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## **Multi-Center Registry Analysis of Center Characteristics Associated with Technique Failure in Incident Peritoneal Dialysis Patients**

Htay Htay<sup>\*,†,¶,§</sup>, Yeoungjee Cho<sup>\*,†,¶</sup>, Elaine M Pascoe<sup>¶</sup>, Darsy Darssan<sup>¶</sup>, Annie-Claire Nadeau-Fredette<sup>‡</sup>, Carmel Hawley<sup>\*,†,¶,||</sup>, Philip A. Clayton<sup>\*,||,‡‡</sup>, Monique Borlace<sup>||</sup>, Sunil V. Badve<sup>\*,¶</sup>, Kamal Sud<sup>\*,‡,††</sup>, Neil Boudville<sup>§§</sup>, Stephen P. McDonald<sup>\*,||,‡‡</sup>, David W Johnson<sup>\*,†,¶,||</sup>

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Htay Htay<sup>1,2,3,4</sup>, Yeoungjee Cho<sup>1,2,3</sup>, Elaine M Pascoe<sup>3</sup>, Darsy Darssan<sup>3</sup>, Annie-Claire Nadeau-Fredette<sup>5</sup>, Carmel Hawley<sup>1,2,3,6</sup>, Philip A. Clayton,<sup>1,7</sup> Monique Borlace<sup>8</sup>, Sunil V. Badve,<sup>1,9</sup> Kamal Sud,<sup>1,10,11</sup> Neil Boudville<sup>12</sup>; Stephen P. McDonald<sup>1,7,13</sup>, David W Johnson<sup>1,2,3,6</sup>

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### Summary of Supplemental Tables and Figure

Supplemental Table 1 (Multivariable Cox shared frailty models for death-censored technique failure defined as 30 day and 180 day)

Supplemental Table 2 (Multivariable Cox shared frailty model of cause specific technique failure)

Supplemental Table 3 (Multivariable Cox shared frailty models for dropouts due to death and transplant)

Supplemental Figure 1 (Figure demonstration variation in hazard of death-censored technique failure across 51 Australian peritoneal dialysis centers during the period of 2004-2014)

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Supplemental Table 1. Multivariable Cox shared frailty models for technique failure and death-censored technique failure in which PD proportion was substituted for center size.						
Covariates	Technique failure			Death-censored technique failure		
	HR	95% CI	p-value	HR	95% CI	p-value
Era (2004-2009)	1.0	reference		1.0	reference	
Era (2010-2014)	0.87	0.82-0.92	<0.001	0.92	0.86-0.99	0.03
<b>Patient-level characteristics</b>						
Age (decade)	1.08	1.05-1.10	<0.001	0.93	0.91-0.96	<0.001
Male	1.00	0.95-1.06	0.89	1.07	1.00-1.15	0.05
Race			<0.001			<0.001
Caucasian	1.00	reference		1.00	reference	
Asian	0.72	0.65-0.80	<0.001	0.78	0.70-0.89	<0.001
ATSI	1.05	0.93-1.18	0.46	1.11	0.96-1.28	0.15
MP	0.75	0.63-0.90	0.001	0.85	0.69-1.03	0.11
Other	0.60	0.48-0.75	<0.001	0.67	0.52-0.87	0.002
BMI (kg/m <sup>2</sup> )			<0.001			<0.001
<18.5	1.12	0.96-1.30	0.15	1.06	0.88-1.23	0.54
18.5-24.9	1.00	reference		1.00	reference	
25-29.9	0.98	0.92-1.04	0.53	1.08	0.99-1.17	0.07
≥30	1.12	1.04-1.20	0.001	1.28	1.17-1.39	<0.001
Smoking status			0.01			0.03
Non-smoker	1.00	reference		1.00	reference	
Current smoker	1.10	1.01-1.20	0.03	1.09	0.98-1.21	0.11
Former smoker	1.08	1.02-1.15	0.008	1.10	1.02-1.19	0.01
Diabetes mellitus	1.05	0.96-1.15	0.29	0.98	0.87-1.10	0.73
Cardiovascular disease	1.30	1.23-1.38	<0.001	1.12	1.03-1.21	0.003
Chronic lung disease	1.11	1.03-1.19	0.004	1.05	0.96-1.16	0.28
Primary renal disease			0.06			<0.001
Glomerulonephritis	1.00	reference		1.00	reference	
Diabetes nephropathy	1.12	1.01-1.24	0.03	0.98	0.86-1.11	0.74

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Hypertension	0.97	0.88-1.05	0.48	0.83	0.74-0.93	0.002
Polycystic kidney disease	1.05	0.93-1.20	0.43	1.20	1.04-1.38	0.01
Other/unknown	0.98	0.91-1.07	0.70	0.86	0.78-0.95	0.003
Late referral	1.10	1.03-1.18	0.007	1.06	0.98-1.16	0.16
<b>Initial modality of RRT (PD)¶</b>						
Overall	0.64	0.59-0.70	<0.001	0.69	0.69-0.76	<0.001
at 6 months	0.67	0.63-0.72	<0.001	0.73	0.67-0.79	<0.001
at 1 year	0.71	0.67-0.75	<0.001	0.76	0.71-0.82	<0.001
at 2 years	0.78	0.73-0.83	<0.001	0.84	0.78-0.91	<0.001
Initial PD modality (CAPD)	0.88	0.82-0.94	<0.001	0.99	0.90-1.08	0.76
IRSAD scores#			0.55			0.91
<934	1.00	reference		1.00	reference	
934-983	0.98	0.91-1.06	0.68	1.02	0.93-1.12	0.65
>983-1032	0.98	0.91-1.06	0.61	1.02	0.93-1.12	0.69
>1032	0.95	0.87-1.02	0.16	0.99	0.90-1.10	0.88
<b>Center-level characteristics</b>						
Transplant center	1.04	0.94-1.16	0.42	0.98	0.83-1.14	0.77
PD proportion			0.009			0.002
<18	0.99	0.90-1.09	0.80	1.09	0.93-1.28	0.28
18-29	1.00	reference		1.00	Reference	
>29	0.83	0.73-0.94	0.003	0.73	0.58-0.92	0.007
APD exposure@			0.09			0.31
<41%	1.12	1.01-1.24	0.02	1.13	0.95-1.35	0.16
41-71%	1.00	reference		1.00	reference	
>71%	1.02	0.93-1.13	0.65	1.09	0.93-1.29	0.29
Icodextrin use@			0.48			0.92
<35 %	0.95	0.84-1.06	0.33	0.96	0.80-1.16	0.70
35-67%	1.00	reference		1.00	reference	
>67%	1.02	0.93-1.13	0.65	0.98	0.84-1.15	0.83
Phosphate in target@			0.006			0.40

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<40%	1.15	1.03-1.28	0.01	1.13	0.95-1.36	0.17
40-46%	1.00	reference		1.00	reference	
>46%	0.96	0.86-1.07	0.42	1.05	0.89-1.25	0.56
Antifungal use*			0.37			0.38
<38%	1.00	0.90-1.11	1.0	1.01	0.84-1.22	0.89
38-86%	1.00	reference		1.00	reference	
>86%	1.08	0.97-1.21	0.17	1.14	0.94-1.38	0.38

@Percentage of all participating patients in the center

\*Percentage of peritonitis in center

¶ There was a significant interaction between initial modality of RRT and time ( $p < 0.001$ ). The overall HR and HR at three time points are given.

# Socioeconomic position reported as IRSAD scores with higher scores reflect higher socioeconomic position

APD, automated peritoneal dialysis; ATSI, Aboriginal and Torres Strait Islander; BMI, body mass index; CAPD, continuous ambulatory peritoneal dialysis; CI, confidence interval; HR, hazard ratio; IRSAD, Index of Relative Socio-economic Advantage and Disadvantage; MP, Maori-Pacific Islanders; PD, peritoneal dialysis; PET, peritoneal equilibration test; RRT, renal replacement therapy; yr, year.

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Supplemental Table 2. Multivariable Cox shared frailty model of cause specific technique failure.												
Covariates	Infection			Social			Inadequate dialysis			Mechanical		
	HR	95% CI	p-val	HR	95% CI	p-val	HR	95% CI	p-val	HR	95% CI	p-val
Era (2004-2009)	1.0	reference		1.0	reference		1.0	reference		1.0	reference	
Era (2010-2014)	0.64	0.57-0.72	<0.001	1.22	1.00-1.47	0.045	0.95	0.80-1.12	0.55	0.93	0.80-1.09	0.38
<b>Patient-level characteristics</b>												
Age(decade)	1.01	0.95-1.05	0.82	1.04	0.97-1.11	0.27	0.78	0.74-0.83	<0.001	0.97	0.92-1.03	0.33
Male	0.88	0.79-0.98	0.02	1.36	1.11-1.65	0.002	1.52	1.29-1.79	<0.001	0.99	0.85-1.15	0.88
Race			<0.001			0.07			0.09			0.11
Caucasian	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
Asian	0.75	0.62-0.91		0.85	0.60-1.19		0.68	0.51-0.90		0.84	0.65-1.09	
ATSI	1.23	0.99-1.52		1.63	1.11-2.37		0.79	0.55-1.13		0.93	0.66-1.31	
MP	0.89	0.65-1.22		1.20	0.71-2.06		0.78	0.50-1.22		0.73	0.45-1.15	
Others	0.56	0.36-0.87		1.05	0.54-2.02		0.68	0.38-1.19		0.45	0.24-0.84	
BMI			<0.001			0.58			<0.001			0.39
<18.5	1.32	1.00-1.75		0.81	0.44-1.49		0.70	0.41-1.18		0.94	0.61-1.44	
18.5-24.9	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
25-29.9	1.06	0.94-1.21		1.11	0.90-1.37		1.18	0.98-1.42		0.99	0.83-1.18	
≥30	1.34	1.18-1.53		0.99	0.78-1.27		1.56	1.28-1.90		1.14	0.95-1.39	

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Smoking status			0.01			0.40			0.73			0.30
Non-smoker	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
Current smoker	1.14	0.97-1.34		1.15	0.87-1.51	0.33	0.91	0.71-1.15	0.43	0.96	0.75-1.23	0.76
Former smoker	1.19	1.06-1.33		0.95	0.77-1.16	0.60	0.98	0.83-1.16	0.85	1.12	0.95-1.32	0.18
Diabetes mellitus	0.96	0.80-1.14	0.62	1.15	0.86-1.54	0.36	0.91	0.69-1.22	0.54	0.98	0.77-1.26	0.89
Cardiovascular disease	1.14	1.02-1.28	0.03	1.09	0.89-1.33	0.41	1.10	0.92-1.30	0.30	1.11	0.94-1.31	0.23
Chronic lung disease	1.01	0.87-1.16	0.91	1.24	0.97-1.57	0.08	1.04	0.83-1.31	0.73	0.99	0.79-1.23	0.90
Primary renal disease			0.008			0.89			0.04			<0.001
Glomerulonephritis	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
Diabetes nephropathy	1.13	0.92-1.38		0.95	0.68-1.34		1.04	0.76-1.42		0.71	0.53-0.95	
Hypertension	0.83	0.60-0.99		1.05	0.78-1.42		0.68	0.51-0.90		0.88	0.69-1.12	
Polycystic kidney disease	1.05	0.83-1.33		1.12	0.74-1.71		0.86	0.60-1.23		1.89	1.46-2.46	
Other/unknown	0.83	0.72-0.98		0.93	0.71-1.22		0.81	0.65-1.00		0.97	0.79-1.20	
Late referral	1.08	0.95-1.22		0.95	0.75-1.20		1.03	0.85-1.25		1.12	0.92-1.35	
Initial modality of RRT (PD) <sup>¶</sup>												
Overall	0.77	0.66-0.91	0.002	0.42	0.33-0.55	<0.001	0.51	0.40-0.65	<0.001	0.84	0.68-1.03	0.09
at 6 months	0.79	0.69-0.90		0.50	0.40-0.62		0.55	0.45-0.68		0.87	0.73-1.04	
at 1 year	0.81	0.72-0.91		0.59	0.48-0.71		0.60	0.50-0.72		0.91	0.77-1.07	
at 2 years	0.84	0.75-0.94		0.81	0.64-1.02		0.72	0.61-0.85		0.99	0.79-1.24	

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Initial PD modality (CAPD)	1.05	0.92-1.20		1.04	0.83-1.32		0.74	0.61-0.90		1.14	0.93-1.40	
IRSAD scores#			0.43			0.27			0.43			0.96
<934	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
934-983	0.91	0.79-1.05		1.22	0.95-1.56		1.03	0.82-1.28		1.0	0.80-1.23	
>983-1032	0.93	0.80-1.07		1.08	0.83-1.40		1.16	0.93-1.44		1.04	0.84-1.29	
>1032	0.89	0.76-1.03		0.97	0.74-1.27		1.16	0.92-1.47		0.99	0.79-1.23	
<b>Center-level characteristics</b>												
Transplant center	0.92	0.75-1.12	0.39	1.21	0.88-1.66	0.25	1.02	0.70-1.49	0.92	1.25	0.92-1.68	0.16
Center size (incident patient/year)			0.11			0.004			0.10			0.004
<16	0.94	0.80-1.11		1.21	0.93-1.58		1.41	1.02-1.93		1.41	1.07-1.85	
16-48	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
>48	0.79	0.63-0.98		0.59	0.40-0.86		0.96	0.56-1.65		0.67	0.44-1.02	
APD exposure <sup>@</sup>			0.002			0.009			1.00			0.82
<41%	1.36	1.14-1.36		1.29	0.96-1.73		0.99	0.68-1.44		1.10	0.81-1.50	
41-71%	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	
>71%	1.15	0.96-1.37		1.53	1.16-2.01		1.0	0.71-1.40		1.05	0.78-1.40	
Icodextrin use			0.17			<0.001			0.14			0.40
<35%	0.83	0.68-1.01		0.83	0.60-1.13		0.72	0.49-1.06		1.21	0.88-1.67	
35-67%	1.0	Reference		1.0	reference		1.0	reference		1.0	reference	



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>67%	1.00	0.84-1.18	0.58	0.43-0.77	0.78	0.55-1.09	1.15	0.87-1.53
Phosphate in target <sup>@</sup>			0.03		0.002		0.56	0.13
<40%	1.22	1.01-1.46	1.62	1.19-2.21	0.93	0.63-1.37	0.96	0.69-1.32
40-46%	1.0	Reference	1.0	reference	1.0	reference	1.0	reference
>46%	0.93	0.77-1.28	1.50	1.12-2.02	1.16	0.81-1.67	0.73	0.54-1.00
Antifungal use*			0.008		0.05		0.54	0.90
<38%	1.30	1.09-1.56	0.73	0.55-0.98	0.84	0.59-1.20	0.96	0.71-1.30
38-86%	1.0	Reference	1.0	reference	1.0	reference	1.0	reference
>86%	1.24	1.02-1.50	1.09	0.79-1.45	1.06	0.71-1.57	1.05	0.75-1.46

<sup>@</sup>Percentage of all participating patients in center

\*Percentage of peritonitis in center

¶ There was a significant interaction between initial modality of RRT and time ( $p < 0.001$ ). The overall HR and HR at three time points are given.

# socioeconomic position reported as IRSAD scores with higher scores reflect higher socioeconomic position

APD, automated peritoneal dialysis; ATSI, Aboriginal and Torres Strait Islander; BMI, body mass index; CAPD, continuous ambulatory peritoneal dialysis; CI, confidence interval; HR, hazard ratio; IRSAD, Index of Relative Socio-economic Advantage and Disadvantage; MP, Maori-Pacific Islanders; PD, peritoneal dialysis; PET, peritoneal equilibration test; RRT, renal replacement therapy; yr, year.

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Supplemental Table 3. Multivariable Cox shared frailty models for dropouts due to death and transplant.						
Covariates	Death			Transplant		
	HR	95% CI	p-value	HR	95% CI	p-value
Era (2004-2009)	1.0	reference		1.0	reference	
Era (2010-2014)	0.78	0.70-0.87	<0.001	1.38	1.22-1.57	<0.001
<b>Patient-level characteristics</b>						
Age (decade)	1.58	1.51-1.65	<0.001	0.58	0.55-0.60	<0.001
Male	0.90	0.82-0.99	0.047	1.19	1.06-1.34	0.004
Race			<0.001			<0.001
Caucasian	1.00	reference		1.00	reference	
Asian	0.60	0.50-0.70	<0.001	0.63	0.52-0.76	<0.001
ATSI	1.02	0.81-1.27	0.88	0.17	0.11-0.27	<0.001
MP	0.56	0.40-0.79	0.001	0.24	0.14-0.42	<0.001
Other	0.41	0.25-0.65	<0.001	0.26	0.16	0.44
BMI (kg/m <sup>2</sup> )			<0.001			<0.001
<18.5	1.11	0.96-1.30	0.12	1.12	0.97-1.28	0.13
18.5-24.9	1.00	reference		1.00	reference	
25-29.9	0.98	0.92-1.05	0.55	0.99	0.93-1.05	0.70
≥30	1.12	1.04-1.20	0.001	1.17	1.10-1.25	<0.001
Smoking status			0.002			<0.001
Non-smoker	1.00	reference		1.00	reference	
Current smoker	1.31	1.13-1.53	<0.001	0.57	0.47-0.70	<0.001
Former smoker	1.11	0.99-1.22	0.05	0.94	0.83-1.07	0.37
Diabetes mellitus	1.28	1.11-1.48	0.001	0.69	0.52-0.91	0.01
Cardiovascular disease	1.78	1.60-1.97	<0.001	0.57	0.48-0.67	<0.001
Chronic lung disease	1.17	1.04-1.31	0.007	0.56	0.43-0.73	<0.001
Primary renal disease			<0.001			<0.001
Glomerulonephritis	1.00	reference		1.00	reference	
Diabetes nephropathy	1.28	1.11-1.99	<0.001	1.07	0.78-1.45	0.68

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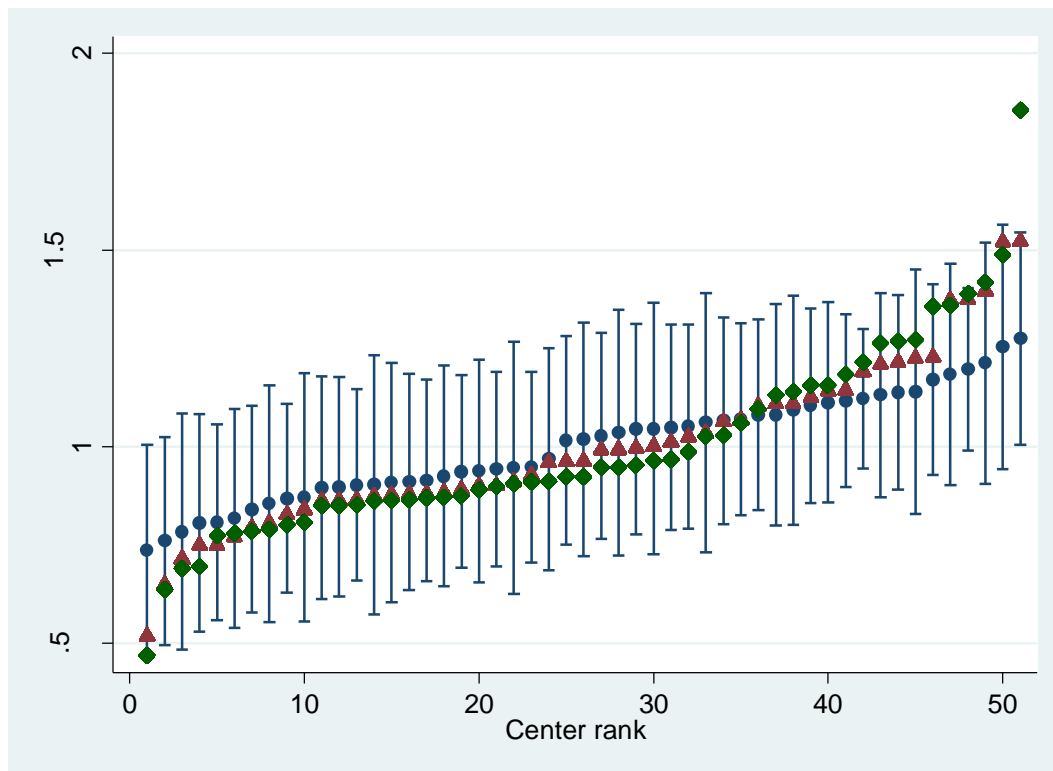
Hypertension	1.33	1.13-1.57	0.001	0.90	0.72-1.13	0.38
Polycystic kidney disease	0.71	0.50-0.99	0.049	1.34	1.10-1.63	0.004
Other/unknown	1.45	1.24-1.70	<0.001	0.71	0.61-0.83	<0.001
Late referral	1.16	1.03-1.30	<0.001	0.74	0.63-0.86	<0.001
<b>Initial modality of RRT (PD)¶</b>						
Overall	0.51	0.44-0.59	<0.001	1.31	1.07-1.60	0.009
at 6 months	0.54	0.48-0.62	<0.001	1.29	1.08-1.53	0.004
at 1 year	0.57	0.51-0.64	<0.001	1.27	1.09-1.48	0.002
at 2 years	0.65	0.59-0.71	<0.001	1.23	1.08-1.41	0.002
Initial PD modality (CAPD)	0.68	0.60-0.77	<0.001	0.89	0.77-1.03	0.12
IRSAD scores#			0.13			0.13
<934	1.00	reference		1.00	reference	
934-983	0.92	0.81-1.04	0.19	1.03	0.87-1.24	0.67
>983-1032	0.89	0.78-1.01	0.07	1.15	0.97-1.38	0.11
>1032	0.86	0.75-0.98	0.02	1.20	1.01-1.43	0.04
<b>Center-level characteristics</b>						
Transplant center	1.18	0.97-1.43	0.10	0.96	0.69-1.34	0.82
Center size (incident patients/yr)			0.13			0.21
<16	0.94	0.81-1.10	0.47	1.07	0.80-1.42	0.64
16-48	1.00	reference		1.00	reference	
>48	1.13	0.91-1.42	0.26	0.68	0.42-1.08	0.10
APD exposure®			0.44			0.84
<41%	0.96	0.80-1.15	0.63	1.10	0.79-1.52	0.57
41-71%	1.00	reference		1.00	reference	
>71%	0.89	0.75-1.06	0.20	1.06	0.77-1.44	0.73
Icodextrin use®			0.24			0.11
<35 %	0.96	0.79-1.15	0.65	0.86	0.60-1.23	0.40
35-67%	1.00	reference		1.00	reference	
>67%	1.14	0.96-1.34	0.14	0.72	0.53-0.99	0.04
Phosphate in target®			0.002			0.75

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<40%	1.12	0.93-1.34	0.24	1.09	0.77-1.53	0.62
40-46%	1.00	reference		1.00	reference	
>46%	0.77	0.64-0.93	0.006	0.94	0.69-1.29	0.71
Antifungal use*			0.58			0.44
<38%	1.02	0.85-1.21	0.86	0.93	0.67-1.29	0.68
38-86%	1.00	reference		1.00	reference	0.61
>86%	0.91	0.75-1.10	0.35	1.22	0.85-1.75	0.28

@Percentage of all participating patients in the center  
 \*Percentage of peritonitis in center  
 ¶ There was a significant interaction between initial modality of RRT and time (p<0.001). The overall HR and HR at three time points are given.  
 # socioeconomic position reported as IRSAD scores with higher scores reflect higher socioeconomic position  
 APD, automated peritoneal dialysis; ATSI, Aboriginal and Torres Strait Islander; BMI, body mass index; CAPD, continuous ambulatory peritoneal dialysis; CI, confidence interval; HR, hazard ratio; IRSAD, Index of Relative Socio-economic Advantage and Disadvantage; MP, Maori-Pacific Islanders; PD, peritoneal dialysis; PET, peritoneal equilibration test; RRT, renal replacement therapy; yr, year.

**Supplemental Figure 1.**



**Supplementary Figure 1.** Variation in hazard of death-censored technique failure across 51 Australian peritoneal dialysis centers during the period of 2004-2014 in unadjusted (green diamond), patient-level adjusted (red triangle) and patient- and center-level adjusted models (blue circle) with standard errors. Dialysis centers are ranked by hazard of death-censored technique failure.