

# **CHAPTER 9**

# **PERITONEAL DIALYSIS**

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**SECTION 9.1: MODALITIES AND PRESCRIPTION OF PD**

The prevalence of PD patients in 2023 was 8,430 which represents a growth of 6% from the previous year. CAPD is utilised for the majority of PD patients (77.6%) but there has been a steady increase in the proportion of APD to 16.5% of patients compared to 11-12% a decade ago. The proportion on DAPD remains stable at 5.1% (Table 9.1.1).

Since 2022, there have been changes in distribution between the three PD systems available in Malaysia. In 2023, the distribution was 48.4% on Baxter disconnect system, followed by 38.2% on Fresenius disconnect system and 13.3% on Lucenia (Table 9.1.2). The distribution in APD disconnect systems are 70.9%, 19.4%, 9.7% among Baxter, Fresenius and Lucenia respectively.

The majority of patients (82.6%) received standard prescriptions of 4 exchanges per day (Table 9.1.4a). However, there is an increased prescription of incremental dialysis of 3 exchanges per day or less over the last decade to 15.5% of patients in 2023. These figures naturally align with the dwell volumes being utilised. In those patients on CAPD, 80.5 % are using dwell volumes of 8L/day while 15.9% are using less 8L/day reflecting this practice of incremental PD. This trend is also seen in APD, with a 10% reduction in the proportion receiving a standard APD total dwell volume of 10L over the last decade (Table 9.1.4b).

The number of patients performing self-care, partially assisted and completely assisted CAPD in 2023 was 60.3%, 18% and 21.6% respectively. There was a reversed pattern in APD, where the majority in APD are 42.2% completely assisted, 19.4% partially assisted and 38.3% self-care (Table 9.1.5).

**Table 9.1.1: Peritoneal dialysis regimes, 2014-2023**

PD regime	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
Standard CAPD	6545	77.6	6317	79.5	5785	78.4	5377	80.3	4924	80.8
DAPD	432	5.1	415	5.2	403	5.5	334	5	307	5
Automated PD/ CCPD	1393	16.5	1148	14.4	1132	15.3	902	13.5	756	12.4
Unknown / NA	60	0.7	67	0.8	57	0.8	81	1.2	107	1.8
Total	8430	100	7947	100	7377	100	6694	100	6094	100

PD regime	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
Standard CAPD	4509	80.2	4183	78.8	3895	83.8	3604	83.6	3036	82
DAPD	279	5	195	3.7	126	2.7	157	3.6	161	4.3
Automated PD/ CCPD	648	11.5	593	11.2	566	12.2	520	12.1	470	12.7
Unknown / NA	186	3.3	335	6.3	61	1.3	29	0.7	35	0.9
Total	5622	100	5306	100	4648	100	4310	100	3702	100

**Table 9.1.2: PD connectology, 2014-2023**

PD connectology	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
<b>CAPD</b>	<b>6977</b>	<b>100</b>	<b>6732</b>	<b>100</b>	<b>6188</b>	<b>100</b>	<b>5711</b>	<b>100</b>	<b>5231</b>	<b>100</b>
Baxter	3376	48.4	3468	51.5	3286	53.1	3134	54.9	3008	57.5
Fresenius	2666	38.2	2781	41.3	2705	43.7	2416	42.3	2148	41.1
Lucenia / Peritone	930	13.3	9	0.1	14	0.2	28	0.5	31	0.6
Others	2	0	0	0	0	0	0	0	0	0
Unknown / NA	3	0	474	7	183	3	133	2.3	44	0.8
<b>APD</b>	<b>1393</b>	<b>100</b>	<b>1148</b>	<b>100</b>	<b>1132</b>	<b>100</b>	<b>902</b>	<b>100</b>	<b>756</b>	<b>100</b>
Baxter	987	70.9	756	65.9	776	68.6	655	72.6	570	75.4
Fresenius	270	19.4	226	19.7	225	19.9	185	20.5	157	20.8
Lucenia	135	9.7	139	12.1	107	9.5	46	5.1	24	3.2
Others	1	0.1	0	0	0	0	0	0	0	0
Unknown / NA	0	0	27	2.4	24	2.1	16	1.8	5	0.7

PD connectology	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
<b>CAPD</b>	<b>4788</b>	<b>100</b>	<b>4378</b>	<b>100</b>	<b>4021</b>	<b>100</b>	<b>3761</b>	<b>100</b>	<b>3197</b>	<b>100</b>
Baxter	2790	58.3	2482	56.7	2393	59.5	2471	65.7	2321	72.6
Fresenius	1980	41.4	1874	42.8	1613	40.1	1273	33.8	869	27.2
Lucenia / Peritone	0	0	1	0	3	0.1	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown / NA	18	0.4	21	0.5	12	0.3	17	0.5	7	0.2
<b>APD</b>	<b>648</b>	<b>100</b>	<b>593</b>	<b>100</b>	<b>566</b>	<b>100</b>	<b>520</b>	<b>100</b>	<b>470</b>	<b>100</b>
Baxter	478	73.8	413	69.6	409	72.3	394	75.8	385	81.9
Fresenius	145	22.4	136	22.9	125	22.1	106	20.4	81	17.2
Lucenia	23	3.5	41	6.9	32	5.7	20	3.8	0	0
Others	0	0	0	0	0	0	0	0	0	0
Unknown / NA	2	0.3	3	0.5	0	0	0	0	4	0.9

**Table 9.1.3: Number of patients on polymer glucose, Icodextrin, 2018-2023**

	2023	2022	2021	2020	2019	2018
	n	n	n	n	n	n
Polymer glucose, Icodextrin	517	446	519	433	386	400

**Table 9.1.4(a): CAPD Number of Exchanges per day, 2014-2023**

Number of exchanges/ day	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
1	7	0.1	5	0.1	8	0.1	10	0.2	9	0.2
2	33	0.5	30	0.4	24	0.4	18	0.3	28	0.5
3	1040	14.9	834	12.4	595	9.6	455	8	430	8.2
4	5763	82.6	5724	85	5417	87.5	5076	88.9	4608	88.1
5	118	1.7	104	1.5	122	2	125	2.2	135	2.6
Unknown / NA	16	0.2	35	0.5	22	0.4	27	0.5	21	0.4
Total	6977	100	6732	100	6188	100	5711	100	5231	100

Number of exchanges/ day	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
1	6	0.1	5	0.1	6	0.1	5	0.1	5	0.1
2	19	0.4	14	0.3	9	0.2	8	0.2	9	0.2
3	365	7	246	5.1	173	3.8	162	3.8	149	4.1
4	4660	89.8	4432	92	4197	92.6	3947	93.4	3409	93.2
5	101	1.9	69	1.4	59	1.3	44	1	37	1
Unknown / NA	37	0.7	49	1	87	1.9	58	1.4	48	1.3
Total	5188	100	4815	100	4531	100	4224	100	3657	100

**Table 9.1.4(b) (i): CAPD total dwell volumes per day, 2014-2023**

Total dwell volumes /day	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
Less than 8	1112	15.9	952	13.6	735	11.2	596	9.8	590	10.5
8	5617	80.5	5798	82.9	5596	85	5255	86.4	4808	85.8
10	217	3.1	207	3	214	3.3	192	3.2	170	3
12	9	0.1	9	0.1	9	0.1	7	0.1	7	0.1
Unknown / NA	22	0.3	32	0.5	27	0.4	30	0.5	26	0.5
Total	6977	100	6998	100	6581	100	6080	100	5601	100

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

**Table 9.1.4(b) (ii): APD total dwell volumes per day, 2014-2023**

Total dwell volumes /day	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
Less than 8	183	13.2	93	8.3	112	9.7	76	8.2	74	9.6
8	41	2.9	34	3	32	2.8	26	2.8	27	3.5
10	897	64.5	637	57	710	61.7	604	65.5	528	68.3
12	59	4.2	36	3.2	45	3.9	47	5.1	50	6.5
14	1	0.1	10	0.9	8	0.7	6	0.7	5	0.6
Unknown / NA	212	15.2	307	27.5	243	21.1	163	17.7	89	11.5
<b>Total</b>	<b>1393</b>	<b>100.0</b>	<b>1117</b>	<b>100</b>	<b>1150</b>	<b>100</b>	<b>922</b>	<b>100</b>	<b>773</b>	<b>100</b>

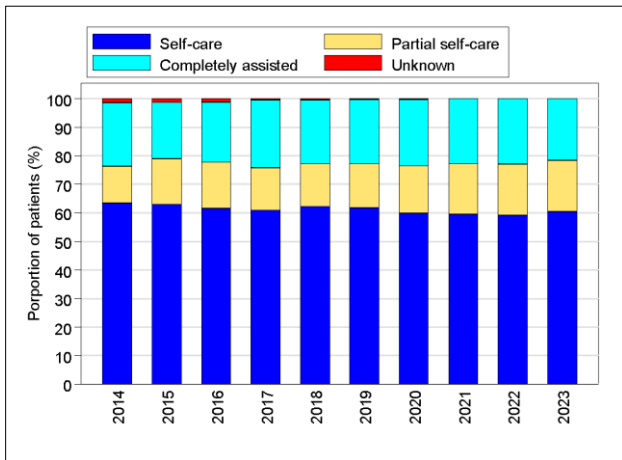
Total dwell volumes /day	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
Less than 8	51	7.6	39	6.5	38	6.3	33	6	36	7
8	25	3.7	25	4.2	23	3.8	15	2.7	16	3.1
10	466	69.9	415	69.4	416	68.8	389	70.3	383	74.2
12	50	7.5	59	9.9	90	14.9	82	14.8	55	10.7
14	5	0.7	3	0.5	17	2.8	7	1.3	6	1.2
Unknown / NA	70	10.5	57	9.6	21	3.5	27	4.9	20	3.9
<b>Total</b>	<b>667</b>	<b>100</b>	<b>598</b>	<b>100</b>	<b>605</b>	<b>100</b>	<b>553</b>	<b>100</b>	<b>516</b>	<b>100</b>

**Table 9.1.5: Assistance to Perform PD, 2014-2023**

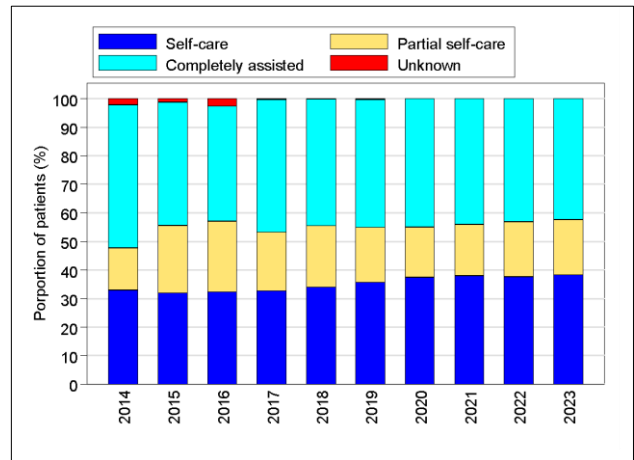
PD Regime / Assistant	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
<b>CAPD</b>	<b>6977</b>	<b>100</b>	<b>6732</b>	<b>100</b>	<b>6188</b>	<b>100</b>	<b>5711</b>	<b>100</b>	<b>5231</b>	<b>100</b>
Self-care	4210	60.3	3978	59.1	3673	59.4	3415	59.8	3232	61.8
Partial self-care	1256	18	1203	17.9	1093	17.7	950	16.6	806	15.4
Completely assisted	1508	21.6	1539	22.9	1412	22.8	1333	23.3	1174	22.4
Unknown / NA	3	0	12	0.2	10	0.2	13	0.2	19	0.4
<b>Automated PD</b>	<b>1393</b>	<b>100</b>	<b>1148</b>	<b>100</b>	<b>1132</b>	<b>100</b>	<b>902</b>	<b>100</b>	<b>756</b>	<b>100</b>
Self-care	534	38.3	432	37.6	430	38	338	37.5	270	35.7
Partial self-care	270	19.4	221	19.3	204	18	159	17.6	145	19.2
Completely assisted	588	42.2	494	43	497	43.9	404	44.8	339	44.8
Unknown / NA	1	0.1	1	0.1	1	0.1	1	0.1	2	0.3

PD Regime / Assistant	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
<b>CAPD</b>	<b>4788</b>	<b>100</b>	<b>4378</b>	<b>100</b>	<b>4021</b>	<b>100</b>	<b>3761</b>	<b>100</b>	<b>3197</b>	<b>100</b>
Self-care	2973	62.1	2666	60.9	2474	61.5	2367	62.9	2030	63.5
Partial self-care	720	15	649	14.8	650	16.2	604	16.1	405	12.7
Completely assisted	1074	22.4	1040	23.8	849	21.1	736	19.6	714	22.3
Unknown / NA	21	0.4	23	0.5	48	1.2	54	1.4	48	1.5
<b>Automated PD</b>	<b>648</b>	<b>100</b>	<b>593</b>	<b>100</b>	<b>566</b>	<b>100</b>	<b>520</b>	<b>100</b>	<b>470</b>	<b>100</b>
Self-care	220	34	194	32.7	183	32.3	166	31.9	155	33
Partial self-care	139	21.5	122	20.6	140	24.7	123	23.7	69	14.7
Completely assisted	287	44.3	275	46.4	228	40.3	224	43.1	236	50.2
Unknown / NA	2	0.3	2	0.3	15	2.7	7	1.3	10	2.1

**Figure 9.1.5(a): Assistance to Perform CAPD, 2014-2023**



**Figure 9.1.5(b): Assistance to Perform APD, 2014-2023**



**SECTION 9.2: ACHIEVEMENT OF SOLUTE CLEARANCE AND PERITONEAL TRANSPORT**

Over the past ten years, the percentage of patients achieving the target delivered Kt/V of  $\geq 1.7$  has gradually declined. This decline is attributed to a shift in clinical practice priorities, moving away from a focus on Kt/V targets towards a more quality-oriented approach in peritoneal dialysis care.

There is a wide inter-centre variation in the proportion of patients achieving the delivered Kt/V in 2023. The percentage of patients achieving  $KT/V \geq 1.7$  fluctuates between centres (Table and Figure 9.2.2). This variability may be due to differences in patient demographics, selection criteria, training or clinical practices at each centre.

Majority of incident PD patients exhibit low-average and high-average membrane transport status. This distribution proportion remains consistent across dialysis vintage, even after 10 years of therapy (Table 9.2.3).

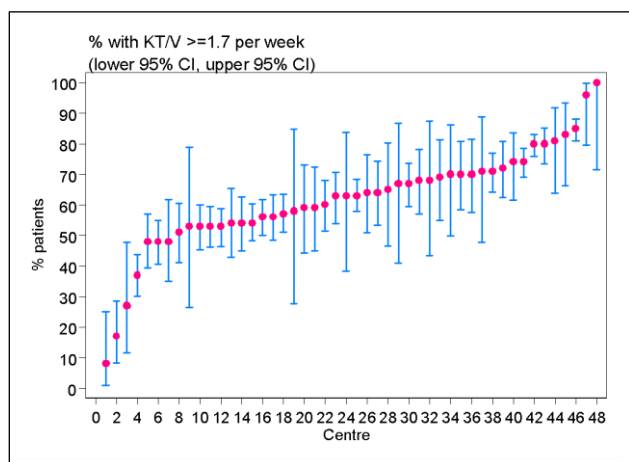
**Table 9.2.1: Distribution of delivered Kt/V, PD patients 2014-2023**

Year	Number of Patients	Mean	SD	Median	LQ	UQ	% patients $\geq 1.7$ per week
2023	6142	1.9	0.5	1.8	1.6	2.1	63
2022	5826	1.9	0.5	1.8	1.6	2.1	65
2021	5573	1.9	0.5	1.8	1.6	2.1	65
2020	5234	1.9	0.5	1.8	1.6	2.1	67
2019	4960	1.9	0.5	1.9	1.6	2.2	69
2018	4399	1.9	0.5	1.9	1.6	2.2	69
2017	4075	2	0.5	1.9	1.7	2.2	72
2016	3809	2	0.5	1.9	1.7	2.3	74
2015	3477	2	0.5	2	1.7	2.3	74
2014	3022	2	0.5	1.9	1.7	2.3	74

**Table 9.2.2: Variation in proportion of patients with Kt/V  $\geq 1.7$  per week among PD centres, 2014-2023**

Year	Number of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
2023	48	8	27	53.5	63	70.5	85	100
2022	47	30	33	56	65	78	86	91
2021	44	23	45	52.5	64	72	82	90
2020	42	22	50	55	65	75	82	92
2019	38	14	32	59	67	77	90	96
2018	35	20	31	59	68	78	90	95
2017	33	37	38	63	68	79	88	89
2016	32	50	54	63.5	74.5	82.5	89	92
2015	30	47	55	66	74.5	80	89	91
2014	28	44	47	66.5	73.5	80	89	89

**Figure 9.2.2: Variation in proportion of patients with Kt/V  $\geq 1.7$  per week among PD centres 2014-2023**



**Table 9.2.3: Peritoneal transport status by PET D/P creatinine at 4 hours, incident PD patients 2014-2023**

Year	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
Low	159	8.5	155	8.1	94	5.6	73	4.7	65	4.5
Low average	345	18.4	432	22.7	379	22.4	328	21	311	21.7
High average	326	17.4	525	27.6	528	31.2	530	33.9	543	37.9
High	129	6.9	254	13.3	241	14.2	237	15.2	260	18.1
Unknown / NA	918	48.9	539	28.3	450	26.6	396	25.3	255	17.8
Total	1877	100	1905	100	1692	100	1564	100	1434	100

Year	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
Low	40	3.2	45	4	40	4	40	3.5	35	3.5
Low average	257	20.9	288	25.4	240	23.8	243	21.4	235	23.6
High average	477	38.7	429	37.9	361	35.8	414	36.4	317	31.8
High	258	21	211	18.6	173	17.2	207	18.2	175	17.6
Unknown / NA	199	16.2	160	14.1	193	19.2	233	20.5	235	23.6
Total	1231	100	1133	100	1007	100	1137	100	997	100



**Table 9.2.4: Peritoneal Transport Status (PET) in 2023 with dialysis vintage 0 to 10 years**

Duration (year)	<1		1 - <2		2 - <3		3 - <4		4 - <5		5 - <6	
	n	%	n	%	n	%	n	%	n	%	n	%
Low	201	17.9	204	16.3	120	15.1	73	13.6	63	14.5	33	13.7
Low Average	391	34.8	440	35.1	288	36.3	182	33.9	163	37.6	98	40.7
High Average	380	33.8	444	35.4	289	36.4	220	41	147	33.9	88	36.5
High	151	13.4	167	13.3	97	12.2	62	11.5	61	14.1	22	9.13
Total	1123	100	1255	100	794	100	537	100	434	100	241	100

Duration (year)	6 - <7		7 - <8		8 - <9		9 - <10		10		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Low	18	12.9	17	17	17	17.5	10	20.4	0	0	756	15.8
Low Average	53	37.9	43	43	32	33	15	30.6	0	0	1705	35.7
High Average	54	38.6	32	32	33	34	20	40.8	0	0	1707	35.8
High	15	10.7	8	8	15	15.5	4	8.16	0	0	602	12.6
Total	140	100	100	100	97	100	49	100	0	0	4770	100

**SECTION 9.3: TECHNIQUE SURVIVAL ON PD**

Table and Figure 9.3.1(a) & (b) illustrates no difference in PD technique survival (uncensored or censored for death and transplant) between the different eras. After censoring for death and transplant, the technique survival in the latter era is lower than the former era.

Younger age had better technique survival compared to older age in uncensored for death and transplant (Table & Figure 9.3.2 (a)). However, this observation is reversed after censoring for death and transplant with increasing age having better technique survival (Table & Figure 9.3.2 (b)).

Female had better technique survival than male earlier on PD therapy till 12 months in uncensored for death and transplant. However, there was no difference between gender after 12 months in uncensored and censored for death and transplant (Table and Figure 6.3.3 (a) and (b)).

Diabetes had been associated with poor technique survival as early as 12 months on PD therapy in uncensored for death and transplant (Table & Figure 9.3.4(a)). After censoring for death and transplant, diabetic had worse technique survival initially but after 48 months of PD vintage, the trend changed with similar technique survival between diabetic and non-diabetic (Table & Figure 9.3.4(b)).

There was a consistent better technique survival with Kt/V >1.7 vs <1.7 and this observation occurred as early as 6 months. There was no difference in technique survival between Kt/V >1.7-2.0 or >2.0.

Technique survival was 86% at 1-year and 39% at 5-year in 2019-2023 when uncensored for death and transplant (Table 9.3.1(a)). Technique survival after censoring for death and transplant was 91% and 58% at 1-year and 5-year respectively in 2019-2023.

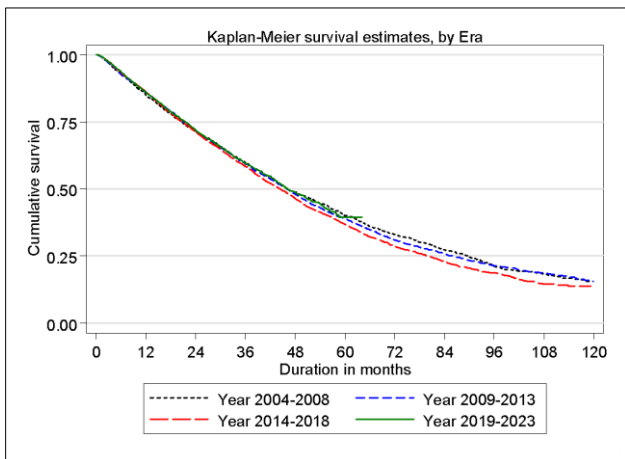
**Table 9.3.1(a): Unadjusted technique survival by era, 2004-2023 (uncensored for death and transplant)**

Era Interval (month)	2004-2008			2009-2013			2014-2018			2019-2023		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	2413	100		4086	100		6954	100		10209	100	
6	2167	93	1	3643	93	0	6284	93	0	8273	94	0
12	1886	85	1	3220	86	1	5559	86	0	6270	86	0
24	1435	71	1	2449	72	1	4169	71	1	3326	72	1
36	1069	60	1	1836	59	1	3120	58	1	1581	59	1
48	799	49	1	1348	48	1	2258	46	1	593	49	1
60	589	40	1	999	39	1	1628	37	1	6	39	2
72	442	33	1	714	31	1	901	29	1	1		
84	330	27	1	534	26	1	501	23	1	1		
96	224	21	1	389	21	1	244	19	1	1		
108	174	18	1	316	19	1	83	15	1	1		
120	134	15	1	234	15	1	3	14	1	1		

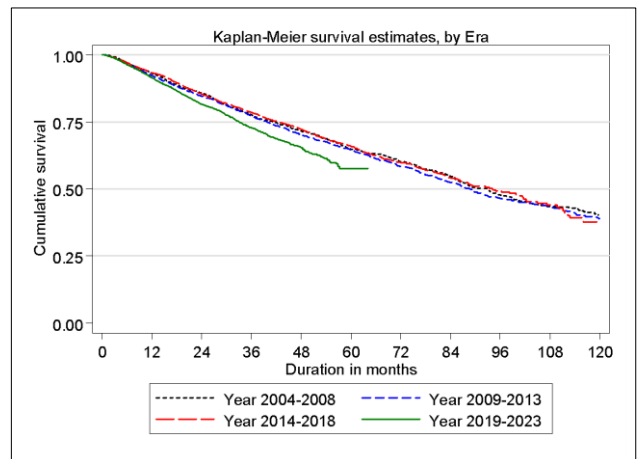
**Table 9.3.1(b): Unadjusted technique survival by era, 2004-2023 (censored for death and transplant)**

Era Interval (month)	2004-2008			2009-2013			2014-2018			2019-2023		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	2413	100		4086	100		6954	100		10209	100	
6	2167	97	0	3643	97	0	6284	97	0	8273	96	0
12	1886	93	1	3220	92	0	5559	93	0	6270	91	0
24	1435	86	1	2449	84	1	4169	85	0	3326	82	0
36	1069	78	1	1836	77	1	3120	78	1	1581	73	1
48	799	71	1	1348	70	1	2258	72	1	593	65	1
60	589	65	1	999	65	1	1628	66	1	6	58	2
72	442	60	1	714	58	1	901	60	1	1		
84	330	55	2	534	52	1	501	54	1	1		
96	224	48	2	389	46	1	244	49	1	1		
108	174	43	2	316	43	1	83	44	2	1		
120	134	40	2	234	39	1	3	38	3	1		

**Figure 9.3.1(a): Unadjusted technique survival by era, 2004-2023 (uncensored for death and transplant)**



**Figure 9.3.1(b): Unadjusted technique survival by era, 2004-2023 (censored for death and transplant)**



**Table 9.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant), 2014-2023**

Age group (years) Interval (month)	20-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	414	100		1636	100		2284	100	
6	365	97	1	1430	97	0	1984	96	0
12	305	94	1	1213	94	1	1610	90	1
24	216	92	1	811	87	1	1051	80	1
36	153	87	2	553	82	1	670	71	1
48	100	83	3	357	75	2	428	62	1
60	66	77	3	226	68	2	253	52	2
72	42	70	4	140	61	2	143	42	2
84	25	66	5	89	57	3	70	34	2
96	19	60	6	38	51	3	34	29	3
108	8	60	6	13	43	5	15	22	3
120	1			2	39	6	2	22	3

Age group (years) Interval (month)	45-54			55-64			≥65		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	3497	100		4817	100		3673	100	
6	3014	95	0	4054	93	0	2977	89	1
12	2445	88	1	3284	84	1	2341	77	1
24	1557	74	1	2052	68	1	1345	57	1
36	1005	61	1	1195	52	1	778	41	1
48	629	50	1	686	39	1	409	27	1
60	375	41	1	361	28	1	203	17	1
72	209	32	1	174	19	1	98	11	1
84	124	25	1	93	14	1	50	7	1
96	62	21	2	42	10	1	20	4	1
108	26	17	2	11	7	1	3	1	1
120	1			1			1		

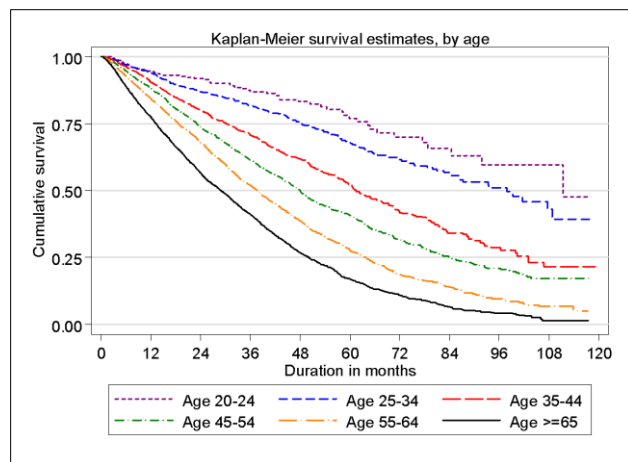
**Table 9.3.2(b): Unadjusted technique survival by age (censored for death and transplant), 2014-2023**

Age group (years) Interval (month)	20-24			25-34			35-44		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	414	100		1636	100		2284	100	
6	365	97	1	1430	96	0	1984	97	0
12	305	92	1	1213	91	1	1610	92	1
24	216	82	2	811	81	1	1051	82	1
36	153	73	3	553	72	1	670	74	1
48	100	64	3	357	64	2	428	64	1
60	66	60	3	226	55	2	253	57	2
72	42	54	4	140	48	2	143	52	2
84	25	51	4	89	42	2	70	46	2
96	19	51	4	38	36	3	34	43	3
108	8	42	6	13	32	3	15	38	4
120	1			2	27	5	2	35	5

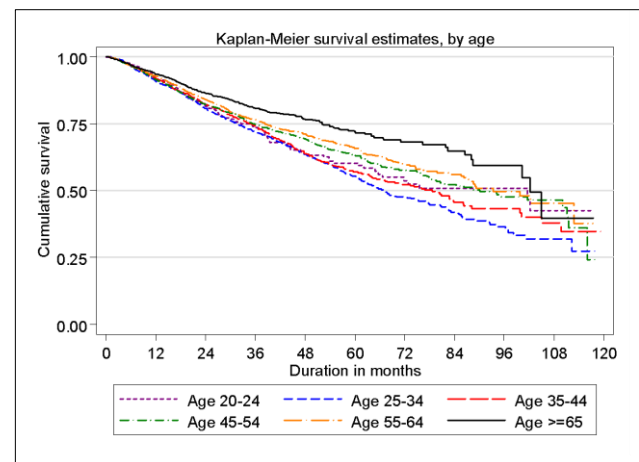
Age group (years) Interval (month)	45-54			55-64			≥65		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	3497	100		4817	100		3673	100	
6	3014	97	0	4054	97	0	2977	97	0
12	2445	91	1	3284	93	0	2341	93	0
24	1557	82	1	2052	84	1	1345	86	1
36	1005	75	1	1195	76	1	778	81	1
48	629	69	1	686	71	1	409	77	1
60	375	63	1	361	66	1	203	72	2
72	209	58	2	174	60	2	98	68	2
84	124	52	2	93	56	2	50	65	3
96	62	48	2	42	50	3	20	59	4
108	26	47	3	11	45	4	3	40	11
120	1			1			1		

\* Account for patients commenced dialysis from 2014-2023

**Figure 9.3.2(a): Unadjusted technique survival by age (uncensored for death and transplant), 2014-2023**



**Figure 9.3.2(b): Unadjusted technique survival by age (censored for death and transplant), 2014-2023**



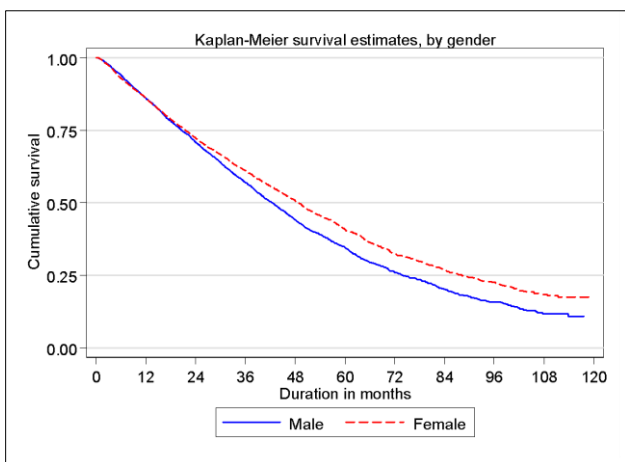
**Table 9.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant), 2014-2023**

Gender Interval (months)	Male			Female		
	n	% Survival	SE	n	% Survival	SE
0	9112	100		8051	100	
6	7765	94	0	6792	93	0
12	6248	86	0	5581	86	0
24	3884	71	1	3611	72	1
36	2384	57	1	2308	61	1
48	1349	44	1	1496	51	1
60	763	35	1	869	41	1
72	410	26	1	495	32	1
84	235	20	1	267	27	1
96	113	16	1	132	23	1
108	37	12	1	46	18	1
120	2	11	1	2	17	1

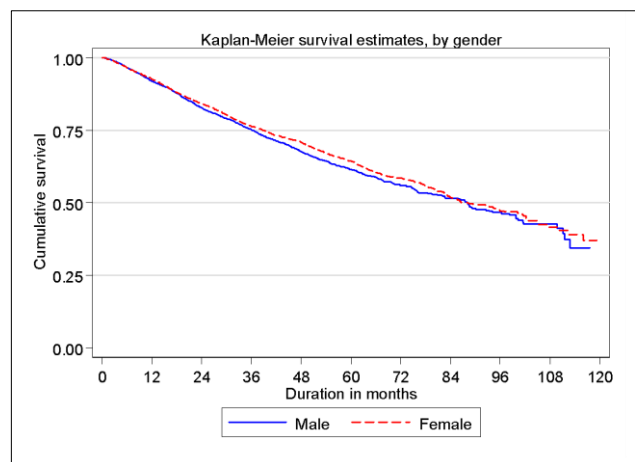
**Table 9.3.3(b): Unadjusted technique survival by gender (censored for death and transplant), 2014-2023**

Gender Interval (months)	Male			Female		
	n	% Survival	SE	n	% Survival	SE
0	9112	100		8051	100	
6	7765	97	0	6792	97	0
12	6248	92	0	5581	93	0
24	3884	83	0	3611	84	0
36	2384	75	1	2308	76	1
48	1349	68	1	1496	71	1
60	763	62	1	869	64	1
72	410	56	1	495	58	1
84	235	52	1	267	52	1
96	113	47	2	132	47	2
108	37	43	2	46	42	2
120	2	34	4	2	37	3

**Figure 9.3.3(a): Unadjusted technique survival by gender (uncensored for death and transplant), 2014-2023**



**Figure 9.3.3(b): Unadjusted technique survival by gender (censored for death and transplant), 2014-2023**



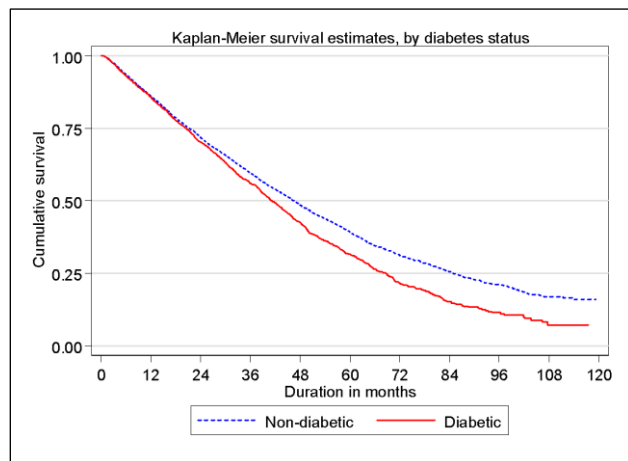
**Table 9.3.4(a): Unadjusted technique survival by diabetes status (uncensored for death and transplant), 2014-2023**

Diabetes status Interval (months)	Non-diabetic			Diabetic		
	n	% Survival	SE	n	% Survival	SE
0	20648	100		6356	100	
6	11575	94	0	2908	93	0
12	9321	86	0	2444	86	1
24	5848	72	0	1613	70	1
36	3622	60	1	1050	56	1
48	2228	49	1	600	42	1
60	1318	39	1	305	32	1
72	743	31	1	152	22	1
84	429	26	1	68	15	1
96	213	21	1	29	11	1
108	74	17	1	8	7	2
120	3	16	1	1		

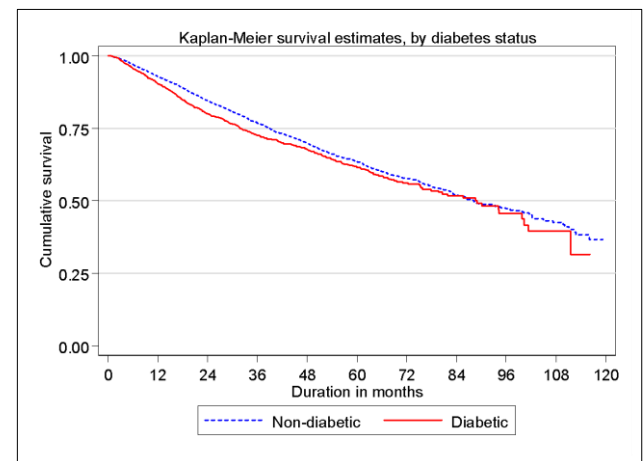
**Table 9.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant), 2014-2023**

Diabetes status Interval (months)	Non-diabetic			Diabetic		
	n	% Survival	SE	n	% Survival	SE
0	20648	100		6356	100	
6	11580	97	0	2904	96	0
12	9325	93	0	2445	90	1
24	5859	85	0	1605	80	1
36	3635	77	0	1039	73	1
48	2236	70	1	594	68	1
60	1330	64	1	296	62	1
72	749	58	1	148	56	2
84	429	52	1	69	52	2
96	207	47	1	34	46	3
108	71	42	2	11	39	4
120	2	37	3	2	32	8

**Figure 9.3.4(a): Unadjusted technique survival by Diabetes status (uncensored for death and transplant), 2014-2023**



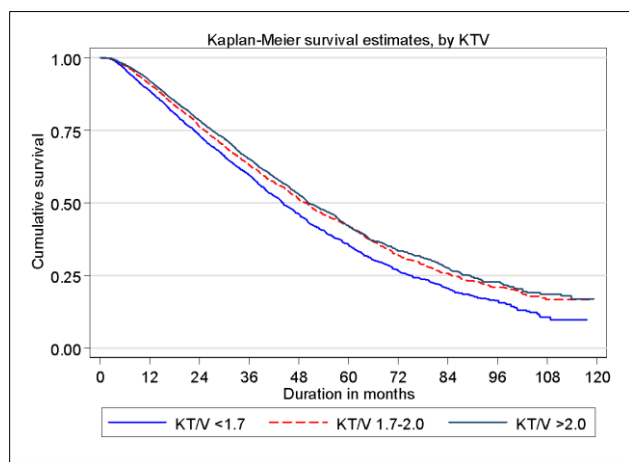
**Figure 9.3.4(b): Unadjusted technique survival by diabetes status (censored for death and transplant), 2014-2023**



**Table 9.3.5: Unadjusted technique survival by Kt/V, 2014-2023**

Kt/V Interval (month)	<1.7			1.7-2.0			>2.0		
	n	% Survival	SE	n	% Survival	SE	n	% Survival	SE
0	4882	100		4010	100		4989	100	
6	4507	96	0	3724	97	0	4675	98	0
12	3743	89	0	3160	91	0	3971	92	0
24	2383	73	1	2108	76	1	2627	79	1
36	1461	60	1	1373	63	1	1688	65	1
48	834	46	1	859	51	1	1073	53	1
60	442	36	1	533	42	1	614	42	1
72	236	27	1	290	32	1	352	33	1
84	127	20	1	160	26	1	198	28	1
96	55	16	1	86	21	1	96	23	1
108	19	10	2	30	17	2	32	19	1
120	2	10	2	2	17	2	1		

**Figure 9.3.5: Unadjusted technique survival by Kt/V, 2014-2023**





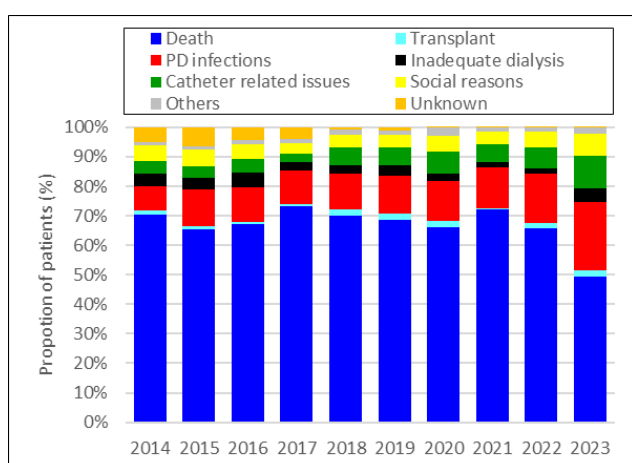
In 2023, the main cause for PD drop-out was death (49.4%), followed by PD infections (23.4%) (Table 9.3.6), The PD drop out occurring < 3 months on PD therapy was lower (4.3%) as compared to previous year. Meanwhile, PD drop out at 3-12 months was 22.2% and 73.3% after 12 months (Table 9.3.8).

**Table 9.3.6: Reasons for drop-out from PD program, 2014-2023**

Year Reasons	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
Death	1108	49.4	1184	65.6	1169	72	882	66.2	893	68.7
Transplant	43	1.9	32	1.8	8	0.5	27	2	27	2.1
PD infections	524	23.4	305	16.9	223	13.7	179	13.4	165	12.7
Inadequate dialysis	100	4.5	29	1.6	33	2	37	2.8	49	3.8
Catheter related issues	254	11.3	132	7.3	94	5.8	97	7.3	79	6.1
Social reasons	167	7.4	96	5.3	73	4.5	74	5.6	53	4.1
Others	42	1.9	25	1.4	20	1.2	36	2.7	21	1.6
Unknown	4	0.2	2	0.1	3	0.2	1	0.1	13	1
Total	2242	100	1805	100	1623	100	1333	100	1300	100
Patient at risk	8430		7947		7377		6694		6094	

Year Reasons	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
Death	819	69.9	775	73.3	731	67.3	631	65.4	576	70.2
Transplant	25	2.1	8	0.8	6	0.6	10	1	14	1.7
PD infections	144	12.3	118	11.2	127	11.7	122	12.6	67	8.2
Inadequate dialysis	34	2.9	33	3.1	55	5.1	38	3.9	34	4.1
Catheter related issues	68	5.8	30	2.8	51	4.7	35	3.6	35	4.3
Social reasons	50	4.3	35	3.3	53	4.9	55	5.7	45	5.5
Others	23	2	18	1.7	17	1.6	11	1.1	7	0.9
Unknown	8	0.7	41	3.9	46	4.2	63	6.5	42	5.1
Total	1171	100	1058	100	1086	100	965	100	820	100
Patient at risk	5622		5306		4648		4310		3702	

**Figure 9.3.6: Reasons for drop-out from PD program, 2014-2023**



**Table 9.3.7: Drop-out rate from PD program with time on treatment, 2014-2023**

Year Time	2023		2022		2021		2020		2019	
	n	%	n	%	n	%	n	%	n	%
< 3 months	100	4.5	92	5.1	81	5	69	5.2	54	4.2
3-<6 months	178	7.9	125	6.9	112	6.9	93	7	82	6.3
6- <12 months	320	14.3	261	14.5	208	12.8	212	15.9	173	13.3
≥12 months	1644	73.3	1327	73.5	1222	75.3	959	71.9	991	76.2
Total	2242	100	1805	100	1623	100	1333	100	1300	100

Year Time	2018		2017		2016		2015		2014	
	n	%	n	%	n	%	n	%	n	%
< 3 months	41	3.5	46	4.3	40	3.7	63	6.5	45	5.5
3-<6 months	80	6.8	75	7.1	87	8	90	9.3	79	9.6
6- <12 months	151	12.9	122	11.5	146	13.4	138	14.3	99	12.1
≥12 months	899	76.8	815	77	813	74.9	674	69.8	597	72.8
Total	1171	100	1058	100	1086	100	965	100	820	100

### SECTION 9.4: PERITONITIS

The median peritonitis rate in 2023 is 0.32 episodes/patient-year (1 in 37.5 patient-months). There is still significant inter-centre variation as illustrated in Table and Figure 9.4.1, the highest peritonitis rate is 1.0 episodes/patient-year (1:12 patient-months) and the lowest at 0 episodes/patient-year. The contribution of gram positive and gram-negative organisms to peritonitis is 33.5 % and 29.4% respectively, while fungal and mycobacterial infections account for 4.1% and 2.3% respectively (Table 9.4.2). Culture-negative peritonitis rates remain high at 25.9% of all episodes in 2023, and it is worsening as compared to previous years. In terms of overall outcomes, 63.6% of peritonitis episodes resolved, with 26.9% resulting in catheter loss either due to relapse or unresolved peritonitis (Table 9.4.3).

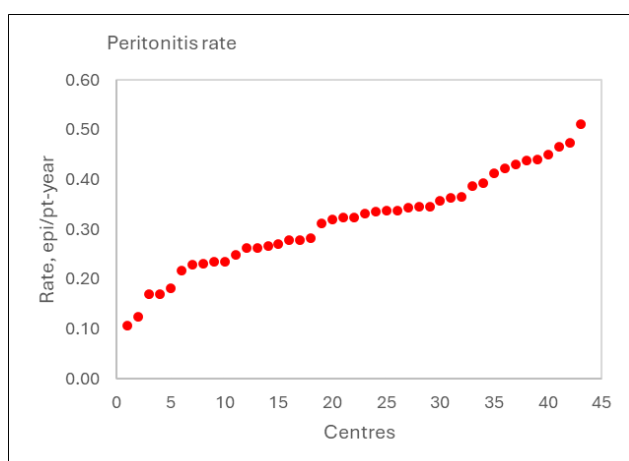
The mortality rate in 2023 was 9.4% of all episodes, and the pattern of the causative organisms remained the same; highest mortality was seen in infections due to mycobacterial, fungus and E. Coli (Table 9.4.4).

Multivariate analysis indicates that age above 55 years and requirement for assistance with PD are risk factors associated with peritonitis (Table 9.4.5).

**Table 9.4.1: Variation of peritonitis rate (epi/pt-year) among PD centres, 2018-2023**

Year	Number of centres	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
2023	60	0.00	0.00	0.21	0.32	0.40	0.59	1.00
2022	58	0.05	0.05	0.25	0.30	0.40	0.55	0.55
2021	54	0.00	0.05	0.19	0.25	0.33	0.52	0.74
2020	50	0.00	0.03	0.23	0.28	0.42	0.60	0.64
2019	46	0.08	0.08	0.19	0.28	0.41	0.67	0.67
2018	45	0.00	0.06	0.22	0.28	0.37	1.01	1.37

**Figure 9.4.1: Variation in peritonitis rate among PD centres, 2023**

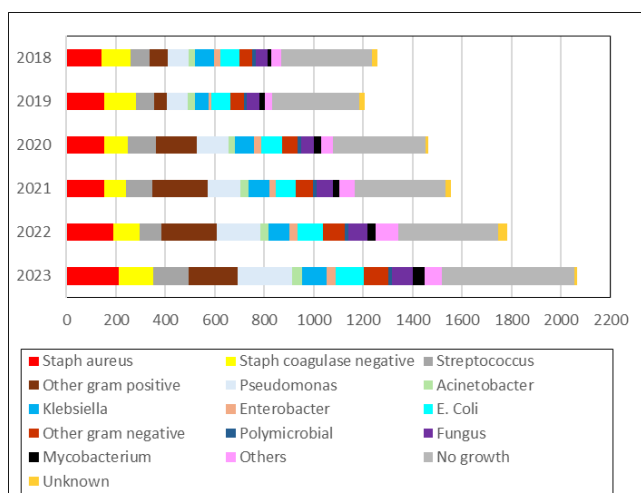


\*Excluded 17 centres with less than 30 patients

**Table 9.4.2: Causative organism in PD peritonitis, 2018-2023**

	2023		2022		2021		2020		2019		2018	
	n	%	n	%	n	%	n	%	n	%	n	%
<b>(A) Gram Positives</b>												
Staph aureus	212	10.3	190	10.7	154	9.9	153	10.5	152	12.6	142	11.3
Staph coagulase negative	137	6.6	105	5.9	86	5.5	96	6.6	128	10.6	116	9.2
Streptococcus	145	7.0	90	5.0	107	6.9	112	7.7	74	6.1	78	6.2
Others	198	9.6	221	12.4	225	14.5	165	11.3	50	4.1	72	5.7
<b>(B) Gram Negatives</b>												
Pseudomonas	220	10.7	177	9.9	130	8.4	130	8.9	87	7.2	86	6.8
Acinetobacter	40	1.9	34	1.9	34	2.2	24	1.6	27	2.2	26	2.1
Klebsiella	100	4.8	83	4.7	83	5.3	79	5.4	55	4.6	77	6.1
Enterobacter	38	1.8	33	1.9	27	1.7	28	1.9	12	1.0	26	2.1
E. Coli	112	5.4	104	5.8	79	5.1	84	5.7	79	6.6	78	6.2
Others	100	4.8	89	5.0	70	4.5	63	4.3	52	4.3	51	4.1
<b>(C) Polymicrobial</b>	14	0.7	12	0.7	16	1.0	15	1.0	11	0.9	12	1.0
<b>(D) Others</b>												
Fungus	84	4.1	77	4.3	68	4.4	53	3.6	53	4.4	50	4.0
Mycobacterium	48	2.3	35	2.0	25	1.6	29	2.0	23	1.9	13	1.0
Others	70	3.4	92	5.2	61	3.9	47	3.2	29	2.4	41	3.3
<b>(E) No growth</b>	535	25.9	404	22.7	366	23.5	372	25.5	353	29.3	366	29.1
<b>(F) Unknown</b>	10	0.5	37	2.1	24	1.5	11	0.8	21	1.7	24	1.9
<b>Total</b>	2063	100	1783	100	1555	100	1461	100	1206	100	1258	100

**Figure 9.4.2: Causative organism in PD peritonitis, 2018-2023**



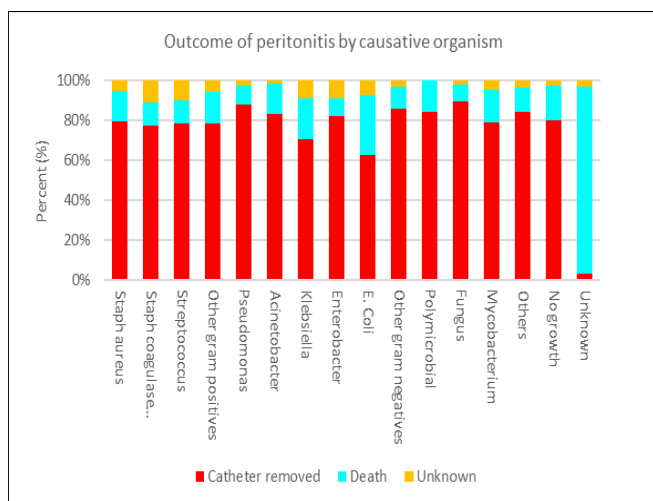
**Table 9.4.3: Overall outcomes of PD peritonitis, 2018-2023**

Year	Resolved		Relapsed Then Resolved		Relapsed Catheter Removed		Not Resolved Catheter Removed		Death		Unknown		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2023	1280	62.0	32	1.6	70	3.4	484	23.5	197	9.4	0	0.0	2063	100
2022	1095	61.4	46	2.6	59	3.3	457	25.6	102	5.7	24	1.3	1783	100
2021	1011	65.0	27	1.7	39	2.5	368	23.7	80	5.1	30	1.9	1555	100
2020	968	66.3	38	2.6	37	2.5	337	23.1	54	3.7	27	1.8	1461	100
2019	775	64.3	29	2.4	22	1.8	280	23.2	68	5.6	32	2.7	1206	100
2018	821	65.3	32	2.5	40	3.2	278	22.1	67	5.3	20	1.6	1258	100

**Table 9.4.4: Outcome of peritonitis by causative organism, 2018-2023**

	Outcome									
	Resolved		Catheter removed		Death		Unknown		Total	
	n	%	n	%	n	n	%	n	%	n
<b>(A) Gram Positives</b>	2532	78.9	533	16.6	97	3.0	46	1.4	3208	100
Staph aureus	747	74.5	204	20.3	39	3.9	13	1.3	1003	100
Staph coagulase negative	566	84.7	79	11.8	12	1.8	11	1.6	668	100
Streptococcus	527	87.0	62	10.2	9	1.5	8	1.3	606	100
Others	692	74.3	188	20.2	37	4.0	14	1.5	931	100
<b>(B) Gram Negatives</b>	1624	62.1	792	30.3	154	5.9	47	1.8	2617	100
Pseudomonas	420	50.6	360	43.4	39	4.7	11	1.3	830	100
Acinetobacter	119	64.3	55	29.7	10	5.4	1	0.5	185	100
Klebsiella	323	67.7	109	22.9	31	6.5	14	2.9	477	100
Enterobacter	119	72.6	37	22.6	4	2.4	4	2.4	164	100
E. Coli	357	66.6	112	20.9	54	10.1	13	2.4	536	100
Others	286	67.3	119	28.0	16	3.8	4	0.9	425	100
<b>(C) Polymicrobial</b>	55	68.8	21	26.3	4	5.0	0	0.0	80	100
<b>(D) Others</b>	247	27.5	560	62.4	72	8.0	19	2.1	898	100
Fungus	27	7.0	321	83.4	30	7.8	7	1.8	385	100
Mycobacterium	25	14.5	117	67.6	24	13.9	7	4.0	173	100
Others	195	57.4	122	35.9	18	5.3	5	1.5	340	100
<b>(E) No growth</b>	1696	70.8	561	23.4	122	5.1	17	0.7	2396	100
<b>(F) Unknown</b>	0	0.0	4	3.1	119	93.7	4	3.1	127	100

**Figure 9.4.4: Outcome of peritonitis by causative organism, 2018-2023**



**Table 9.4.5: Risk factors influencing peritonitis rate, 2014-2023**

Factors	n	Risk Ratio	95% CI	P value
<b>Age (years)</b>				
20-24	148	1.02	(0.88, 1.18)	0.828
25-34 (ref*)	443	1		
35-44	678	1.05	(0.95, 1.16)	0.347
45-54	1015	1.05	(0.96, 1.15)	0.306
55-64	1401	1.13	(1.03, 1.24)	0.01
>=65	971	1.17	(1.06, 1.29)	0.002
<b>Gender</b>				
Male (ref*)	2938	1		
Female	2669	0.99	(0.95, 1.04)	0.733
<b>Diabetes</b>				
No (ref*)	3830	1		
Yes	1017	1.03	(0.98, 1.09)	0.226
<b>Income</b>				
<RM 1000 (ref*)	1466	1		
RM 1000-3000	2396	0.96	(0.91, 1.01)	0.106
RM 3001-5000	683	0.93	(0.86, 1.01)	0.07
RM 5001-10000	251	0.99	(0.88, 1.12)	0.903
>=RM 10000	51	1.29	(1.04, 1.6)	0.022
<b>Education</b>				
Nil	224	0.98	(0.88, 1.1)	0.768
Primary	1196	0.99	(0.94, 1.05)	0.78
Secondary (ref*)	2600	1		
Tertiary	827	1.02	(0.95, 1.1)	0.542
<b>Assistance to perform CAPD</b>				
Self-care (ref*)	2415	1		
Partially assisted	922	1.16	(1.09, 1.24)	<0.001
Completely assisted	1510	1.24	(1.17, 1.31)	<0.001