

CHAPTER 10

Peritoneal Dialysis

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SECTION 10.1: Modalities and Prescription of PD

In 2018, there was a total of 5268 patients on peritoneal dialysis (PD) in Malaysia. The overall number of PD patients has been increasing over the last decade.

In 2018, 81.2% of PD patients were on CAPD and 12.4% on APD. APD penetration has been fluctuating from about 9.9% to 14.9% for the period of 2008 to 2018. DAPD was prescribed to only a small proportion of patients accounting for about 6.2% (Table 10.1.1).

In 2018, 58.2% of patients were on the Baxter disconnect system and 41.8% were on the Fresenius disconnect system (Table 10.1.2). 90.1% were performing 4 exchanges a day. Only 2.7% of patients require 5 exchanges a day reflecting that patients that require better clearances were converted to haemodialysis rather than increasing the number of exchanges (Table 10.1.3a). In those patients on CAPD, about 89.9% are using dwell volumes of 8L/day or less (Table 10.1.3bii). The ability to perform self-care CAPD in the last 10 years varied from 61.4% to 64.5% and 32.9% to 38.1% required assistance either partially or completely (Table 10.1.4).

With APD, 3 systems are available – Baxter, Fresenius and Lucenia. In the year 2018, 70.7% were using the Baxter system, 24.7% were using the Fresenius system and 4.6% were on the Lucenia system. About 90% of patients on APD use dwell volumes of 10 litres or less (Table 10.1.3bi). The ability to perform self-care APD in the last 10 years varied from 23.3% to 35.4% emphasizing the need for increased access to APD (Table 10.1.4).

Table 10.1.1: Peritoneal dialysis regimes, 2008-2018

PD regime	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
Standard CAPD	4277	81.2	3977	81.0	3522	81.6	3227	81.0	2679	79	2273	78.2
DAPD	325	6.2	246	5.0	194	4.5	208	5.2	218	6.4	202	7.0
Automated PD/ CCPD	655	12.4	630	12.8	592	13.7	538	13.5	482	14.2	429	14.8
Unknown/NA	11	0.2	55	1.1	8	0.2	9	0.2	11	0.3	2	0.1
Total	5268	100	4908	100	4316	100	3982	100	3390	100	2906	100

PD regime	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
Standard CAPD	2017	79.5	1787	79.5	1718	83.0	1627	84.1	1521	83.5
DAPD	154	6.1	124	5.5	91	4.4	114	5.9	121	6.6
Automated PD/ CCPD	361	14.2	335	14.9	260	12.6	193	10.0	180	9.9
Unknown/NA	5	0.2	1	0.0	1	0.0	1	0.1	0	0.0
Total	2537	100	2247	100	2070	100	1935	100	1822	100

Table 10.1.2: CAPD connectology, 2008-2018

CAPD connectology	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
CAPD	4602	100	4223	100	3716	100	3435	100	2897	100	2475	100
Baxter disconnect	2677	58.2	2379	56.3	2182	58.7	2252	65.6	2094	72.3	1894	76.5
Fresenius disconnect	1923	41.8	1841	43.6	1532	41.2	1182	34.4	802	27.7	579	23.4
Others	2	0.0	3	0.1	1	0.0	1	0.0	1	0.0	2	0.1
Unknown	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0
APD	655	100	630	100	592	100	538	100	482	100	429	100
Baxter disconnect	463	70.7	433	68.7	414	69.9	395	73.4	389	80.7	346	80.7
Fresenius disconnect	162	24.7	152	24.1	146	24.7	114	21.2	87	18.0	83	19.3
Lucenxia	30	4.6	45	7.1	32	5.4	29	5.4	6	1.2	0	0.0
Others	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

CAPD connectology	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
CAPD	2171	100	1911	100	1809	100	1741	100	1642	100
Baxter disconnect	1716	79.0	1647	86.2	1666	92.1	1610	92.5	1524	92.8
Fresenius disconnect	454	20.9	263	13.8	140	7.7	127	7.3	116	7.1
Others	1	0.0	1	0.1	3	0.2	4	0.2	2	0.1
Unknown	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
APD	361	100	335	100	260	100	193	100	180	100
Baxter disconnect	281	77.8	250	74.6	182	70.0	145	75.1	173	96.1
Fresenius disconnect	80	22.2	84	25.1	78	30.0	46	23.8	5	2.8
Lucenxia	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Others	0	0.0	0	0.0	0	0.0	2	1.0	2	1.1
Unknown	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0

Table 10.1.3(a): CAPD Number of Exchanges per day, 2008-2018

Number of exchanges/ day	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
2	31	0.7	28	0.7	24	0.6	14	0.4	16	0.6	17	0.7
3	290	6.3	198	4.7	117	3.1	119	3.5	144	5.0	109	4.4
4	4147	90.1	3881	91.9	3494	94.0	3216	93.6	2639	91.1	2282	92.2
5	125	2.7	108	2.6	67	1.8	60	1.7	66	2.3	43	1.7
Unknown	9	0.2	8	0.2	14	0.4	26	0.8	32	1.1	24	1.0
Total	4602	100	4223	100	3716	100	3435	100	2897	100	2475	100

Number of exchanges/ day	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
2	8	0.4	3	0.2	5	0.3	0	0.0	1	0.1
3	100	4.6	76	4.0	83	4.6	58	3.3	30	1.8
4	1994	91.8	1776	92.9	1688	93.3	1639	94.1	1582	96.3
5	54	2.5	40	2.1	18	1.0	29	1.7	22	1.3
Unknown	15	0.7	16	0.8	15	0.8	15	0.9	7	0.4
Total	2171	100	1911	100	1809	100	1741	100	1642	100

Table 10.1.3(b) (i): CAPD total dwell volumes per day, 2008-2018

Total dwell volumes /day	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
Less than 8	378	8.2	279	6.6	169	4.5	155	4.5	187	6.5	147	5.9
8	3758	81.7	3579	84.8	3201	86.1	2957	86.1	2410	83.2	2079	84
10	276	6	325	7.7	307	8.3	277	8.1	236	8.1	211	8.5
12	20	0.4	23	0.5	22	0.6	19	0.6	23	0.8	11	0.4
Unknown	170	3.7	17	0.4	17	0.5	27	0.8	41	1.4	27	1.1
Total	4602	100	4223	100	3716	100	3435	100	2897	100	2475	100

Total dwell volumes /day	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
Less than 8	127	5.8	92	4.8	97	5.4	71	4.1	39	2.4
8	1811	83.4	1615	84.5	1538	85	1506	86.5	1433	87.3
10	205	9.4	171	8.9	157	8.7	144	8.3	160	9.7
12	12	0.6	11	0.6	2	0.1	5	0.3	2	0.1
Unknown	16	0.7	22	1.2	15	0.8	15	0.9	8	0.5
Total	2171	100	1911	100	1809	100	1741	100	1642	100

Table 10.1.3(b) (ii): APD total dwell volumes per day, 2008-2018

Total dwell volumes /day	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
Less than 8	69	10.5	54	8.6	2	0.3	5	0.9	8	1.7	6	1.4
8	16	2.4	13	2.1	8	1.4	12	2.2	3	0.6	11	2.6
10	493	75.3	479	76.0	459	77.5	416	77.3	402	83.4	368	85.8
12	67	10.2	74	11.7	99	16.7	90	16.7	60	12.4	35	8.2
14	4	0.6	5	0.8	17	2.9	9	1.7	5	1.0	7	1.6
16	6	0.9	5	0.8	5	0.8	6	1.1	4	0.8	1	0.2
18	0	0.0	0	0.0	2	0.3	0	0.0	0	0.0	1	0.2
Total	655	100	630	100	592	100	538	100	482	100	429	100

Total dwell volumes /day	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
Less than 8	7	1.9	9	2.7	15	5.8	7	3.6	3	1.7
8	9	2.5	6	1.8	8	3.1	2	1.0	5	2.8
10	315	87.3	308	91.9	227	87.3	173	89.6	170	94.4
12	24	6.6	7	2.1	10	3.8	11	5.7	0	0.0
14	4	1.1	1	0.3	0	0.0	0	0.0	0	0.0
16	1	0.3	4	1.2	0	0.0	0	0.0	2	1.1
18	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0
Total	361	100	335	100	260	100	193	100	180	100

Table 10.1.4: Assistance to Perform PD, 2008-2018

PD Regime / Assistant	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
CAPD	4602	100	4223	100	3716	100	3435	100	2897	100	2475	100
Self-care	2837	61.6	2610	61.8	2292	61.7	2161	62.9	1863	64.3	1590	64.2
Partial self-care	691	15	621	14.7	606	16.3	559	16.3	356	12.3	326	13.2
Completely assisted	1062	23.1	990	23.5	774	20.8	660	19.2	639	22.1	494	20
Unknown	12	0.3	2	0	44	1.2	55	1.6	39	1.3	65	2.6
Automated PD	655	100	630	100	592	100	538	100	482	100	429	100
Self-care	229	35	206	32.7	190	32.1	179	33.3	154	32	152	35.4
Partial self-care	142	21.7	123	19.5	142	24	128	23.8	80	16.6	119	27.7
Completely assisted	284	43.3	301	47.8	244	41.2	223	41.4	238	49.4	148	34.5
Unknown	0	0	0	0	16	2.7	8	1.5	10	2.0	10	2.4

PD Regime / Assistant	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
CAPD	2171	100	1911	100	1809	100	1741	100	1642	100
Self-care	1366	62.9	1232	64.5	1128	62.4	1069	61.4	1034	63
Partial self-care	328	15.1	255	13.3	274	15.1	228	13.1	239	14.6
Completely assisted	434	20	375	19.6	357	19.7	392	22.5	328	20
Unknown	43	2	49	2.6	50	2.8	52	3	41	2.4
Automated PD	361	100	335	100	260	100	193	100	180	100
Self-care	119	33	89	26.6	66	25.4	45	23.3	43	23.9
Partial self-care	84	23.3	105	31.3	94	36.2	66	34.2	56	31.1
Completely assisted	146	40.4	126	37.6	92	35.4	72	37.3	68	37.8
Unknown	12	3.3	15	4.5	8	3.0	10	5.2	13	7.2

Figure 10.1.4(a): Assistance to Perform CAPD, 2008-2018

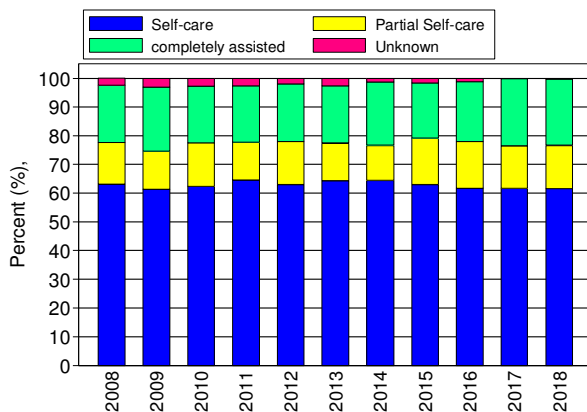
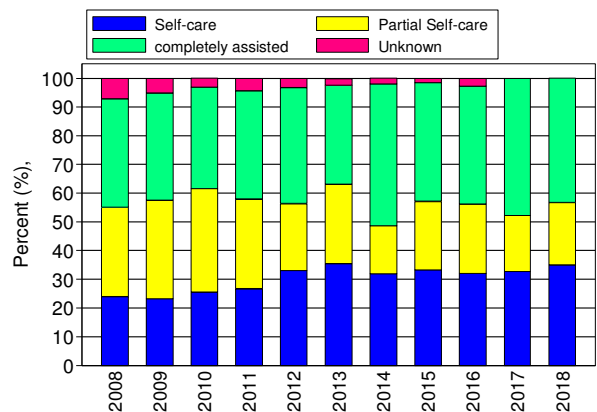


Figure 10.1.4(b): Assistance to Perform APD, 2008-2018



SECTION 10.2: ACHIEVEMENT OF SOLUTE CLEARANCE AND PERITONEAL TRANSPORT

The percentage of patients achieving target solute clearance of ≥ 1.7 per week was 69% in 2018 (Table 10.2.1). It has been observed from 2008-2018, the rate is in declining trend. This may be due to the current understanding in which there is less emphasis on the importance of targeting Kt/V to achieve better patient clinical outcomes.

There is wide inter-centre variation in the proportion of patients achieving the delivered Kt/V in 2018 (31% in 5th percentile and 89% in 95th percentile). This wide inter-centre variation has been observed each year (Table and Figure 10.2.2).

Majority of incident PD patients have either low average or high average membrane transport status (Table 10.2.3). This proportion of distribution was no different across the dialysis vintage even after 10 years on therapy (Table 10.2.4).

Table 10.2.1: Distribution of delivered Kt/V, PD patients 2008-2018

Year	Number of Patients	Mean	SD	Median	LQ	UQ	% patients ≥ 1.7 per week
2018	4146	2.0	0.5	1.9	1.6	2.2	69
2017	3824	2.0	0.5	1.9	1.7	2.2	72
2016	3564	2.0	0.5	1.9	1.7	2.3	74
2015	3275	2.0	0.5	2.0	1.7	2.3	74
2014	2808	2.0	0.5	1.9	1.7	2.3	74
2013	2509	2.1	0.5	2.0	1.7	2.3	78
2012	2085	2.1	0.5	2.0	1.8	2.3	79
2011	1878	2.1	0.5	2.0	1.8	2.3	79
2010	1747	2.1	0.5	2.0	1.7	2.3	79
2009	1663	2.1	0.5	2.0	1.8	2.4	81
2008	1527	2.1	0.5	2.0	1.8	2.4	82

Table 10.2.2: Variation in proportion of patients with Kt/V ≥ 1.7 per week among PD centres, 2008-2018

Year	Number of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
2018	32	20	31	60.0	68.5	78.0	89	95
2017	31	36	37	59.0	69.0	78.0	88	90
2016	29	52	54	64.0	74.0	81.0	88	89
2015	27	50	55	64.0	72.0	80.0	88	91
2014	23	43	46	66.0	75.0	81.0	88	89
2013	23	46	46	69.0	76.0	86.0	89	100
2012	21	59	64	68.0	77.0	86.0	88	94
2011	21	60	62	75.0	80.0	84.0	88	92
2010	20	48	53	67.5	78.0	85.5	93	95
2009	18	48	48	73.0	82.5	88.0	97	97
2008	19	0	0	72.0	79.0	89.0	97	97

Figure 10.2.2: Variation in proportion of patients with Kt/V ≥ 1.7 per week among PD centres 2008-2018

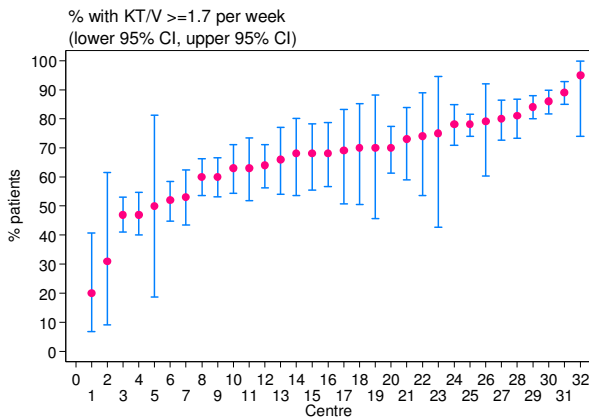


Table 10.2.3: Peritoneal transport status by PET D/P creatinine at 4 hours, new PD patients 2008-2018

Year	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
Low	493	11.4	508	11.7	464	12.3	449	12.9	378	13.1	292	11.5
Low average	1857	42.8	1907	44.1	1635	43.2	1487	42.6	1143	39.5	1013	40.0
High average	1535	35.4	1512	34.9	1284	33.9	1177	33.7	984	34.0	930	36.7
High	456	10.4	401	9.3	404	10.6	380	10.8	387	13.4	297	11.8
Total	4341	100	4328	100	3787	100	3493	100	2892	100	2532	100

Year	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
Low	237	10.5	206	10.3	257	13.6	237	13.5	202	12.1
Low average	911	40.4	774	38.7	725	38.4	671	38.2	688	41.1
High average	852	37.8	780	39.0	666	35.3	621	35.4	610	36.4
High	253	11.3	241	12.0	240	12.7	226	12.9	174	10.4
Total	2253	100	2001	100	1888	100	1755	100	1674	100

Table 10.2.4: Peritoneal Transport Status (PET) with dialysis vintage

Duration (Years)	<1		1-<2		2-<3		3-<4		4-<5	
	n	%	n	%	n	%	n	%	n	%
Low	93	12.6	111	12.3	65	10.9	57	11.4	30	10.1
Low average	287	38.9	379	41.9	242	40.6	215	43.0	126	42.3
High average	268	36.3	325	36.0	228	38.3	179	35.8	116	38.9
High	90	12.2	89	9.8	61	10.2	49	9.8	26	8.7
Total	738	100	904	100	596	100	500	100	298	100

Duration (Years)	5-<6		6-<7		7-<8		8-<9		9-<10		10 or more	
	n	%	n	%	n	%	n	%	n	%	n	%
Low	25	13.1	8	6.8	13	17.8	5	14.7	1	2.9	2	5.6
Low average	85	44.5	48	41.0	33	45.2	12	35.3	9	26.5	17	47.2
High average	67	35.1	51	43.6	20	27.4	12	35.3	16	47.1	16	44.4
High	14	7.3	10	8.5	7	9.6	5	14.7	8	23.5	1	2.8
Total	191	100	117	100	73	100	34	100	34	100	36	100

SECTION 10.3: TECHNIQUE SURVIVAL ON PD

Table and Figure 10.3.1(a) & (b) illustrate patient technique survival by era. In the recent era of 2015-2018, the technique survival at 4 years PD vintage is better as compared to previous era (both uncensored and censored for death and transplant). In 2015-2018, technique survival was 94%, 80% and 74% at 1, 3 and 4 years respectively.

When censored for death and transplant, older age group (≥ 65 years) have a better technique survival compared to younger age group (Table & Figure 10.3.2b). This is advantage is observed even after 3 years on therapy.

Tables and Figures 10.3.3 (a) & (b) illustrates female gender consistently had better technique survival than male. Diabetes has been associated with worse technique survival as early at 1 year (Table & Figure 10.3.4(a) and (b)) both uncensored and censored for death and transplant).

Patients with $Kt/V < 1.7$ had the worst technique survival illustrated in Table & Figure 10.3.5. There was no difference in technique survival between $Kt/v > 2.0$ and $Kt/V > 1.7 - 2.0$.

Table 10.3.1(a): Unadjusted technique survival by era, 2000-2018 (uncensored for death and transplant)

Era Interval (month)	2000-2004			2005-2009			2010-2014			2015-2018		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	1473	100		2447	100		4395	100		5405	100	
6	1318	90	1	2181	90	1	3898	89	0	4281	91	0
12	1164	79	1	1880	78	1	3447	79	1	3208	81	1
24	876	61	1	1426	59	1	2557	59	1	1580	61	1
36	636	45	1	1063	44	1	1881	43	1	622	46	1
48	471	33	1	782	33	1	1366	32	1	9	35	2
60	364	26	1	573	24	1	717	23	1	9		
72	278	20	1	427	18	1	355	16	1	9		
84	198	14	1	311	13	1	152	12	1	9		
96	148	11	1	206	9	1	43	9	1	9		
108	120	9	1	149	6	0	1			9		
120	95	7	1	79	5	0	1			9		

Table 10.3.1(b): Unadjusted technique survival by era, 2000-2018 (censored for death and transplant)

Era Interval (month)	2000-2004			2005-2009			2010-2014			2015-2018		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	1473	100		2447	100		4395	100		5405	100	
6	1318	97	0	2181	97	0	3898	97	0	4281	97	0
12	1164	94	1	1880	92	1	3447	93	0	3208	94	0
24	876	86	1	1426	85	1	2557	85	1	1580	87	1
36	636	79	1	1063	77	1	1881	78	1	622	80	1
48	471	72	1	782	71	1	1366	71	1	9	74	3
60	364	65	2	573	65	1	717	66	1	9		
72	278	59	2	427	60	1	355	60	1	9		
84	198	54	2	311	55	2	152	55	2	9		
96	148	48	2	206	47	2	43	49	2	9		
108	120	45	2	149	42	2	1			9		
120	95	41	2	79	37	2	1			9		

Figure 10.3.1(a): Unadjusted technique survival by era, 2000-2018 (uncensored for death and transplant)

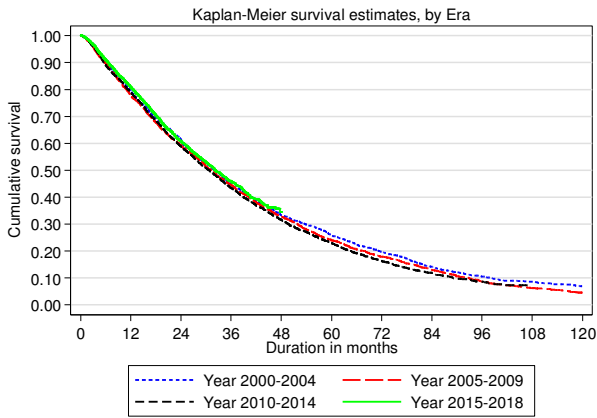


Figure 10.3.1(b): Unadjusted technique survival by era, 2000-2018 (censored for death and transplant)

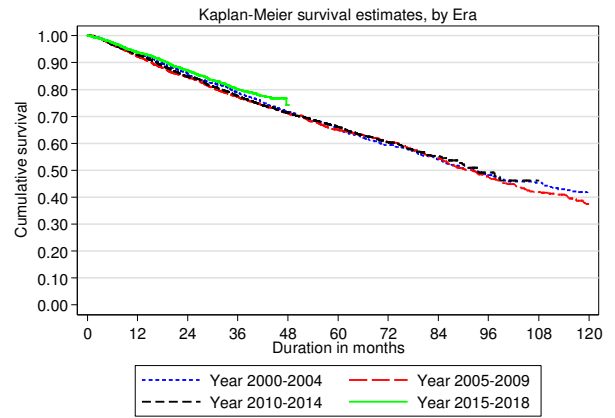


Table 10.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant)

Age group (years) Interval (month)	20-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	551	100		1464	100		1954	100	
6	462	94	1	1115	93	1	1524	94	1
12	409	87	2	967	86	1	1292	85	1
24	294	74	2	706	73	1	911	69	1
36	236	66	2	509	62	2	647	56	1
48	175	55	3	366	52	2	438	43	1
60	121	44	3	261	42	2	315	36	1
72	86	38	3	193	35	2	219	29	1
84	67	33	3	130	28	2	145	22	1
96	39	23	3	86	21	2	98	17	1
108	30	20	3	54	16	2	75	14	1
120	21	15	3	33	12	2	56	12	1

Age group (years) Interval (month)	45-54			55-64			>=65		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	3496	100		4309	100		3299	100	
6	2714	92	1	3358	90	0	2507	84	1
12	2261	82	1	2782	79	1	1989	71	1
24	1557	62	1	1780	57	1	1191	48	1
36	1044	47	1	1089	39	1	679	32	1
48	673	36	1	638	27	1	335	20	1
60	436	27	1	352	18	1	172	12	1
72	269	19	1	200	11	1	95	8	1
84	165	13	1	109	7	1	48	5	1
96	98	9	1	55	4	1	23	3	0
108	66	7	1	35	3	0	13	2	0
120	40	5	1	21	2	0	7	1	0

Table 10.3.2(b): Unadjusted technique survival by age (censored for death and transplant)

Age group (years) Interval (month)	20-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	551	100		1464	100		1954	100	
6	462	96	1	1115	96	1	1524	98	0
12	409	93	1	967	92	1	1292	93	1
24	294	83	2	706	83	1	911	85	1
36	236	76	2	509	75	1	647	76	1
48	175	68	3	366	68	2	438	68	1
60	121	58	3	261	60	2	315	63	2
72	86	52	3	193	55	2	219	58	2
84	67	49	3	130	50	2	145	52	2
96	39	37	4	86	44	3	98	47	2
108	30	36	4	54	38	3	75	43	3
120	21	31	4	33	33	3	56	40	3

Age group (years) Interval (month)	45-54			55-64			>=65		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	3496	100		4309	100		3299	100	
6	2714	97	0	3358	97	0	2507	97	0
12	2261	92	1	2782	93	0	1989	95	0
24	1557	85	1	1780	85	1	1191	89	1
36	1044	79	1	1089	77	1	679	84	1
48	673	73	1	638	72	1	335	79	1
60	436	67	1	352	67	1	172	76	2
72	269	61	2	200	62	2	95	74	2
84	165	53	2	109	58	2	48	69	3
96	98	45	2	55	55	2	23	67	4
108	66	41	3	35	49	3	13	67	4
120	40	36	3	21	45	4	7	67	4

Figure 10.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant)

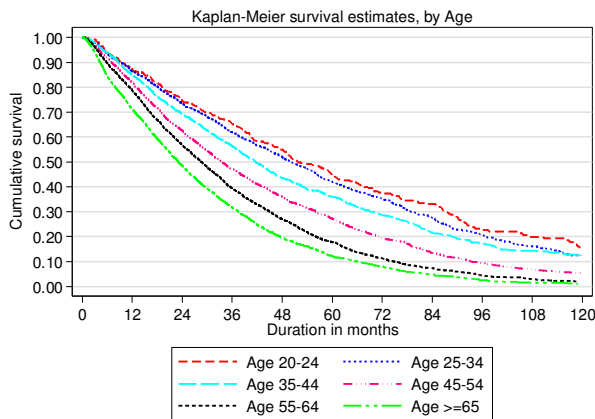


Figure 10.3.2(b): Unadjusted technique survival by age (censored for death and transplant)

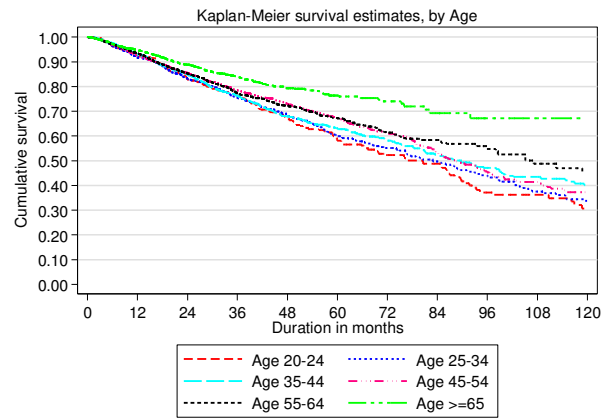


Table 10.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant)

Gender Interval (months)	Male			Female		
	n	% Survival	SE	n	% Survival	SE
0	7678	100		7395	100	
6	6559	90	0	6317	90	0
12	5436	79	0	5312	80	0
24	3560	58	1	3643	61	1
36	2277	42	1	2479	47	1
48	1371	29	1	1641	36	1
60	847	21	1	1110	28	1
72	539	15	1	739	21	1
84	318	10	0	508	16	1
96	185	7	0	324	11	1
108	125	5	0	228	9	0
120	79	4	0	153	7	0

Table 10.3.3(b): Unadjusted technique survival by gender (censored for death and transplant)

Gender Interval (months)	Male			Female		
	n	% Survival	SE	n	% Survival	SE
0	7678	100		7395	100	
6	6559	97	0	6317	97	0
12	5436	93	0	5312	93	0
24	3560	85	0	3643	86	0
36	2277	78	1	2479	80	1
48	1371	71	1	1641	74	1
60	847	65	1	1110	68	1
72	539	59	1	739	63	1
84	318	52	1	508	58	1
96	185	46	2	324	52	1
108	125	42	2	228	48	1
120	79	38	2	153	43	2

Figure 10.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant)

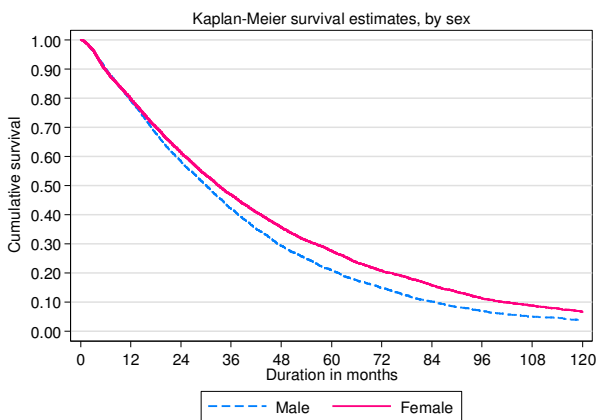


Figure 10.3.3(b): Unadjusted technique survival by gender (censored for death and transplant)

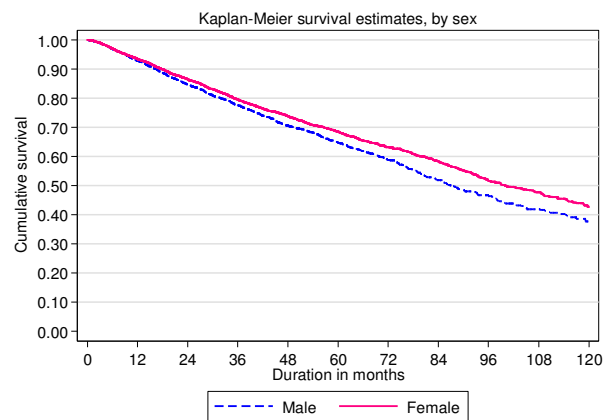


Table 10.3.4(a): Unadjusted technique survival by diabetes status (uncensored for death and transplant)

Diabetes status Interval (month)	Non-diabetic			Diabetic		
	n	% Survival	SE	n	% Survival	SE
0	5956	100		9117	100	
6	5258	92	0	7618	88	0
12	4570	84	0	6178	76	0
24	3366	69	1	3837	53	1
36	2520	58	1	2236	35	1
48	1745	46	1	1267	23	1
60	1267	37	1	690	15	0
72	884	29	1	395	10	0
84	608	23	1	218	6	0
96	400	17	1	108	4	0
108	293	13	1	60	2	0
120	204	10	1	28	1	0

Table 10.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant)

Diabetes status Interval (month)	Non-diabetic			Diabetic		
	n	% Survival	SE	n	% Survival	SE
0	5956	100		9117	100	
6	5258	97	0	7618	97	0
12	4570	94	0	6178	92	0
24	3366	87	0	3837	84	0
36	2520	81	1	2236	77	1
48	1745	74	1	1267	71	1
60	1267	68	1	690	65	1
72	884	63	1	395	60	1
84	608	57	1	218	54	1
96	400	51	1	108	47	2
108	293	47	1	60	43	2
120	204	42	2	28	38	3

Figure 10.3.4(a): Unadjusted technique survival by Diabetes status (uncensored for death and transplant)

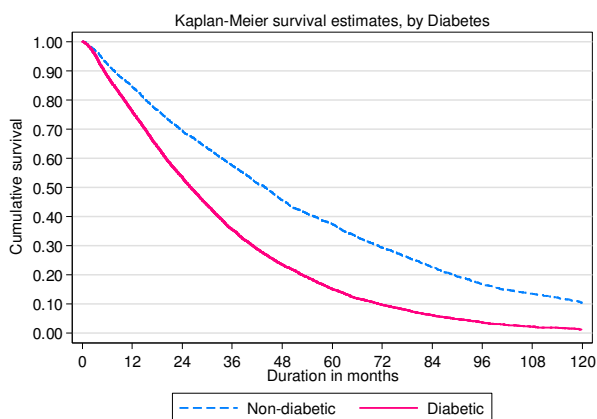


Figure 10.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant)

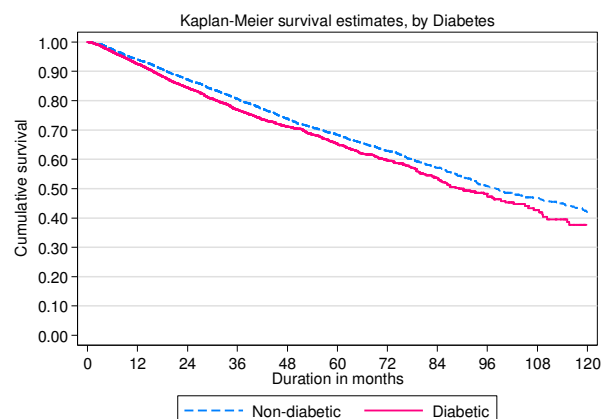
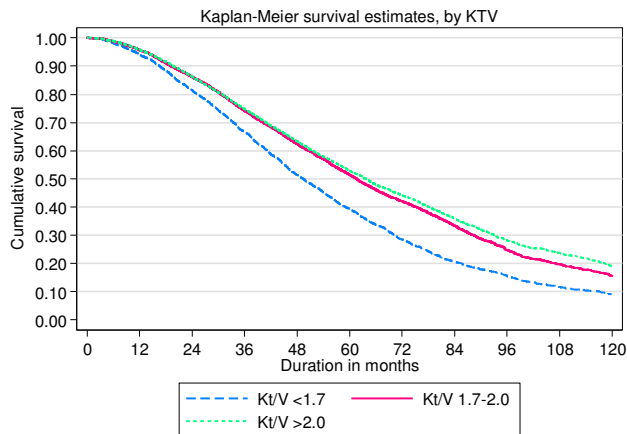


Table 10.3.5: Unadjusted technique survival by Kt/V

Kt/V Interval (months)	<1.7			1.7-2.0			>2.0		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	8115	100		9585	100		16491	100	
6	7897	98	0	9391	99	0	16208	99	0
12	7413	94	0	8963	96	0	15420	96	0
24	6012	81	0	7670	86	0	13186	86	0
36	4518	67	1	6190	74	0	10704	75	0
48	3090	51	1	4743	62	1	8259	63	0
60	2043	39	1	3509	51	1	6319	53	0
72	1307	28	1	2631	42	1	4798	44	0
84	822	21	1	1852	33	1	3578	36	0
96	543	15	1	1223	25	1	2527	28	0
108	376	12	0	886	20	1	1960	24	0
120	255	9	0	623	16	0	1421	19	0

Figure 10.3.5: Unadjusted technique survival by Kt/V



In 2018, death is the main factor for PD drop out, contributing to 71% (Table 10.3.7). This is followed by PD infections (15%) as the second commonest cause for PD drop out. This trend has been consistent from 2008-2018 (Figure 10.3.7). Over the years, the number of PD drop-out occurring less than 12 months on therapy is low and has reduced compared to earlier years (Table 10.3.8).

Table 10.3.6:-Reasons for drop-out from PD program, 2008-2018

Year Reasons	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
Death	803	71	753	74	720	68	607	65	557	72	445	69
Transplant	18	2	6	1	6	1	6	1	5	1	8	1
Inadequate clearance	27	2	25	2	38	4	27	3	29	4	28	4
Inadequate ultrafiltration	7	1	13	1	10	1	7	1	4	1	2	0
PD infections	174	15	130	13	170	16	161	17	101	13	106	16
Catheter related issues	38	3	16	2	22	2	8	1	7	1	4	1
Social reasons	17	2	8	1	24	2	26	3	15	2	13	2
Others	31	3	28	3	26	2	28	3	16	2	16	2
Unknown	11	1	38	4	39	4	61	7	38	5	24	4
Total	1126	100	1017	100	1055	100	931	100	772	100	646	100

Year Reasons	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
Death	384	70	360	67	338	68	310	66	266	66
Transplant	7	1	6	1	5	1	6	1	8	2
Inadequate clearance	18	3	20	4	10	2	9	2	12	3
Inadequate ultrafiltration	2	0	1	0	1	0	0	0	0	0
PD infections	81	15	85	16	93	19	92	20	65	16
Catheter related issues	11	2	12	2	8	2	13	3	3	1
Social reasons	9	2	15	3	5	1	18	4	38	9
Others	10	2	7	1	13	3	3	1	2	0
Unknown	24	4	30	6	24	5	20	4	7	2
Total	546	100	536	100	497	100	471	100	401	100

Figure 10.3.6: Reasons for drop-out from PD program, 2008-2018

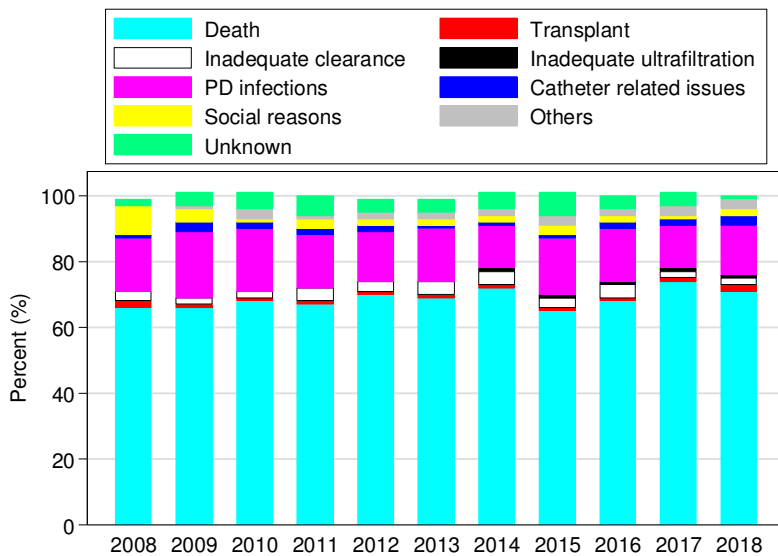


Table 10.3.7: Drop-out rate from PD program with time on treatment, 2008-2018

Year Time	2018		2017		2016		2015		2014		2013		2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
< 3 months	41	4	48	5	43	4	63	7	42	5	41	6	34	6	29	5	20	4	35	7	28	7
3-<6 months	77	7	73	7	84	8	88	9	79	10	55	9	58	11	51	10	42	8	38	8	28	7
6- <12 months	151	13	117	12	145	14	139	15	95	12	83	13	74	14	76	14	73	15	76	16	64	16
>=12 months	857	76	779	77	783	74	641	69	556	72	467	72	380	70	380	71	362	73	322	68	281	70
Total	1126	100	1017	100	1055	100	931	100	772	100	646	100	546	100	536	100	497	100	471	100	401	100

SECTION 10.4: PERITONITIS

The median peritonitis rate in 2018 is 1 in 42.6 patient-months or 0.28 episodes/year. There is still significant inter-centre variation as illustrated in Figure 10.4.1, but the gap between the UQ and LQ has been closing over the last few years. The contribution of gram positive and gram negative organisms to peritonitis is 27.9 % and 26% respectively, while fungal and mycobacterial infections account for 3.7% and 1% respectively. There have been no significant changes in the relative contributions of these causative organisms over the last 5 years. Culture-negative peritonitis rates remain unacceptably high at 30.4% of all episodes in 2018.

In terms of overall outcomes, 68.8% of peritonitis episodes resolved but 27.6% resulted in catheter loss. The mortality rate in 2018 was 3.2% with highest mortality seen in infections due to fungal, mycobacterial and gram negative infections. Comparing the eras of 2009-2013 and 2014-2018, improved outcomes have been seen for Pseudomonal infections with more resolution and less catheter loss. There has also been less mortality from Mycobacterial infections, likely related to more aggressive management with early removal of catheters.

Multivariate analysis indicates that age above 65 years, diabetes and requirement for assistance with PD are risk factors associated with peritonitis.

Table 10.4.1: Variation of peritonitis rate (pt-month/epi) among PD centres, 2008-2018

Year	Number of centres	Min	5 th Centile	LQ	Median	UQ	95 th Centile	Max
2018	36	7.5	8.8	35.5	42.6	55.7	86.2	95.9
2017	35	10.4	19.4	38.1	42.7	53.2	69.3	190.1
2016	31	9.2	22.0	35.4	42.8	61.7	111.2	158.6
2015	29	3.5	14.3	27.5	39.2	55.1	84.4	102.7
2014	26	11.1	26.8	31.6	41.8	65.4	350.0	363.3
2013	22	14.5	30.4	33.7	44.5	53.8	68.2	91.3
2012	23	13.5	36.0	41.4	48.8	73.4	90.6	171.5
2011	22	6.5	7.2	30.6	42.5	65.9	112.7	257.1
2010	20	19.3	20.5	32.9	42.3	53.9	75.0	76.9
2009	20	13.2	17.0	28.3	41.7	57.7	164.1	230.1
2008	19	12.0	12.0	30.0	42.3	57.2	98.8	98.8

Figure 10.4.1: Variation in peritonitis rate among PD centres, 2018

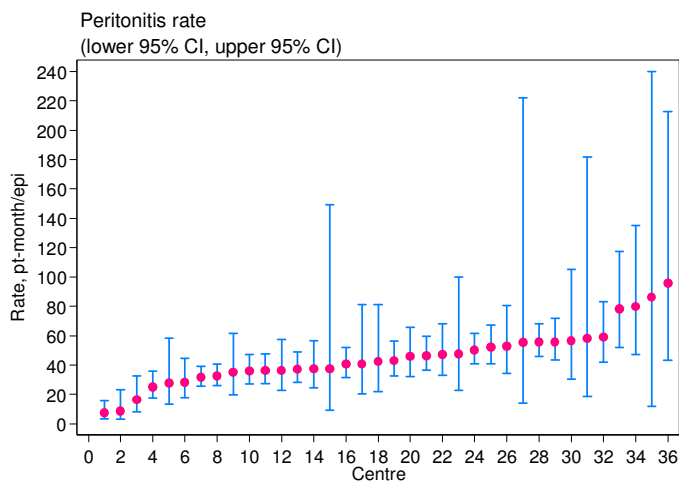


Table 10.4.2: Causative organism in PD peritonitis, 2008-2018

	2018		2017		2016		2015		2014		2013	
	n	%	n	%	n	%	n	%	n	%	n	%
(A) Gram Positives												
<i>Staph. aureus</i>	128	11.1	132	13.0	93	9.8	96	9.6	85	11.9	97	15.6
Staph Coagulase Neg.	117	10.1	117	11.5	127	13.4	137	13.6	77	10.8	57	9.2
Strep	54	4.7	69	6.8	58	6.1	73	7.3	57	8.0	52	8.4
Others	23	2.0	33	3.3	31	3.3	42	4.2	22	3.1	30	4.8
(B) Gram Negatives												
Pseudomonas	71	6.1	54	5.3	51	5.4	57	5.7	41	5.7	31	5.0
Acinetobacter	24	2.1	25	2.5	34	3.6	26	2.6	20	2.8	18	2.9
Klebsiella	74	6.4	48	4.7	52	5.5	55	5.5	50	7.0	34	5.5
Enterobacter	23	2.0	22	2.2	28	3.0	16	1.6	14	2.0	10	1.6
E.Coli	74	6.4	81	8.0	89	9.4	73	7.3	55	7.7	44	7.1
Others	35	3.0	33	3.3	31	3.3	16	1.6	19	2.7	11	1.8
(C) Polymicrobial	0	0.0	6	0.6	22	2.3	30	3.0	22	3.1	16	2.6
(D) Others												
Fungal	43	3.7	44	4.3	31	3.3	39	3.9	15	2.1	25	4.0
Mycobacterium	12	1.0	9	0.9	7	0.7	2	0.2	6	0.8	5	0.8
Others	128	11.1	92	9.1	55	5.8	70	7.0	46	6.4	32	5.2
(E) No growth	352	30.4	250	24.6	239	25.2	273	27.2	185	25.9	158	25.5
Total	1158	100	1015	100	948	100	1005	100	714	100	620	100

	2012		2011		2010		2009		2008	
	n	%	n	%	n	%	n	%	n	%
(A) Gram Positives										
<i>Staph. aureus</i>	65	14.1	73	15.2	70	15.7	49	10.8	39	9.1
Staph Coagulase Neg.	47	10.2	44	9.1	48	10.8	50	11.0	46	10.7
Strep	37	8.0	32	6.7	11	2.5	16	3.5	19	4.4
Others	18	3.9	19	4.0	5	1.1	6	1.3	7	1.6
(B) Gram Negatives										
Pseudomonas	15	3.3	40	8.3	31	7.0	31	6.8	38	8.8
Acinetobacter	12	2.6	18	3.7	9	2.0	17	3.8	19	4.4
Klebsiella	26	5.6	29	6.0	28	6.3	25	5.5	23	5.3
Enterobacter	7	1.5	8	1.7	6	1.3	12	2.6	3	0.7
E.Coli	44	9.5	44	9.1	51	11.4	34	7.5	42	9.8
Others	11	2.4	8	1.7	7	1.6	8	1.8	7	1.6
(C) Polymicrobial	0	0.0	0	0.0	4	0.9	13	2.9	0	0.0
(D) Others										
Fungal	17	3.7	18	3.7	11	2.5	16	3.5	21	4.9
Mycobacterium	2	0.4	4	0.8	0	0.0	1	0.2	3	0.7
Others	33	7.2	25	5.2	31	7.0	14	3.1	21	4.9
(E) No growth	127	27.5	119	24.7	134	30.0	161	35.5	142	33.0
Total	461	100	481	100	446	100	453	100	430	100

Figure 10.4.2: Causative organism in PD peritonitis, 2008-2018

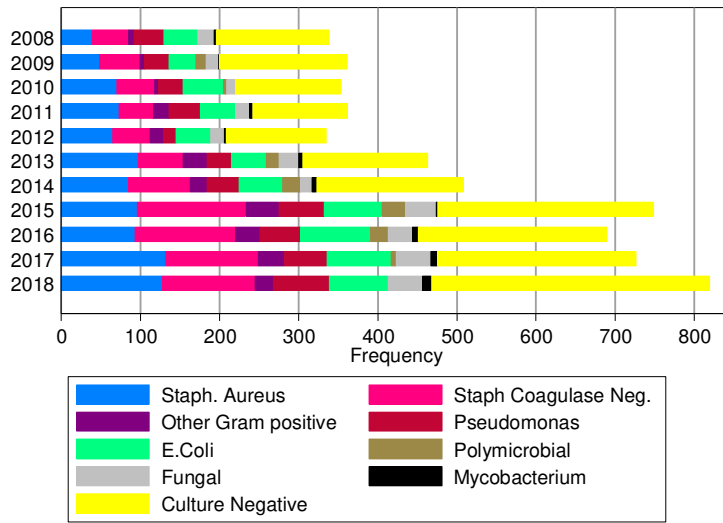


Table 10.4.3: Overall outcomes of PD peritonitis, 2008-2018

Year	Resolved		Relapsed Then Resolved		Relapsed Catheter Removed		Not Resolved Catheter Removed		Death		Unknown		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n
2018	780	66.3	29	2.5	37	3.1	288	24.5	38	3.2	5	0.4	1177
2017	729	70.6	21	2.0	9	0.9	230	22.3	39	3.8	4	0.4	1032
2016	655	66.1	27	2.7	11	1.1	235	23.7	33	3.3	30	3.0	991
2015	678	65.1	31	3.0	15	1.4	272	26.1	24	2.3	22	2.1	1042
2014	459	61.0	34	4.5	7	0.9	184	24.5	40	5.3	28	3.7	752
2013	436	67.4	13	2.0	8	1.2	141	21.8	23	3.6	26	4.0	647
2012	304	60.7	12	2.4	25	5.0	115	23.0	19	3.8	26	5.2	501
2011	295	57.8	25	4.9	17	3.3	108	21.2	26	5.1	39	7.6	510
2010	248	54.0	12	2.6	17	3.7	117	25.5	29	6.3	36	7.8	459
2009	278	58.3	21	4.4	10	2.1	108	22.6	25	5.2	35	7.3	477
2008	261	59.0	21	4.8	12	2.7	104	23.5	16	3.6	28	6.3	442

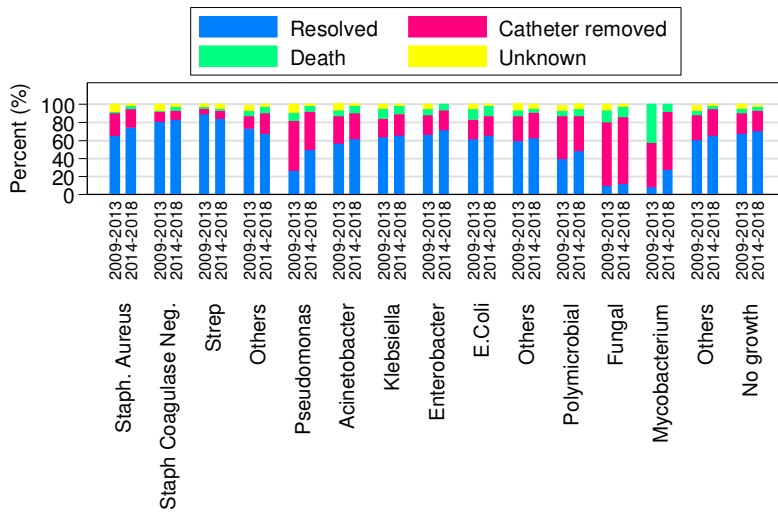
Table 10.4.4(a): Outcome of peritonitis by causative organism, 2009-2013

	Resolved		Catheter removed		Outcome Death		Unknown		Total	
	n	%	n	%	n	%	n	%	n	%
(A) Gram Positives										
Staph. Aureus	233	66	86	24	8	2	27	8	354	100
Staph Coagulase Neg.	200	81	27	11	3	1	16	7	246	100
Strep	131	89	10	7	3	2	4	3	148	100
Others	57	73	11	14	5	6	5	6	78	100
(B) Gram Negatives										
Pseudomonas	40	27	82	55	13	9	13	9	148	100
Acinetobacter	42	57	22	30	5	7	5	7	74	100
Klebsiella	91	64	28	20	17	12	6	4	142	100
Enterobacter	29	67	9	21	3	7	2	5	43	100
E.Coli	135	62	46	21	25	12	11	5	217	100
Others	27	60	12	27	3	7	3	7	45	100
(C) Polymicrobial	13	39	16	48	2	6	2	6	33	100
(D) Others										
Fungal	8	9	62	71	12	14	5	6	87	100
Mycobacterium	1	8	6	50	5	42	0	0	12	100
Others	83	61	37	27	7	5	8	6	135	100
(E) No growth	472	68	154	22	45	6	28	4	699	100

Table 10.4.4(b): Outcome of peritonitis by causative organism, 2014-2018

	Resolved		Catheter removed		Outcome Death		Unknown		Total	
	n	%	n	%	n	%	n	%	n	%
(A) Gram Positives										
Staph. Aureus	396	74	111	21	20	4	7	1	534	100
Staph Coagulase Neg.	480	83	55	10	29	5	11	2	575	100
Strep	261	84	29	9	10	3	11	4	311	100
Others	103	68	33	22	12	8	3	2	151	100
(B) Gram Negatives										
Pseudomonas	134	49	119	43	18	7	3	1	274	100
Acinetobacter	80	62	36	28	11	9	2	2	129	100
Klebsiella	185	66	63	23	28	10	3	1	279	100
Enterobacter	74	72	23	22	6	6	0	0	103	100
E.Coli	246	66	78	21	45	12	3	1	372	100
Others	84	63	38	28	7	5	5	4	134	100
(C) Polymicrobial	38	48	31	39	6	8	5	6	80	100
(D) Others										
Fungal	21	12	128	74	20	12	3	2	172	100
Mycobacterium	10	28	23	64	3	8	0	0	36	100
Others	259	66	112	29	17	4	3	1	391	100
(E) No growth	925	71	292	22	63	5	19	1	1299	100

Figure 10.4.4: Outcome of peritonitis by causative organism by era, 2009-2013 & 2014-2018



Outcome of peritonitis by causative organism by era

Table 10.4.5: Risk factors influencing peritonitis rate, 2001-2018

Factors	n	Risk Ratio	95% CI	P value
Age (years)				
20-24	204	1.095	(0.98, 1.23)	0.119
25-34 (ref*)	565	1.000		
35-44	712	1.019	(0.94, 1.11)	0.646
45-54	1223	1.012	(0.94, 1.09)	0.758
55-64	1441	1.080	(1.00, 1.17)	0.057
>=65	963	1.172	(1.07, 1.28)	<0.001
Gender				
Male (ref*)	2503	1.000		
Female	2605	0.957	(0.92, 0.99)	0.045
Diabetes				
No (ref*)	2156	1.000		
Yes	2952	1.183	(1.13, 1.24)	<0.001
Income				
<RM 1000 (ref*)	2037	1.000		
RM 1000-3000	2372	0.920	(0.88, 0.96)	<0.001
RM 3001-5000	598	0.929	(0.86, 0.99)	0.045
RM 5001-10000	83	1.076	(0.89, 1.31)	0.461
>=RM 10000	18	1.080	(0.76, 1.55)	0.673
Education				
Nil	385	1.019	(0.94, 1.11)	0.659
Primary	1674	1.041	(0.99, 1.09)	0.102
Secondary (ref*)	2482	1.000		
Tertiary	567	1.001	(0.93, 1.08)	0.984
Assistance to perform CAPD				
Self care (ref*)	3048	1.000		
Partially assisted	831	1.149	(1.08, 1.22)	<0.001
Completely assisted	1229	1.184	(1.12, 1.25)	<0.001