared to other causes of end stage renal failure. There was gradual improvement in adjusted mortality in recent years where patients starting dialysis in 2013-2014 have 28% lower morality compared to those who initiate dialysis a decade ago (in 2005-2006).

After adjustment, patients on peritoneal dialysis have a 4.8% lower mortality risk compared to those on haemodialysis.

Table 3.4.1: Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality (2005-2014)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	381	1.106	(0.889;1.377)	0.365
Age 15-24	1506	0.902	(0.778;1.045)	0.170
Age 25-34 (ref*)	3183	1.000		
Age 35-44	5478	1.416	(1.285;1.561)	<0.001
Age 45-54	12631	2.049	(1.873;2.242)	<0.001
Age 55-64	15948	2.648	(2.419;2.897)	<0.001
Age >=65	13441	3.626	(3.308;3.975)	<0.001
Gender				
Male (ref*)	29156	1.000		
Female	23410	0.824	(0.800;0.848)	<0.001
Primary diagnosis				
Unknown primary	11539	1.623	(1.484;1.776)	<0.001
Diabetes mellitus	30724	2.044	(1.869;2.235)	<0.001
GN/SLE (ref*)	2520	1.000		
Polycystic kidney	800	1.404	(1.221;1.614)	<0.001
Obstructive nephropathy	179	1.023	(0.764;1.368)	0.881
Others	6804	1.238	(1.123;1.366)	<0.001
Year start dialysis				
2005-2006 (ref*)	6719	1.000		
2007-2008	8549	1.014	(0.974;1.055)	0.51
2009-2010	10160	0.973	(0.932;1.014)	0.196
2011-2012	12798	0.942	(0.900;0.985)	0.009
2013-2014	14340	0.720	(0.678;0.764)	<0.001
Modality				
HD (ref*)	46403	1.000		
PD	6163	0.952	(0.908;0.998)	0.042
BMI				
BMI<18.5	3129	1.066	(1.005;1.132)	0.034
BMI 18.5-25 (ref*)	30627	1.000		
>=25	18810	0.888	(0.861;0.917)	<0.001
Serum albumin (g/L)				
<30	3964	4.115	(3.877;4.366)	<0.001
30-<35	8483	2.389	(2.278;2.507)	<0.001
35-<40	25582	1.855	(1.785;1.928)	<0.001
>=40 (ref*)	14537	1.000		
Serum cholesterol (mmol/L)				
<3.5	5697	0.935	(0.895;0.977)	0.003
3.5-<5.2 (ref*)	36991	1.000		
5.2-<6.2	7023	0.941	(0.901;0.983)	0.006
>=6.2	2855	1.177	(1.106;1.253)	<0.001
Diastolic BP (mmHg)				
<70	10338	0.897	(0.859;0.937)	<0.001
70-<80	20266	1.000	(0.965;1.036)	0.993
80-<90 (ref*)	15878	1.000		
90-<100	4837	1.030	(0.971;1.092)	0.332
>=100	1247	1.610	(1.455;1.781)	<0.001
Hemoglobin (g/dL)				
<10	23992	1.782	(1.730;1.835)	<0.001

Factors	n	Hazardratio	95% CI	P-value
10-<12 (ref*)	25521	1.000		
>=12	3053	0.875	(0.820;0.934)	<0.001
Serum calcium (mmol/L)				
<2.1	12745	0.975	(0.941;1.009)	0.149
2.1-<=2.37 (ref*)	32917	1.000		
>2.37	6094	0.758	(0.724;0.795)	<0.001
Calcium Phosphate product ($mmol^2/L^2$)				
<3.5	21425	0.844	(0.811;0.878)	<0.001
3.5-<4.5 (ref*)	21006	1.000		
4.5-<5.5	7464	0.772	(0.725;0.821)	<0.001
>=5.5	2671	0.977	(0.878;1.086)	0.665
Serum Phosphate (mmol/L)				
<0.8	333	1.756	(1.526;2.020)	<0.001
0.8-<1.3 (ref*)	7077	1.000		
1.3-<1.8	25511	0.970	(0.929;1.013)	0.172
1.8-<2.2	13544	0.897	(0.843;0.955)	0.001
>=2.2	6101	0.944	(0.856;1.041)	0.252
HBsAg				
Negative (ref*)	50972	1.000		
Positive	1594	1.092	(1.015;1.175)	0.019
Anti-HCV				
Negative (ref*)	51609	1.000		
Positive	957	1.034	(0.944;1.132)	0.468
Cardiovascular disease (CVD)				
No CVD (ref*)	46117	1.000		
CVD	6449	1.277	(1.231;1.325)	<0.001

Figure 3.4.1(a): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by diastolic blood pressure (2005-2014 cohort)

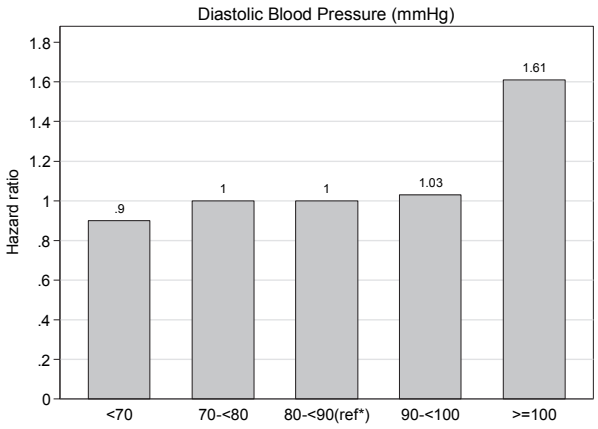


Figure 3.4.1(b): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by serum phosphate (2005-2014 cohort)

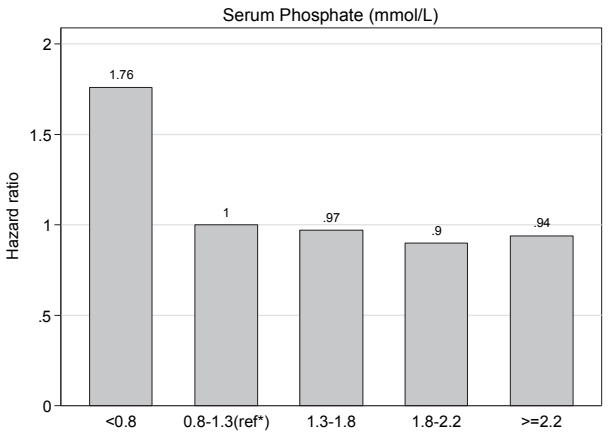
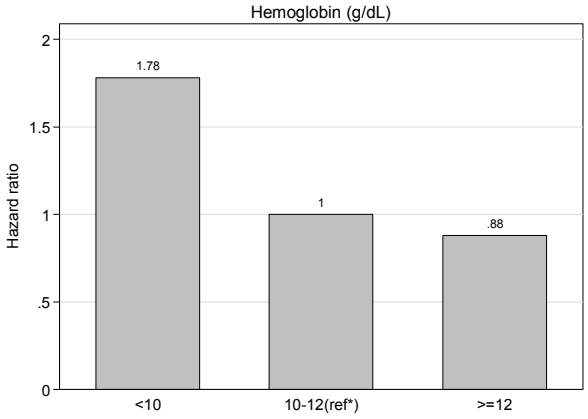


Figure 3.4.1(c): Adjusted hazard ratio for mortality of dialysis patients uncensored for change of modality by hemoglobin (2005-2014 cohort)



3.4.2. ADJUSTED HAZARD RATIO FOR MORTALITY OF HAEMODIALYSIS PATIENTS

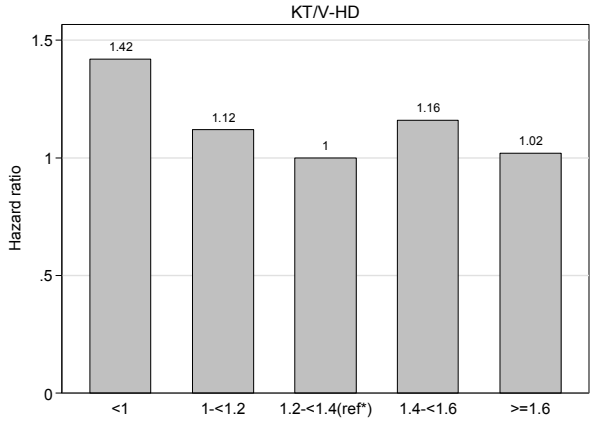
The adjusted hazard ratio for mortality of hemodialysis patients [Table 3.4.2] demonstrated almost identical pattern with the whole cohort of 2005-2014 dialysis patients since more than 90% of this dialysis population consisted of haemodialysis patients. The dose of dialysis treatment (KT/V) and patient mortality appeared to have a "J" curve relationship with KT/V of 1.2 to 1.4 having the best outcome [Figure 3.4.2].

Table 3.4.2: Adjusted hazard ratio for mortality of HD patients uncensored for change of modality (2005-2014 cohort)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	85	1.644	(1.097;2.464)	0.016
Age 15-24	1029	0.910	(0.762;1.088)	0.301
Age 25-34 (ref*)	2653	1.000		
Age 35-44	4804	1.337	(1.202;1.487)	<0.001
Age 45-54	11377	1.961	(1.778;2.163)	<0.001
Age 55-64	14307	2.547	(2.309;2.810)	<0.001
Age >=65	12148	3.473	(3.143;3.838)	<0.001
Gender				
Male (ref*)	26020	1.000		
Female	20383	0.830	(0.804;0.858)	<0.001
Primary diagnosis				
Unknown primary	10415	1.653	(1.488;1.836)	<0.001
Diabetes mellitus	27523	2.030	(1.830;2.253)	<0.001
GN/SLE (ref*)	1801	1.000		
Polycystic kidney	616	1.526	(1.298;1.795)	<0.001
Obstructive nephropathy	150	1.004	(0.729;1.383)	0.980
Others	5898	1.240	(1.107;1.388)	<0.001
Year start dialysis				
2005-2006 (ref*)	6028	1.000		
2007-2008	7512	1.009	(0.966;1.054)	0.685
2009-2010	9079	0.995	(0.951;1.041)	0.839
2011-2012	11351	0.959	(0.914;1.007)	0.091
2013-2014	12433	0.729	(0.684;0.778)	<0.001

Factors	n	Hazard ratio	95% CI	P-value
BMI				
BMI<18.5	2480	1.090	(1.021;1.164)	0.009
BMI 18.5-25 (ref*)	27409	1.000		
>=25 (	16514	0.846	(0.815;0.877)	<0.001
Serum albumin (g/L)				
<30	2212	4.356	(4.071;4.660)	<0.001
30-<35	6402	2.331	(2.215;2.454)	<0.001
35-<40	23917	1.877	(1.805;1.953)	<0.001
>=40 (ref*)	13872	1.000		
Serum cholesterol (mmol/L)				
<3.5	5312	0.925	(0.883;0.968)	0.001
3.5-<5.2	33499	1.000		
5.2-<6.2	5622	0.912	(0.869;0.957)	<0.001
>=6.2 (ref*)	1970	1.144	(1.062;1.232)	<0.001
Kt/V				
<1	1113	1.424	(1.283;1.581)	0.001
1-<1.2	3491	1.123	(1.051;1.200)	<0.001
1.2-<1.4 (ref*)	7259	1.000		
1.4-<1.6	11968	1.162	(1.108;1.219)	<0.001
>=1.6	22572	1.016	(0.969;1.066)	0.505
Diastolic BP (mmHg)				
<70	9522	0.869	(0.830;0.910)	<0.001
70-<80	18030	0.986	(0.949;1.024)	0.461
80-<90 (ref*)	13652	1.000		
90-<100	4102	1.021	(0.958;1.089)	0.522
>=100	1097	1.743	(1.568;1.939)	<0.001
Hemoglobin (g/dL)				
<10	21712	1.856	(1.799;1.915)	<0.001
10-<12 (ref*)	22223	1.000		
>=12	2468	0.810	(0.752;0.873)	<0.001
Serum calcium (mmol/L)				
<2.1	10826	0.956	(0.920;0.993)	0.019
2.1-<=2.37 (ref*)	29584	1.000		
>2.37	5993	0.727	(0.691;0.765)	<0.001
Calcium Phosphate product ($mmol^2/L^2$)				
<3.5	17829	0.810	(0.777;0.845)	<0.001
3.5-<4.5 (ref*)	19286	1.000		
4.5-<5.5	6841	0.766	(0.718;0.818)	<0.001
>=5.5	2447	0.985	(0.880;1.102)	0.787
Serum Phosphate (mmol/L)				
<0.8	255	1.727	(1.468;2.031)	<0.001
0.8-<1.3 (ref*)	5567	1.000		
1.3-<1.8	22525	0.972	(0.926;1.020)	0.248
1.8-<2.2	12471	0.877	(0.819;0.938)	<0.001
>=2.2	5585	0.896	(0.807;0.994)	0.039
HBsAg				
Negative (ref*)	45009	1.000		
Positive	1394	1.103	(1.019;1.193)	0.015
Anti-HCV				
Negative (ref*)	45551	1.000		
Positive	852	1.043	(0.947;1.148)	0.396
Cardiovascular disease (CVD)				
No CVD (ref*)	41060	1.000		
CVD	5343	1.250	(1.201;1.302)	<0.001

Figure 3.4.2: Adjusted hazard ratio for mortality of HD patients uncensored for change of modality by Kt/V (2005-2014 cohort)



3.4.3. ADJUSTED HAZARD RATIO FOR MORTALITY OF PERITONEAL DIALYSIS PATIENTS

The adjusted hazard ratio for peritoneal dialysis patients [Table 3.4.3] showed similarity to the whole cohort of 2005-2014 dialysis patients. However gender, and viral hepatitis status were not independent risk factors for mortality in peritoneal dialysis patients. These differences may partly be contributed by the smaller number of peritoneal dialysis patients in this cohort.

Unlike haemodialysis patients, there was a negative correlation between KT/V and mortality of patients on peritoneal dialysis.

Table 3.4.3: Adjusted hazard ratio for mortality of PD patients uncensored for change of modality (2005-2014 cohort)

Factors	n	Hazard ratio	95% CI	P-value
Age (years)				
Age 1-14	296	1.968	(1.348;2.874)	<0.001
Age 15-24	477	1.412	(1.040;1.917)	0.027
Age 25-34 (ref*)	530	1.000		
Age 35-44	672	1.713	(1.338;2.194)	<0.001
Age 45-54	1254	2.372	(1.881;2.993)	<0.001
Age 55-64	1641	2.945	(2.332;3.719)	<0.001
Age >=65	1293	4.255	(3.357;5.393)	<0.001
Gender				
Male (ref*)	3136	1.000		
Female	3027	0.978	(0.886;1.080)	0.663
Primary diagnosis				
Unknown primary	1124	1.324	(1.094;1.603)	0.004
Diabetes mellitus	3201	2.063	(1.700;2.505)	<0.001
GN/SLE (ref*)	719	1.000		
Polycystic kidney	184	1.149	(0.865;1.525)	0.338
Obstructive nephropathy	29	0.907	(0.442;1.859)	0.790
Others	906	1.203	(0.971;1.489)	0.091
Year start dialysis				
2005-2006 (ref*)	691	1.000		
2007-2008	1037	1.013	(0.902;1.136)	0.833
2009-2010	1081	0.871	(0.770;0.986)	0.028
2011-2012	1447	0.887	(0.780;1.008)	0.066
2013-2014	1907	0.667	(0.564;0.789)	<0.001
BMI				
BMI<18.5	649	1.327	(1.130;1.559)	0.001
BMI 18.5-25 (ref*)	3218	1.000		
>=25	2296	0.992	(0.910;1.082)	0.863
Serum albumin (g/L)				
<30	1752	2.690	(2.230;3.245)	<0.001
30-<35	2081	1.914	(1.595;2.297)	<0.001
35-<40	1665	1.238	(1.028;1.492)	0.024
>=40 (ref*)	665	1.000		
Serum cholesterol (mmol/L)				
<3.5	385	1.066	(0.914;1.243)	0.416
3.5-<5.2 (ref*)	3492	1.000		
5.2-<6.2	1401	1.082	(0.978;1.197)	0.126
>=6.2	885	1.229	(1.090;1.386)	0.001
Kt/V				
<1.7	3706	1.106	(0.978;1.251)	0.109
1.7-<2.0 (ref*)	1758	1.000		
>=2.0	699	0.606	(0.478;0.768)	<0.001
Diastolic BP (mmHg)				
<70	816	1.168	(1.029;1.325)	0.016
70-<80	2236	1.029	(0.934;1.134)	0.560
80-<90 (ref*)	2226	1.000		
90-<100	735	1.153	(0.986;1.348)	0.074
>=100	150	0.984	(0.691;1.401)	0.931
Hemoglobin (g/dL)				

Factors	n	Hazard ratio	95%CI	P-value
<10	2280	1.354	(1.239;1.479)	<0.001
10-<12 (ref*)	3298	1.000		
>=12	585	1.127	(0.982;1.292)	0.088
Serum calcium (mmol/L)				
<2.1	1919	1.113	(1.013;1.223)	0.026
2.1-<=2.37 (ref*)	3333	1.000		
>2.37	911	1.002	(0.886;1.132)	0.977
Calcium Phosphate product ($mmol^2/L^2$)				
<3.5	3596	1.156	(1.019;1.312)	0.024
3.5-<4.5 (ref*)	1720	1.000		
4.5-<5.5	623	0.944	(0.773;1.154)	0.577
>=5.5	224	1.039	(0.744;1.452)	0.821
Serum Phosphate (mmol/L)				
<0.8	78	1.993	(1.499;2.650)	<0.001
0.8-<1.3 (ref*)	1510	1.000		
1.3-<1.8	2986	0.980	(0.886;1.084)	0.695
1.8-<2.2	1073	1.013	(0.838;1.223)	0.897
>=2.2	516	1.321	(0.983;1.777)	0.065
HBsAg				
Negative (ref*)	5963	1.000		
Positive	200	0.976	(0.797;1.195)	0.814
Anti-HCV				
Negative (ref*)	6058	1.000		
Positive	105	0.959	(0.723;1.271)	0.77
Cardiovascular disease (CVD)				
No CVD (ref*)	5057	1.000		
CVD	1106	1.323	(1.202;1.456)	<0.001

3.4.4 RISK ADJUSTED MORTALITY RATE BY HAEMODIALYSIS CENTRES

There were marked centre variations in risk adjusted mortality rate (RAMR) of haemodialysis patients and the median RAMR for HD centres was 19.5 [Figure 3.4.4(a)]. When adjusted for the size of haemodialysis centres using funnel plot, only 56.5% and 70.2% of haemodialysis centres were within the 95% CI and 99% CI of the median RAMR respectively [Figure 3.4.4(b)].

Figure 3.4.4(a): Variations in RAMR by HD centre, 2013

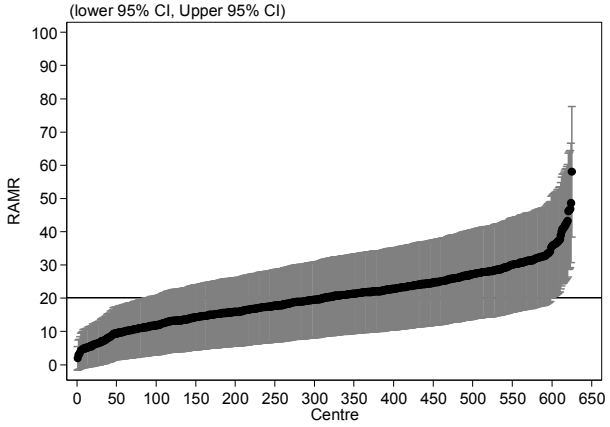
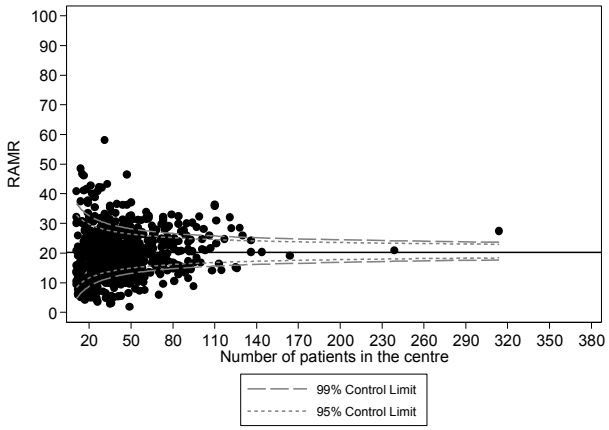


Figure 3.4.4(b): Funnel plot of RAMR by HD centre, 2013



3.4.5 RISK ADJUSTED MORTALITY RATE BY PD CENTRES

There was a wide variation in RAMR among PD centres with a median RAMR of 26.7 [Figure 3.4.5(a)]. The variation of the RAMR rate among the various PD centres in this country was larger compared to haemodialysis centres where only 44.8% and 58.6% of PD centres were within the 95% CI and 99% CI of the median RAMR respectively [Figure 3.4.5(b)]

Figure 3.4.5(a): Variations in RAMR by PD centres, 2012

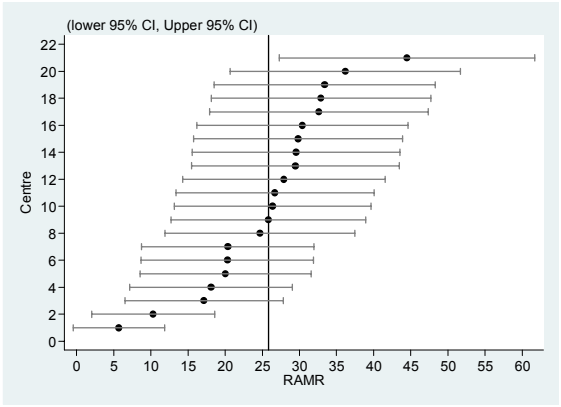


Figure 3.4.5(b): Funnel plot for RAMR by PD centres, 2012