

Chapter 12

PERITONEAL DIALYSIS

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SECTION 12.1: MODALITIES AND PRESCRIPTION OF PD (TABLES 12.1.1 -12.1.4)

The number of patients treated with Peritoneal Dialysis (PD) in Malaysia has grown by approximately 2.7 times over the last decade where the prevalence of PD patients as of 31st December has increased from 1174 in the year 2005 to 3149 patients for the year 2014. PD therapy overall comprises 9.4 % of the total number of dialysis patients (Table 12. 1.6(b)).

The bulk of PD therapy (81.3%) remains in the form of Continuous Ambulatory Peritoneal Dialysis (CAPD). Automated Peritoneal Dialysis (APD) utilization has increased from a mere 3.6% in 2005 to the present level of 13.3%. However, in the last five years the growth of APD has ceased (Table 12.1.1).

There has been an increased utilization of the Fresenius Medical Care (FMC) system, with the ratio of FMC to Baxter approaching 1:3 by 2014 (Table 12.1.2). The majority of patients on CAPD (91.5%) are using 4 exchanges per day, while 81.8% of those on APD are using total dwell volumes of 10L per day (Tables12.1.3a and Table 12.1.3b).

In CAPD, the majority of patients (65%) practice self care but in APD, the largest proportion (66%) are either completely or partially assisted. In terms of age distribution, it is clear PD is the preferred modality in the paediatric age groups where for ages 1-14 years, 78% of new patients start PD, for those aged 15 to 24 years it is approximately one-quarter and in the young working age group of 25-34 years, one-fifth choose PD (Tables12.1.5(a) and (b)). There are no significant gender differences in choice of PD therapy (Tables 12.1.6(a) and (b)).

Table 12.1.1: Peritoneal dialysis regimes, 2005-2014

PD regime	2005		2006		2007		2008		2009	
	n	%	n	%	n	%	N	%	n	%
Standard CAPD	1303	93.2	1397	90	1547	85.7	1717	82.4	1847	83.5
DAPD	45	3.2	67	4.3	115	6.4	121	5.8	119	5.4
Automated PD/ CCPD	50	3.6	88	5.7	144	8	245	11.8	246	11.1
TOTAL	1398	100	1552	100	1806	100	2083	100	2212	100

PD regime	2010		2011		2012		2013		2014	
	n	%	n	%	n	%	N	%	n	%
Standard CAPD	1973	83.6	2061	80.9	2309	81.1	2571	79.7	2965	81.3
DAPD	91	3.9	117	4.6	140	4.9	183	5.7	194	5.3
Automated PD/ CCPD	296	12.5	371	14.6	397	13.9	470	14.6	486	13.3
TOTAL	2360	100	2549	100	2846	100	3224	100	3645	100

Table 12.1.2: CAPD connectology, 2005-2014

CAPD connectology	2005		2006		2007		2008		2009	
	n	%	n	%	n	%	N	%	n	%
Baxter disconnect	1286	92.1	1425	92	1675	93.5	1955	93.9	2013	92.1
Fresenius disconnect	111	7.9	119	7.7	116	6.5	124	6	173	7.9
Others	0	0	5	0.3	0	0	4	0.2	0	0
TOTAL	1397	100	1549	100	1791	100	2083	100	2186	100

CAPD connectology	2010		2011		2012		2013		2014	
	n	%	n	%	n	%	N	%	n	%
Baxter disconnect	2126	90.7	2169	85.5	2270	79.6	2502	77.4	2725	73.8
Fresenius disconnect	218	9.3	366	14.4	579	20.3	731	22.6	962	26
Others	1	0	1	0	1	0	1	0	6	0.2
TOTAL	2345	100	2536	100	2850	100	3234	100	3693	100

Table 12.1.3a: CAPD Number of Exchanges per day, 2005-2014

Number of exchanges/day	2005		2006		2007		2008		2009	
	n	%	n	%	n	n	%	n	%	N
2	3	0.2	3	0.2	2	0.1	3	0.2	2	0.1
3	20	1.5	52	3.7	29	1.9	47	2.8	79	4.4
4	1234	95.1	1296	93.2	1456	95.8	1611	94.4	1676	92.3
5	40	3.1	39	2.8	33	2.2	46	2.7	59	3.2
TOTAL	1297	100	1390	100	1520	100	1707	100	1816	100

Number of exchanges/day	2010		2011		2012		2013		2014	
	n	%	n	%	n	%	N	%	n	%
2	7	0.4	1	0	10	0.4	18	0.7	15	0.5
3	125	6.4	112	5.5	136	6	124	4.9	157	5.4
4	1778	91.1	1857	91.3	2057	90.3	2338	92.5	2653	91.5
5	42	2.2	65	3.2	74	3.2	47	1.9	75	2.6
TOTAL	1952	100	2035	100	2277	100	2527	100	2900	100

Table 12.1.3b: APD dwell volumes per day, 2005-2014

Dwell volumes/day	2005		2006		2007		2008		2009	
	n	%	n	%	n	%	N	%	n	%
8	9	47.4	6	12.5	11	10.5	4	2.2	7	5.1
10	7	36.8	32	66.7	83	79	164	92.1	119	87.5
12	3	15.8	10	20.8	10	9.5	10	5.6	8	5.9
14	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	1	1	0	0	2	1.5
TOTAL	19	100	48	100	105	100	178	100	136	100

Dwell volumes/day	2010		2011		2012		2013		2014	
	n	%	n	%	n	%	N	%	n	%
8	11	14.5	2	1	11	10.7	5	17.9	2	18.2
10	56	73.7	200	98	89	86.4	20	71.4	9	81.8
12	8	10.5	1	0.5	1	1	2	7.1	0	0
14	0	0	0	0	0	0	0	0	0	0
16	1	1.3	1	0.5	2	1.9	1	3.6	0	0
TOTAL	76	100	204	100	103	100	28	100	11	100

Table 12.1.4: Assistance to Perform PD, 2005-2014

PD regime/Assistance	2005		2006		2007		2008		2009	
	n	%	n	%	n	%	N	%	n	%
CAPD										
Self-care	958	74	997	71	1051	68	1088	63	1133	61
Partial self-care	82	6	121	9	197	13	249	15	246	13
Completely assisted	228	17	224	16	254	16	336	20	407	22
Unknown	35	3	55	4	45	3	44	3	61	3
Automated PD										
Self-care	18	36	35	40	33	23	62	25	61	25
Partial self-care	7	14	9	10	24	17	62	25	78	32
Completely assisted	23	46	41	47	77	53	105	43	96	39
Unknown	2	4	3	3	10	7	16	7	11	4

PD regime/Assistance	2010		2011		2012		2013		2014	
	n	%	n	%	n	%	N	%	n	%
CAPD										
Self-care	1222	62	1319	64	1441	62	1650	64	1913	65
Partial self-care	294	15	267	13	349	15	342	13	371	13
Completely assisted	408	21	420	20	476	21	514	20	640	22
Unknown	49	2	55	3	43	2	65	3	41	1
Automated PD										
Self-care	78	26	94	25	125	31	153	33	155	32
Partial self-care	98	33	112	30	92	23	127	27	83	17
Completely assisted	111	38	149	40	169	43	181	39	238	49
Unknown	9	3	16	4	11	3	9	2	10	2

Figure 12.1.4(a): Assistance to Perform CAPD, 2005-2014

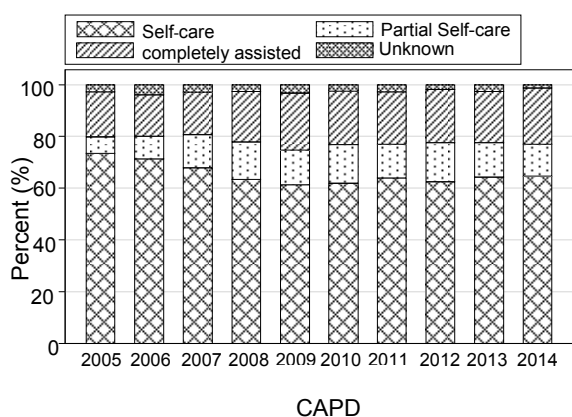


Figure 12.1.4(b): Assistance to Perform APD, 2005-2014

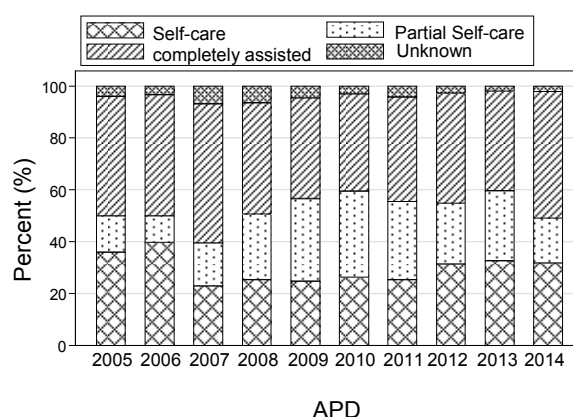


Table 12.1.5(a): PD Treatment Rate by Age Group, per million age group population 2005 - 2014

Age groups (years)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
≤14	4	3	4	4	5	5	5	4	5	3
15-24	7	8	8	8	10	7	9	9	15	11
25-34	6	10	9	11	11	13	11	14	14	18
35-44	13	15	19	16	18	15	24	23	29	30
45-54	33	36	35	47	39	42	51	68	60	74
55-64	49	70	106	93	87	93	109	137	130	170
≥ 65	45	69	100	128	118	106	112	151	134	172

Table 12.1.5(b): Percentage Age Distribution of PD Patients 2005-2014

Year	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
	n	%	n	%	n	%	n	%	N	%	n	%	n	%	n	%	n	%	N	%
New Dialysis patients	317	10	401	11	518	13	571	12	554	11	539	10	616	10	760	11	789	11	948	13
1-14 years	32	76	27	73	33	79	28	72	42	79	38	79	37	82	30	73	40	87	21	78
15-24 years	36	27	37	27	38	28	37	28	45	28	39	28	49	33	48	29	76	37	48	26
25-34 years	26	13	36	16	40	16	37	13	45	15	54	16	51	14	62	15	67	16	77	19
35-44 years	44	12	51	12	67	15	57	10	61	12	47	9	81	13	69	10	84	12	92	13
45-54 years	75	10	88	9	95	9	125	11	105	9	97	7	117	8	169	11	161	10	203	12
55-64 years	64	7	95	9	143	12	148	11	131	9	149	9	164	9	211	10	210	10	289	13
>=65 years	40	6	67	7	102	10	139	12	125	10	115	9	117	8	171	10	151	9	218	12
Dialysing at 31 st December	1174	9	1317	9	1549	9	1750	9	1887	9	1991	8	2176	8	2561	9	2834	9	3270	9
1-14 years	128	73	123	68	128	67	126	63	136	63	150	63	157	64	168	65	171	65	151	60
15-24 years	134	19	142	18	156	18	164	18	189	18	201	18	203	17	214	17	250	18	268	18
25-34 years	121	9	137	9	147	9	164	9	183	9	213	9	229	9	273	10	306	10	352	11
35-44 years	194	9	203	8	243	9	251	8	272	8	263	7	297	8	324	8	365	8	402	8
45-54 years	278	8	313	8	344	8	381	8	379	7	397	6	448	6	536	7	572	7	677	8
55-64 years	210	6	259	7	333	8	396	8	420	8	453	7	501	7	625	8	688	8	851	9
>=65 years	109	5	140	6	198	7	268	8	308	8	314	7	341	7	421	8	482	8	569	9

Where % = PD / HD+PD

The numbers in table for
incident and prevalent pts
are reversed - pl correct

Table 12.1.6(a): PD Treatment Rate by Gender, per million male or female population 2005-2014

Gender	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Male	14	17	21	24	23	22	26	35	34	41
Female	14	18	22	23	23	24	28	32	34	39

Table 12.1.6(b): Gender Distribution of PD Patients 2004-2013

	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	N	%	n	%
New PD patient	317	10	401	11	518	13	571	12	554	11	539	10	616	10	760	11	789	11	948	13
Male	159	9	195	10	260	11	304	12	286	10	255	9	307	9	399	11	398	10	504	13
Female	158	12	206	12	258	14	267	13	268	12	284	12	309	11	361	12	391	12	444	14
PD at 31 st December	1174	8.8	1317	8.7	1549	9.1	1750	9	1887	8.7	1991	8.4	2176	8.3	2561	8.8	2834	8.8	3270	9.4
Male	571	7.7	629	7.6	739	7.9	831	7.8	909	7.6	951	7.3	1023	7.1	1234	7.7	1365	7.8	1619	8.5
Female	603	10.1	688	10.1	810	10.5	919	10.5	978	10.1	1040	9.7	1153	9.7	1327	10	1469	10.1	1651	10.5

n = PD count only

% = PD / HD+PD

SECTION 12.2: ACHIEVEMENT OF SOLUTE CLEARANCE AND PERITONEAL TRANSPORT

The percentage of patients achieving target solute clearance of ≥ 1.7 per week showed a further decline to 74% in 2014 (Table 12.2.1). The figure had been static at 79% from 2010-2012 with a slight drop to 78% in 2013. This should prompt some work to be done in identifying the causes for the declining rate.

Wide inter-centre variation for delivered Kt/v was still seen in 2014. The proportion of patients achieving the delivered Kt/v varied from 47% to 89% (5th, 95th percentiles) (Table 12.2.2). Perhaps the PD practices in the better performing centres can be evaluated and shared with less well performing centres.

The majority of the new PD patients had a low average and high average peritoneal membrane transport status with 39.3% and 33.4% respectively (Table 12.2.3). Interestingly, most patients had a low average and high average membrane transport status even with 5 and 10 years dialysis vintage (Table 12.2.4).

As expected, residual urine volume showed a steady decline over time (Table and Figure 12.2.5). However, on a positive note, up to a third of patients have a residual urine volume more than 400 ml/day after 4 or more years on PD (Table 12.2.5)

Table 12.2.1: Distribution of delivered Kt/V, PD patients 2005-2014

Year	Number of Patients	Mean	SD	Median	LQ	UQ	% patients ≥ 1.7 per week
2005	1092	2.1	0.5	2.1	1.8	2.4	83
2006	1266	2.1	0.5	2.1	1.8	2.4	84
2007	1412	2.1	0.5	2.1	1.8	2.4	83
2008	1679	2.1	0.5	2.0	1.8	2.4	82
2009	1837	2.1	0.5	2.0	1.8	2.4	81
2010	1913	2.1	0.5	2.0	1.7	2.3	79
2011	1727	2.1	0.5	2.0	1.8	2.3	79
2012	2278	2.1	0.5	2.0	1.8	2.4	79
2013	2724	2.1	0.5	2.0	1.7	2.3	78
2014	3022	2.0	0.5	1.9	1.7	2.3	74

Figure 12.2.1: Cumulative distribution of delivered Kt/V, PD patients 2005-2014

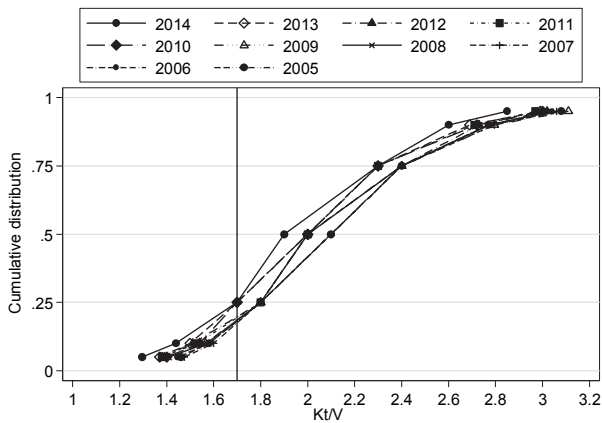


Figure 12.2.2: Variation in proportion of patients with Kt/V ≥ 1.7 per week among PD centres 2005-2014

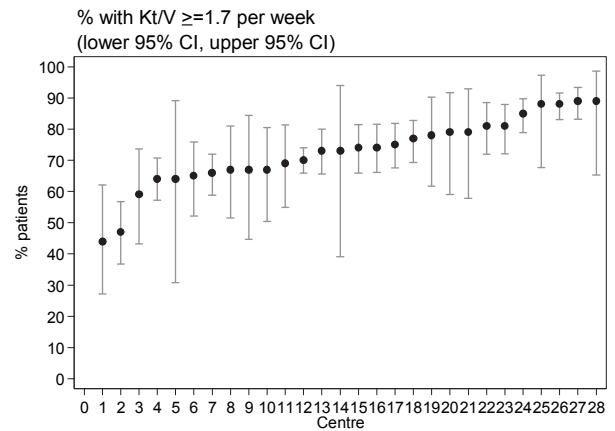


Table 12.2.2: Variation in proportion of patients with Kt/V ≥ 1.7 per week among PD centres, 2005-2014

Year	Number of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
2005	18	56	56	75	85	89	96	96
2006	20	66	66	78	82.5	91.5	100	100
2007	21	25	69	78	85	89	93	93
2008	20	33	50.5	76.5	80	89	93.5	96
2009	21	48	63	76	83	89	97	100
2010	22	48	59	73	79	86	90	94
2011	23	61	64	70	79	83	90	91
2012	24	53	59	70	79.5	87.5	95	100
2013	25	48	52	70	80	84	88	91
2014	28	44	47	66.5	73.5	80	89	89

Table 12.2.3: Peritoneal transport status by PET D/P creatinine at 4 hours, new PD patients 2005-2014

Year	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
	n	%	n	%	n	%	n	%	n	n	%	%	n	%	n	%	n	%	n	%
Low	18	9.1	71	13.4	79	10	133	13.2	176	13.8	184	13.6	157	10.2	190	10.5	263	12.6	305	13.1
Low average	80	40.6	217	41	317	40.2	422	41.9	498	39.1	525	38.9	607	39.3	733	40.5	849	40.6	914	39.3
High average	75	38.1	198	37.4	315	40	353	35	428	33.6	467	34.6	588	38	688	38.1	739	35.3	778	33.4
High	24	12.2	43	8.1	77	9.8	100	9.9	172	13.5	173	12.8	194	12.5	197	10.9	242	11.6	329	14.1
TOTAL	197	100	529	100	788	100	1008	100	1274	100	1349	100	1546	100	1808	100	2093	100	2326	100

Table 12.2.4: Peritoneal Transport Status (PET) with dialysis vintage

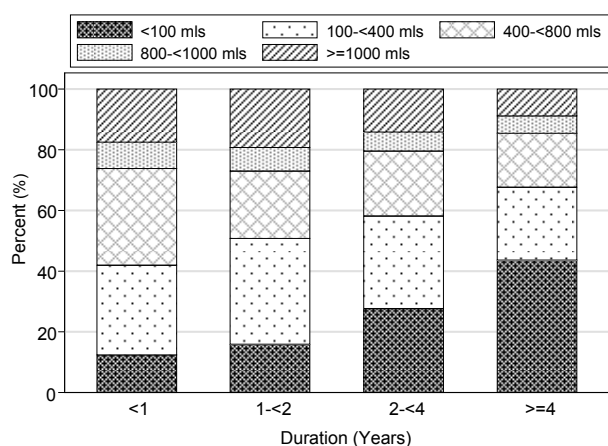
Duration (Years)	<1		1- <2		2- <3		3- <4		4- <5	
	n	%	n	%	n	%	n	%	n	%
Low	89	15	72	13	60	14	27	10	16	10
Low average	245	43	186	33	161	38	112	40	74	45
High average	174	30	206	36	137	33	94	34	57	35
High	67	12	102	18	62	15	44	16	16	10
TOTAL	575	100	566	100	420	100	277	100	163	100

Duration (Years)	5- <6		6- <7		7- <8		8- <9		9- <10		10 or more	
	n	%	n	%	n	%	n	%	n	%	n	%
Low	17	14	11	13	5	8	6	15	2	8	5	7
Low average	54	46	35	42	31	53	8	21	8	32	24	35
High average	35	30	28	33	18	31	17	44	12	48	28	41
High	12	10	10	12	5	8	8	21	3	12	12	17
TOTAL	118	100	84	100	59	100	39	100	25	100	69	100

Table 12.2.5: Residual Urine Volume

Duration (Years)	<1		1- <2		2- <4		4 or more	
	n	%	n	%	n	%	n	%
<100 ml	46	12	71	16	143	28	117	44
100 - <400 ml	110	29	157	35	158	30	64	24
400 - <800 ml	119	32	100	22	111	21	48	18
800 - <1000 ml	32	9	35	8	33	6	15	6
≥ 1000 ml	66	18	87	19	74	14	24	9
TOTAL	373	100	450	100	519	100	268	100

Figure 12.2.5: Residual Urine Volume in prevalent PD patients (2014)



SECTION 12.3: TECHNIQUE SURVIVAL ON PD

There was no difference in technique survival (uncensored and censored for death and transplant) between the 2005-2009 and 2010-2014 time periods (Table and Figure 12.3.1a & b). In the latter period, technique survival was 93%, 78% and 72% at 1, 3 and 4 years respectively (censored for death and transplant).

The youngest age group (age <14 years) had better technique survival (uncensored for death and transplant) (Table & Figure 12.3.2a). However, after censoring for death and transplant, the age group ≥65 years fared best compared to other age groups after 3 years on PD treatment (Table & Figure 12.3.2b).

Females consistently had better technique survival than their male counterparts (Table and Figure 12.3.3a & b). The technique survival (uncensored for death and transplant) was better for non-diabetic patients (Table & Figure 12.3.4a) but the difference was lost on censoring for death and transplant (Table & Figure 12.3.4b) .

There was a clear association between technique survival and solute clearance. Patients with Kt/V <1.7 had the worst technique survival. There was no initial difference in technique survival between Kt/V 1.7-2.0 and Kt/V >2.0 but the curves started to diverge at 36 months, with better outcome in Kt/V >2.0 (Table & Figure 12.3.5).

Age group 15-24 years, a history of peritonitis, male gender, obesity, low hemoglobin, low serum albumin, low serum calcium and low serum phosphate were associated with an increased risk of change in modality of renal replacement therapy (Table 12.3.6).

The commonest cause of PD drop out in year 2014 was peritonitis (13%) followed by membrane failure (6%) as shown in Table and Figure 12.3.7(a). Majority of the technique failure (72%) occurred after 12 months of treatment (Table 12.3.7b).

Table 12.3.1(a): Unadjusted technique survival by era 2005–2009 and 2010-2014 (uncensored for death and transplant)

Era Interval (month)	2005-2009			2010-2014		
	N	% Survival	SE	N	% Survival	SE
0	2725	100		4628	100	
6	2440	93	0	3560	93	0
12	2112	85	1	2696	86	1
24	1616	72	1	1430	72	1
36	1213	60	1	628	58	1
48	896	49	1	203	49	1
60	667	40	1	1		
72	370	34	1			
84	197	28	1			
96	85	22	1			
108	31	19	2			
120	1					

Table 12.3.1(b): Unadjusted technique survival by era 2005–2009 and 2010-2014 (censored for death and transplant)

Era Interval (month)	2005–2009			2010-2014		
	N	% Survival	SE	N	% Survival	SE
0	2725	100		4628	100	
6	2440	97	0	3560	97	0
12	2112	93	1	2696	93	0
24	1616	85	1	1430	85	1
36	1213	78	1	628	78	1
48	896	71	1	203	72	1
60	667	65	1	1		
72	370	60	1			
84	197	54	2			
96	85	48	2			
108	31	43	3			
120	1					

Figure 12.3.1a: Unadjusted technique survival by era 2005–2009 and 2010–2014 (uncensored for death and transplant)

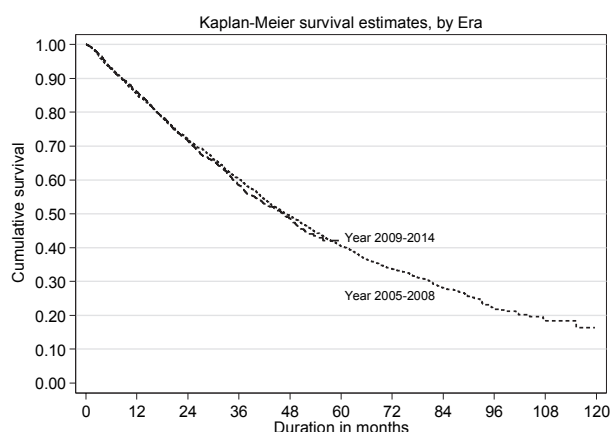


Figure 12.3.1(b): Unadjusted technique survival by era 2005–2009 and 2010-2014 (censored for death and transplant)

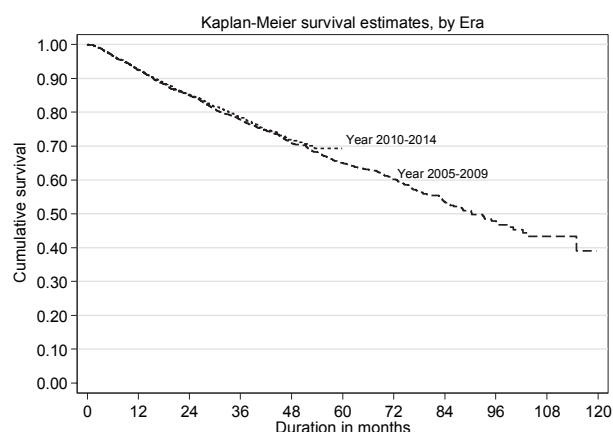


Table 12.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant)

Age group (years) Interval (month)	<=14			15-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	590	100		756	100		921	100		1261	100	
6	554	96	1	658	93	1	793	92	1	1109	93	1
12	506	92	1	568	85	1	681	85	1	941	84	1
24	386	81	2	396	72	2	514	73	2	681	68	1
36	287	69	2	299	62	2	390	63	2	489	55	2
48	214	60	2	221	51	2	282	51	2	350	44	2
60	153	51	2	164	42	2	206	44	2	262	35	2
72	98	41	3	124	36	2	148	36	2	179	27	2
84	67	33	3	89	30	2	104	29	2	128	22	2
96	43	24	3	55	22	2	70	23	2	91	17	1
108	30	20	3	43	21	2	50	19	2	74	15	1
120	21	16	3	30	16	2	33	15	2	53	12	1

Age group (years)	45-54			55-64			>=65		
	n	% Survival	SE	n	% Survival	SE	N	% Survival	SE
0	2270	100		2783	100		2031	100	
6	1942	91	1	2259	89	1	1558	83	1
12	1638	81	1	1820	78	1	1196	69	1
24	1118	62	1	1155	56	1	695	46	1
36	724	46	1	693	39	1	365	29	1
48	477	34	1	414	27	1	181	17	1
60	353	27	1	248	19	1	95	10	1
72	229	20	1	158	13	1	51	7	1
84	137	13	1	90	9	1	30	5	1
96	87	9	1	49	5	1	14	3	1
108	52	6	1	29	4	1	8	2	1
120	33	4	1	21	3	1	5	1	0

Table 12.3.2(b): Unadjusted technique survival by age (censored for death and transplant)

Age group (years)	<=14			15-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	590	100		756	100		921	100		1261	100	
6	554	99	0	658	96	1	793	96	1	1109	97	1
12	506	97	1	568	92	1	681	92	1	941	92	1
24	386	93	1	396	83	2	514	84	1	681	83	1
36	287	86	2	299	76	2	390	77	2	489	74	1
48	214	79	2	221	68	2	282	69	2	350	66	2
60	153	75	2	164	60	2	206	62	2	262	60	2
72	98	69	3	124	56	3	148	56	2	179	55	2
84	67	60	3	89	52	3	104	48	3	128	51	2
96	43	54	4	55	42	3	70	43	3	91	48	2
108	30	50	4	43	41	3	50	40	3	74	46	3
120	21	44	5	30	39	3	33	34	3	53	41	3

Age group (years)	45-54			55-64			>=65		
	n	% Survival	SE	n	% Survival	SE	N	% Survival	SE
0	2270	100		2783	100		2031	100	
6	1942	97	0	2259	97	0	1558	97	0
12	1638	93	1	1820	93	1	1196	94	1
24	1118	85	1	1155	85	1	695	89	1
36	724	79	1	693	78	1	365	84	1
48	477	73	1	414	72	1	181	80	2
60	353	68	2	248	67	2	95	77	2
72	229	62	2	158	64	2	51	74	3
84	137	52	2	90	60	2	30	73	3
96	87	46	3	49	57	3	14	69	4
108	52	41	3	29	53	3	8	69	4
120	33	36	3	21	51	4	5	69	4

Figure 12.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant)

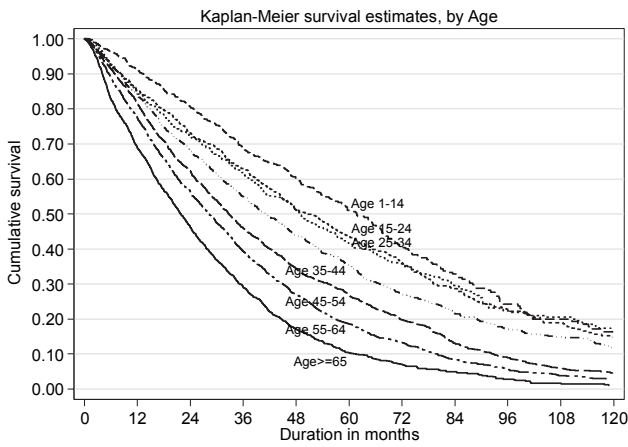


Figure 12.3.2(b): Unadjusted technique survival by age (censored for death and transplant)

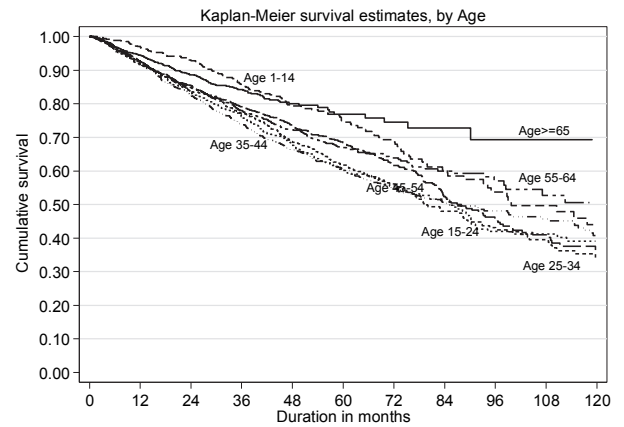


Table 12.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant)

Gender Interval (months)	Male			Female		
	N	% survival	SE	N	% survival	SE
0	5385	100		5177	100	
6	4531	90	0	4340	90	0
12	3698	79	1	3645	80	1
24	2427	60	1	2515	63	1
36	1533	44	1	1710	49	1
48	975	32	1	1160	38	1
60	646	24	1	831	30	1
72	413	17	1	572	24	1
84	249	12	1	391	18	1
96	150	8	1	254	14	1
108	102	6	1	179	11	1
120	68	5	0	123	9	1

Figure 12.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant)

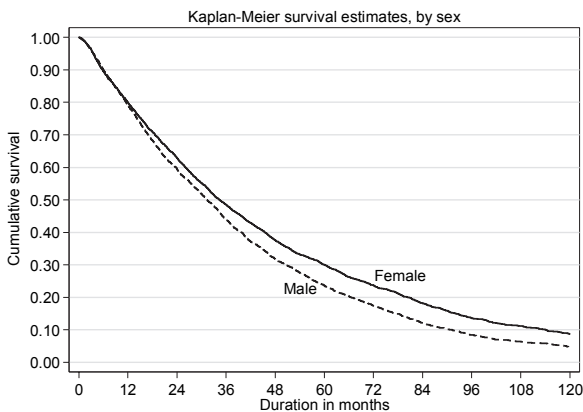


Figure 12.3.3(b): Unadjusted technique survival by gender (censored for death and transplant)

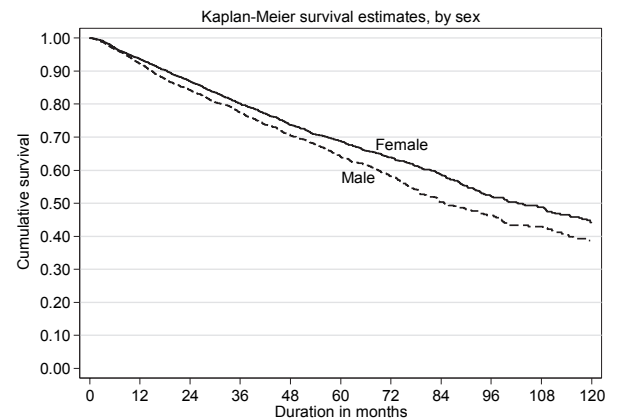


Table 12.3.3(b): Unadjusted technique survival by gender (censored for death and transplant)

Gender Interval (months)	n	Male % survival	SE	N	Female % survival	SE
0	5385	100		5177	100	
6	4531	97	0	4340	97	0
12	3698	92	0	3645	94	0
24	2427	84	1	2515	87	1
36	1533	78	1	1710	80	1
48	975	70	1	1160	74	1
60	646	64	1	831	69	1
72	413	58	1	572	64	1
84	249	50	2	391	59	1
96	150	46	2	254	52	2
108	102	43	2	179	49	2
120	68	39	2	123	44	2

Table 12.3.4(a): Unadjusted technique survival by diabetes status (uncensored for death and transplant), 2005-2014

Diabetes status Interval (month)	N	Non-diabetic % survival	SE	N	Diabetic % survival	SE
0	6593	100		3969	100	
6	5575	91	0	3296	87	1
12	4677	83	0	2666	75	1
24	3223	67	1	1719	52	1
36	2270	55	1	973	34	1
48	1563	43	1	571	22	1
60	1137	35	1	339	14	1
72	797	28	1	185	9	1
84	545	22	1	95	6	1
96	360	16	1	45	3	0
108	259	14	1	22	2	0
120	180	11	1	11	1	0

Figure 12.3.4(a): Unadjusted technique survival by Diabetes status (uncensored for death and transplant)

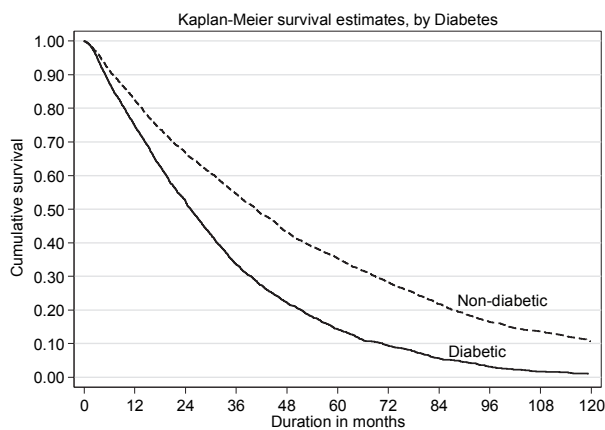


Figure 12.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant)

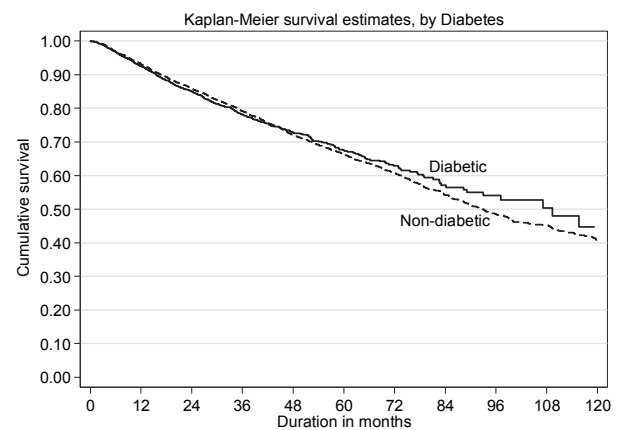


Table 12.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant)

Diabetes status Interval (month)	Non- diabetes			Diabetic		
	n	% survival	SE	N	% survival	SE
0	6593	100		3969	100	
6	5575	97	0	3296	97	0
12	4677	93	0	2666	93	0
24	3223	86	0	1719	85	1
36	2270	79	1	973	78	1
48	1563	72	1	571	73	1
60	1137	66	1	339	68	1
72	797	61	1	185	63	2
84	545	54	1	95	57	2
96	360	48	1	45	54	3
108	259	45	1	22	50	4
120	180	41	2	11	45	5

Table 12.3.5: Unadjusted technique survival by Kt/V, 2005-2014

Kt/V Interval (months)	<1.7			1.7-2.0			>2.0		
	n	% Survival	SE	N	%Survival	SE	N	% Survival	SE
0	2505	100		3526	100		7079	100	
6	2447	98	0	3471	98	0	6993	99	0
12	2342	94	0	3346	95	0	6744	96	0
24	2052	83	1	3014	86	1	6077	87	0
36	1653	69	1	2543	74	1	5105	76	1
48	1262	55	1	2066	63	1	4049	64	1
60	952	44	1	1614	52	1	3168	54	1
72	655	34	1	1247	44	1	2418	46	1
84	433	25	1	861	33	1	1787	38	1
96	319	20	1	579	25	1	1235	31	1
108	255	18	1	411	20	1	917	27	1
120	194	15	1	281	16	1	659	22	1

Figure 12.3.5: Unadjusted technique survival by Kt/V, 2005-2014

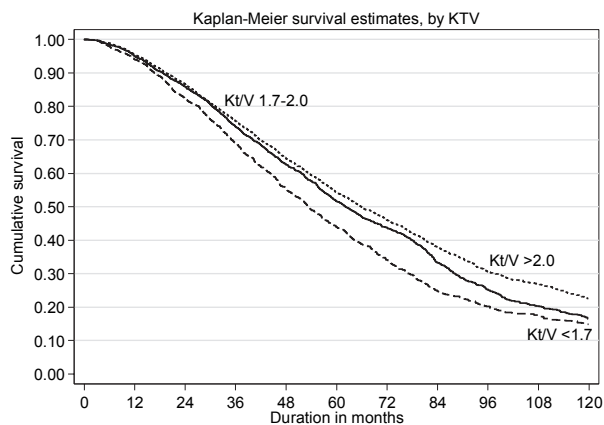


Table 12.3.6: Adjusted hazard ratio for change of modality, 2005-2014

Factors	n	Hazardratio	95%CI	p value
Age (years)				
Age 1-14 (ref*)	340	1.000		
Age 15-24	501	1.552	(1.079;2.234)	0.018
Age 25-34	592	1.129	(0.766;1.663)	0.539
Age 35-44	790	1.218	(0.834;1.778)	0.308
Age 45-54	1496	1.014	(0.700;1.468)	0.943
Age 55-64	2019	1.019	(0.706;1.471)	0.921
Age >=65	1615	0.959	(0.646;1.425)	0.838
Peritonitis				
No (ref*)	6889	1.000		
Yes	464	9.256	(8.090;10.590)	<0.001
Diabetes Mellitus				
Non-diabetic (ref*)	4553	1.000		
Diabetic	2800	0.994	(0.851;1.161)	0.939
Gender				
Male (ref*)	3764	1.000		
Female	3589	0.708	(0.611;0.819)	<0.001
Cardiovascular Disease				
No CVD (ref*)	6049	1.000		
CVD	1304	0.950	(0.776;1.164)	0.623
BMI				
<18.5	700	0.888	(0.698;1.131)	0.336
18.5-<25 (ref*)	3802	1.000		
>=25	2851	1.358	(1.178;1.565)	<0.001
Serum Albumin				
<30	2300	1.262	(1.058;1.507)	0.010
30-<35	2734	1.091	(0.938;1.269)	0.259
35-<45 (ref*)	2241	1.000		
>=45	78	0.799	(0.393;1.622)	0.534
Serum cholesterol (mmol/L)				
<3.5	417	0.952	(0.682;1.328)	0.770
3.5-<5.2	4072	0.771	(0.641;0.928)	0.006
5.2-<6.2	1772	0.948	(0.779;1.154)	0.594
>=6.2 (ref*)	1092	1.000		
Diastolic BP				
<70	1009	1.050	(0.808;1.363)	0.717
70-<80	2664	1.031	(0.881;1.208)	0.701
80-<90 (ref*)	2701	1.000		
90-<100	810	1.190	(0.983;1.442)	0.075
>=100	169	1.608	(1.048;2.469)	0.030
Hemoglobin (g/dL)				
<10	2590	1.379	(1.197;1.590)	<0.001
10-<12 (ref*)	4012	1.000		
>=12	751	0.917	(0.713;1.178)	0.498
Serum calcium (mmol/L)				
<2.1	2328	1.175	(1.007;1.373)	0.041
2.1-<=2.37 (ref*)	3930	1.000		
>2.37	1095	1.003	(0.838;1.200)	0.976

Factors	n	Hazardratio	95%CI	p value
Calcium Phosphate product				
<3.5	4387	1.031	(0.848;1.254)	0.757
3.5-<4.5 (ref*)	1989	1.000		
4.5-<5.5	724	0.699	(0.531;0.921)	0.011
>=5.5	253	0.925	(0.605;1.414)	0.719
Serum Phosphate (mmol/L)				
<0.8	104	3.981	(2.198;7.211)	<0.001
0.8-<1.3 (ref*)	1860	1.000		
1.3-<1.8	3572	0.820	(0.684;0.984)	0.033
1.8-<2.2	1204	0.831	(0.622;1.111)	0.211
>=2.2	613	1.312	(0.860;2.002)	0.207
Kt/V				
<1.7	1371	1.084	(0.904;1.301)	0.385
1.7-2.0 (ref*)	1556	1.000		
<=2	3045	1.166	(0.995;1.366)	0.058
Assisted PD				
Selfcare (ref*)	3434	1.000		
Assisted	3682	0.997	(0.854;1.165)	0.972

Table 12.3.7(a): Reasons for drop-out from PD program, 2005-2014

Year	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
	n	%	n	%	n	%	n	%	n	%	n	%	N	%	n	%	n	%	n	%
Death	182	61	177	58	231	66	277	63	321	66	353	69	374	68	397	73	471	70	493	69
Transplant	21	7	25	8	18	5	21	5	15	3	12	2	17	3	14	3	17	3	14	2
Peritonitis	29	10	33	11	35	10	50	11	72	15	72	14	63	12	57	10	83	12	90	13
Catheter related infection	2	1	2	1	4	1	4	1	11	2	13	3	15	3	13	2	21	3	21	3
Membrane failure	27	9	18	6	13	4	24	5	18	4	21	4	27	5	27	5	41	6	42	6
Technical problem	11	4	9	3	4	1	7	2	19	4	12	2	19	3	14	3	7	1	15	2
Patient preference	10	3	9	3	20	6	50	11	28	6	16	3	23	4	17	3	22	3	32	4
Others	7	2	16	5	14	4	2	0	3	1	14	3	8	1	7	1	9	1	12	2
Unknown	8	3	17	6	12	3	2	0	1	0	1	0	1	0	0	0	0	0	0	0
TOTAL	297	100	306	100	351	100	437	100	488	100	514	100	547	99	546	100	671	100	719	100

Figure 12.3.7(a): Reasons for drop-out from PD program, 2005-2014

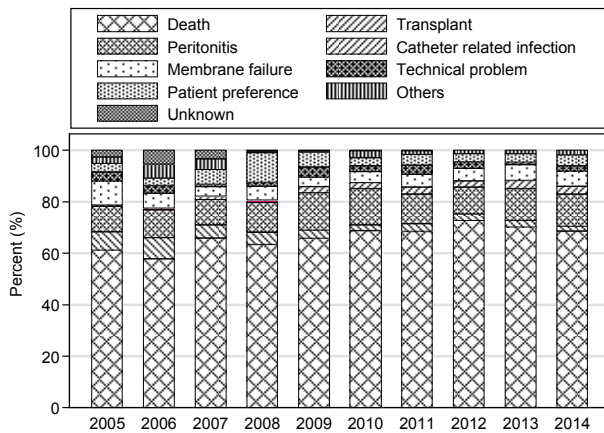


Table 12.3.7(b): Drop-out rate from PD program with time on treatment, 2005-2014

Year	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
< 3 months	16	5	12	4	19	5	29	7	38	8	20	4	28	5	34	6	41	6	37	5
3-<6 months	24	8	24	8	33	9	31	7	38	8	41	8	49	9	52	10	58	9	77	11
6- <12 months	40	13	39	13	58	17	66	15	76	16	68	13	74	14	75	14	82	12	84	12
>=12 months	217	73	231	75	241	69	311	71	336	69	385	75	396	72	385	71	490	73	521	72
TOTAL	297	100	306	100	351	100	437	100	488	100	514	100	547	100	546	100	671	100	719	100

Table 12.3.8: Time on PD (2005-2014)

	Months													
	0-<6	6-11	12-17	18-23	24-29	30-35	36-41	42-47	48-59	60-71	72-83	84-95	96-107	≥108
1st Treatment (n=7316)	1354	1185	917	829	675	527	400	340	425	296	172	113	53	30

SECTION 12.4: PERITONITIS

The median peritonitis rate for the year 2014 was 42.9 patient-months per episode (Table 12.4.1). While this is a good result as compared to ISPD standards, there is a worsening trend for peritonitis rates in 2013 and 2014 compared to the achievements in 2011 and 2012. This may be due to an increased number of newer PD units over the last 2 years. There was a wide inter-centre variation at 67.6 versus 34 patient-months per episode.

There was a similar incidence of gram positive (32.9%) and gram negative peritonitis (31.8%) (Table 12.4.2(a)). The commonest gram positive pathogens were *Staphylococcus aureus* and *Staphylococcus coagulase negative* while *Escherichia coli* and *Klebsiella* were the main gram negative organisms isolated. Rates of fungal and mycobacterial peritonitis were very low, i.e. 2.2% and 0.8% respectively. Culture negative rates remain high at 25.6%, although the rates in 2010-2014 are slightly improved compared the earlier 5-year period

Gram positive peritonitis showed better recovery rate compared to gram negative infections in both eras (Figures of 12.4.3 (a) and (b)). Amongst the gram negative infections, *Pseudomonas* has the worst prognosis with only 35-38% reported complete resolution and nearly one third resulting in catheter removal. The death rate was highest with fungal or Mycobacterial peritonitis.

Comparing year 2005-2009 vs 2010-2014, Streptococcal, *Klebsiella* and Polymicrobial organisms showed obvious improvement in peritonitis outcome in the latter era. In the 2010-2014 era, polymicrobial peritonitis had a better resolution rate than in the previous era (51% versus 36%) resulting in a lower death rate (23% compared to 43%) (Figure 12.4.3c). The improvements in resolution of peritonitis were also noted with Streptococcal and *Klebsiella* peritonitis in year 2010-2014.

Factors that significantly contributed to a lower risk of peritonitis were younger age group (age less than 14 years) and higher income group (Table 12.4.4). The elderly age group (>55 years) and assisted PD (partially or complete) were shown to have a higher risk of developing peritonitis.

Table 12.4.1: Variation in peritonitis rate (pt-month/epi) among PD centres, 2005-2014

Year	Number of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
2005	15	18	18	29.2	37.3	48.4	57.7	57.7
2006	21	14.8	18.5	27.6	40.1	51.6	65.2	97.7
2007	24	12	12.9	31	43.3	55.2	67	106.7
2008	24	23.8	25	31	41.3	62.5	106	152.8
2009	25	13	17.7	28.8	38.2	52.4	173.6	246.1
2010	26	10.8	15.3	28.7	36.2	57.8	72.5	87.6
2011	28	8.9	12	35	47.9	65.7	101	264.6
2012	27	25.5	29.5	46.2	58.4	72	164.5	249.1
2013	29	15.7	16.2	31.9	48.1	52.6	94	106.2
2014	31	27.2	28	34	42.9	67.6	187.3	338.9

Figure 12.4.1: Variation in peritonitis rate among PD centres, 2014

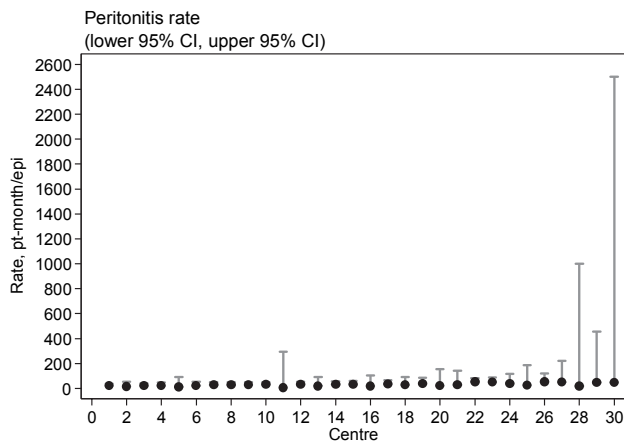


Table 12.4.2 (a): Causative organism in PD peritonitis, 2005-2014

	2005		2006		2007		2008		2009		2010		2011		2012		2013		2014		
	N	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
(A) Gram Positives																					
<i>Staph. aureus</i>	38	12.5	48	13.8	40	11.3	40	8.9	50	10.6	70	15	72	14.3	68	14.8	96	14.8	86	12.1	
Staph Coagulase Neg.	40	13.1	30	8.6	29	8.2	48	10.7	50	10.6	53	11.3	46	9.1	48	10.4	59	9.1	72	10.1	
Strep	9	3	17	4.9	15	4.2	19	4.3	17	3.6	13	2.8	33	6.5	36	7.8	53	8.2	54	7.6	
Others	8	2.6	13	3.7	11	3.1	7	1.6	6	1.3	6	1.3	19	3.8	19	4.1	30	4.6	22	3.1	
(B) Gram Negatives																					
Pseudomonas	26	8.5	22	6.3	29	8.2	38	8.5	34	7.2	33	7.1	44	8.7	18	3.9	37	5.7	43	6	
Acinetobacter	21	6.9	7	2	20	5.6	23	5.1	17	3.6	9	1.9	22	4.4	12	2.6	19	2.9	20	2.8	
Klebsiella	19	6.2	20	5.8	17	4.8	23	5.1	27	5.7	30	6.4	27	5.4	26	5.6	35	5.4	50	7	
Enterobacter	13	4.3	6	1.7	7	2	3	0.7	13	2.7	8	1.7	9	1.8	7	1.5	11	1.7	15	2.1	
E.Coli	29	9.5	16	4.6	32	9	42	9.4	39	8.2	58	12.4	49	9.7	38	8.2	45	7	55	7.7	
Others	4	1.3	6	1.7	6	1.7	8	1.8	9	1.9	9	1.9	9	1.8	11	2.4	11	1.7	19	2.7	
(C) Polymicrobial	0	0	1	0.3	0	0	0	0	13	2.7	4	0.9	0	0	0	0	18	2.8	25	3.5	
(D) Others																					
Fungal	7	2.3	16	4.6	20	5.6	24	5.4	18	3.8	15	3.2	17	3.4	18	3.9	28	4.3	16	2.2	
Mycobacterium	2	0.7	4	1.2	1	0.3	4	0.9	1	0.2	0	0	6	1.2	2	0.4	5	0.8	6	0.8	
Others	3	1	10	2.9	12	3.4	21	4.7	16	3.4	32	6.9	30	6	32	6.9	38	5.9	47	6.6	
(E) No growth	86	28.2	131	37.8	115	32.5	147	32.9	163	34.5	127	27.2	121	24	126	27.3	162	25	182	25.6	
TOTAL	305	100	347	100	354	100	447	100	473	100	467	100	504	100	461	100	647	100	712	100	

Figure 12.4.2(b) Causative organism in PD peritonitis, 2005-2014

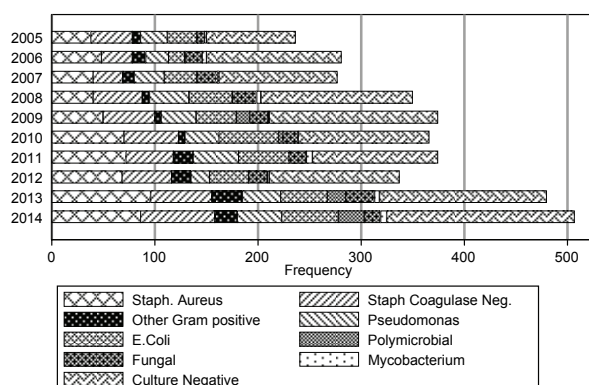


Table 12.4.3(a): Outcome of peritonitis by causative organism, 2005-2009

	Outcome							
	Resolved		Not resolved, catheter removed		Death		Total	
	n	%	N	%	n	%	n	%
(A) Gram Positives								
Staph. Aureus	142	69	33	16	30	15	205	100
Staph Coagulase Neg.	152	82	10	5	24	13	186	100
Strep	55	76	5	7	12	17	72	100
Others	31	74	5	12	6	14	42	100
(B) Gram Negatives								
Pseudomonas	52	38	37	27	48	35	137	100
Acinetobacter	43	54	16	20	20	25	79	100
Klebsiella	47	46	22	22	33	32	102	100
Enterobacter	25	63	3	8	12	30	40	100
E.Coli	89	60	21	14	39	26	149	100
Others	20	63	7	22	5	16	32	100
(C) Polymicrobial	5	36	3	21	6	43	14	100
(D) Others								
Fungal	6	7	23	27	55	65	84	100
Mycobacterium	0	0	3	25	9	75	12	100
Others	36	62	9	16	13	22	58	100
(E) No growth	424	70	70	12	113	19	607	100

Table 12.4.3(b): Outcome of peritonitis by causative organism, 2010-2014

	Outcome							
	Resolved		Not resolved, catheter removed		Death		Total	
	n	%	N	%	n	%	n	%
(A) Gram Positives								
Staph. aureus	257	70	57	15	55	15	369	100
Staph coagulase neg.	217	82	23	9	26	10	266	100
Strep	156	84	11	6	18	10	185	100
Others	68	75	13	14	10	11	91	100
(B) Gram Negatives								
Pseudomonas	58	35	49	29	60	36	167	100
Acinetobacter	44	56	12	15	22	28	78	100
Klebsiella	105	66	19	12	36	23	160	100
Enterobacter	33	67	6	12	10	20	49	100
E.coli	149	63	27	11	60	25	236	100
Others	34	61	12	21	10	18	56	100
(C) Polymicrobial	22	51	11	26	10	23	43	100
(D) Others								
Fungal	8	9	39	43	44	48	91	100
Mycobacterium	2	11	8	42	9	47	19	100
Others	105	62	30	18	34	20	169	100
(E) No growth	257	70	57	15	55	15	369	100

Figure 12.4.3(a): Outcome of peritonitis by causative organism, 2005-2009

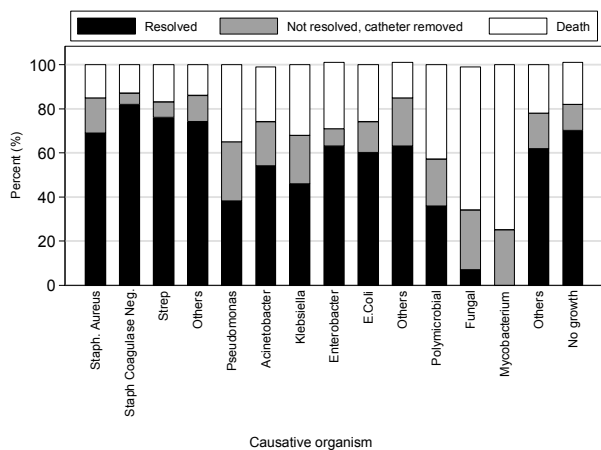


Figure 12.4.3(b): Outcome of peritonitis by causative organism, 2010-2014

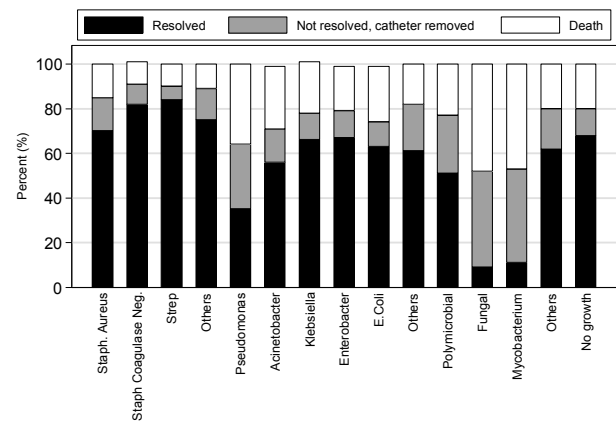


Figure 12.4.3(c): Comparison of peritonitis outcome by causative organism by era, 2005-2009 & 2009-2014

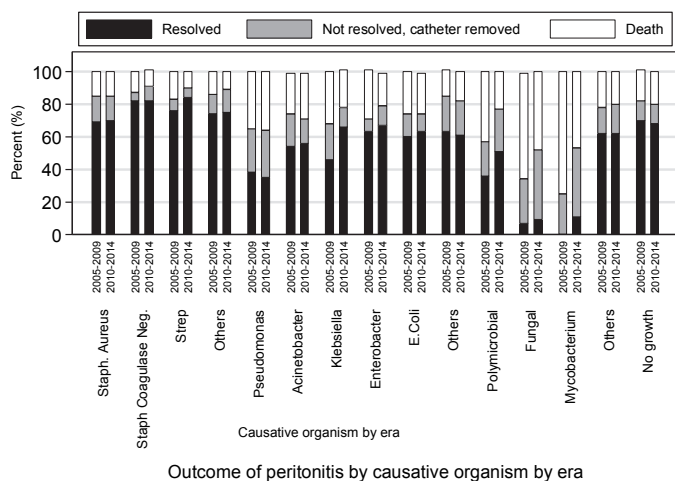


Table 12.4.4: Risk factors influencing peritonitis rate, 2005-2014

Factors	n	Risk Ratio	95% CI	P value
Age (years)				
<=14	300	0.809	(0.664;0.986)	0.035
15-24	433	0.949	(0.806;1.116)	0.523
25-34 (ref*)	525	1.000		
35-44	697	1.093	(0.946; 1.263)	0.227
45-54	1317	1.040	(0.906;1.195)	0.574
55-64	1781	1.181	(1.028;1.357)	0.019
>=65	1355	1.157	(0.993;1.348)	0.061
Gender				
Male (ref*)	3294	1.000		
Female	3114	1.031	(0.963;1.103)	0.386
Diabetes				
No (ref*)	3900	1.000		
Yes	2508	1.035	(0.961;1.115)	0.364
Income				
<RM 1000 (ref*)	2289	1.000		
RM 1000-3000	3099	0.814	(0.758; 0.875)	<0.001
RM 3001-5000	924	0.619	(0.548;0.700)	<0.001
RM 5001-10000	75	0.621	(0.350;1.101)	0.103
>=RM 10000	21	0.488	(0.122;1.958)	0.312
Education				
Nil	514	1.042	(0.914;1.189)	0.539
Primary	2052	1.007	(0.930;1.090)	0.863
Secondary (ref*)	3112	1.000		
Tertiary	730	0.975	(0.861;1.105)	0.693
Assistance to perform CAPD				
Self care (ref*)	3106	1.000		
Partially assisted	1144	1.122	(1.019;1.235)	0.019
Completely assisted	2158	1.155	(1.058;1.261)	0.001