

# **Chapter 4**

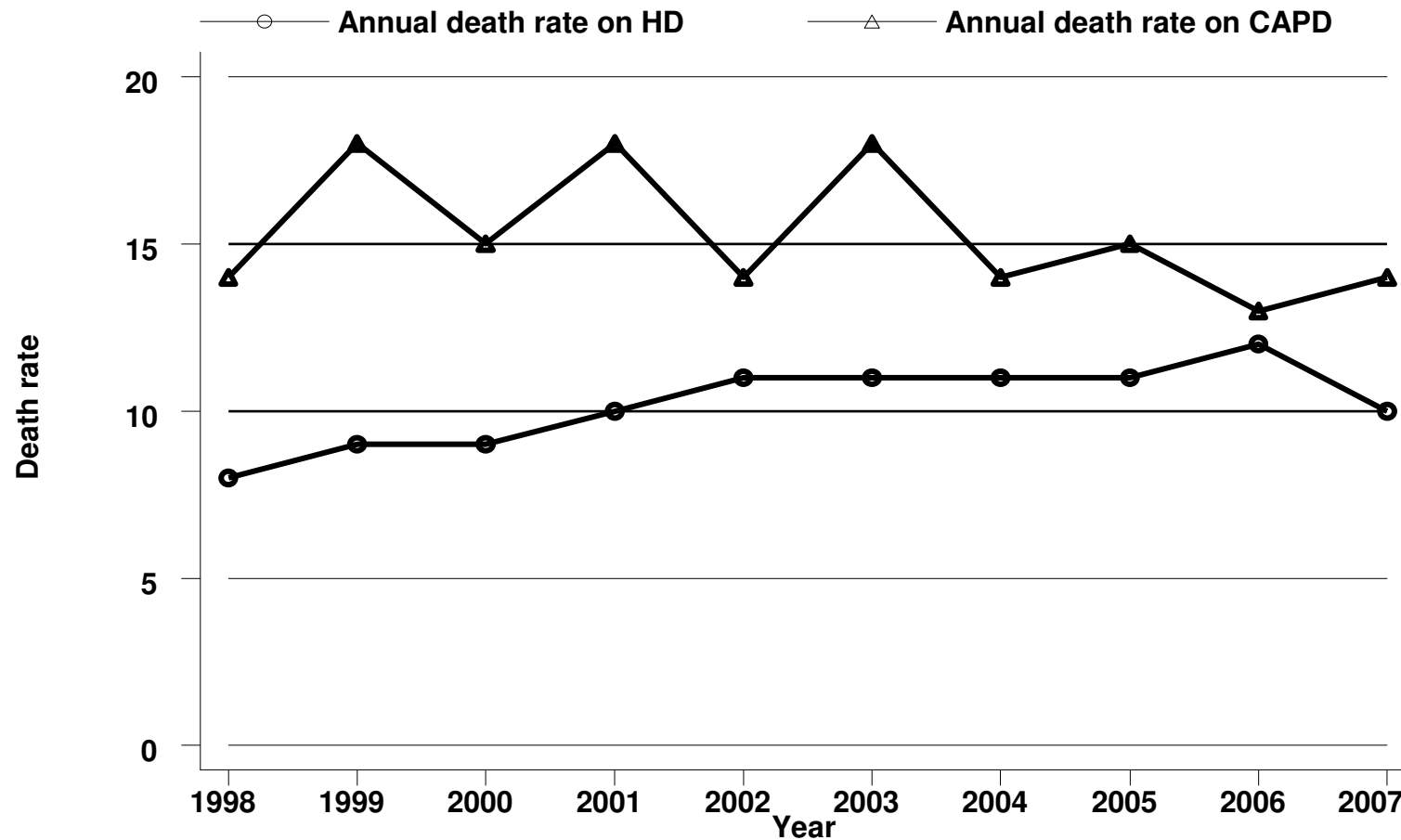
## **Death and Survival on Dialysis**

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**Table 4.1.1: Deaths on Dialysis 1998-2007**

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>No. of dialysis patients at risk</b>	<b>4120</b>	<b>5040</b>	<b>6117</b>	<b>7270</b>	<b>8483</b>	<b>9778</b>	<b>11152</b>	<b>12626</b>	<b>14212</b>	<b>15879</b>
Dialysis deaths	376	493	594	816	927	1157	1272	1420	1673	1678
Dialysis death rate %	9	10	10	11	11	12	11	11	12	11
<b>No. of HD patients at risk</b>	<b>3600</b>	<b>4472</b>	<b>5489</b>	<b>6556</b>	<b>7640</b>	<b>8791</b>	<b>10066</b>	<b>11489</b>	<b>12980</b>	<b>14460</b>
HD deaths	302	393	502	686	812	979	1120	1249	1507	1477
HD death rate %	8	9	9	10	11	11	11	11	12	10
<b>No. of CAPD patients at risk</b>	<b>520</b>	<b>568</b>	<b>628</b>	<b>714</b>	<b>843</b>	<b>988</b>	<b>1086</b>	<b>1138</b>	<b>1232</b>	<b>1420</b>
CAPD deaths	74	100	92	130	115	178	152	171	166	201
CAPD death rate %	14	18	15	18	14	18	14	15	13	14

Figure 4.1.1: Death Rates on Dialysis 1998-2007



Death rates on dialysis, 1998 to 2007

**Table 4.1.2: Causes of Death on Dialysis 1998-2007**

Year	1998		1999		2000		2001		2002	
	no	%	no	%	no	%	no	%	no	%
Cardiovascular	110	29	129	26	177	30	210	26	307	33
Died at home	72	19	107	22	135	23	228	28	212	23
Sepsis	66	18	84	17	85	14	128	16	141	15
CAPD peritonitis	2	1	11	2	21	4	29	4	16	2
GIT bleed	7	2	18	4	18	3	18	2	24	3
Cancer	8	2	6	1	8	1	18	2	18	2
Liver disease	5	1	7	1	14	2	11	1	16	2
Withdrawal	1	0	10	2	17	3	20	2	18	2
Others	54	14	65	13	74	12	88	11	104	11
Unknown	51	14	56	11	45	8	66	8	71	8
TOTAL	376	100	493	100	594	100	816	100	927	100

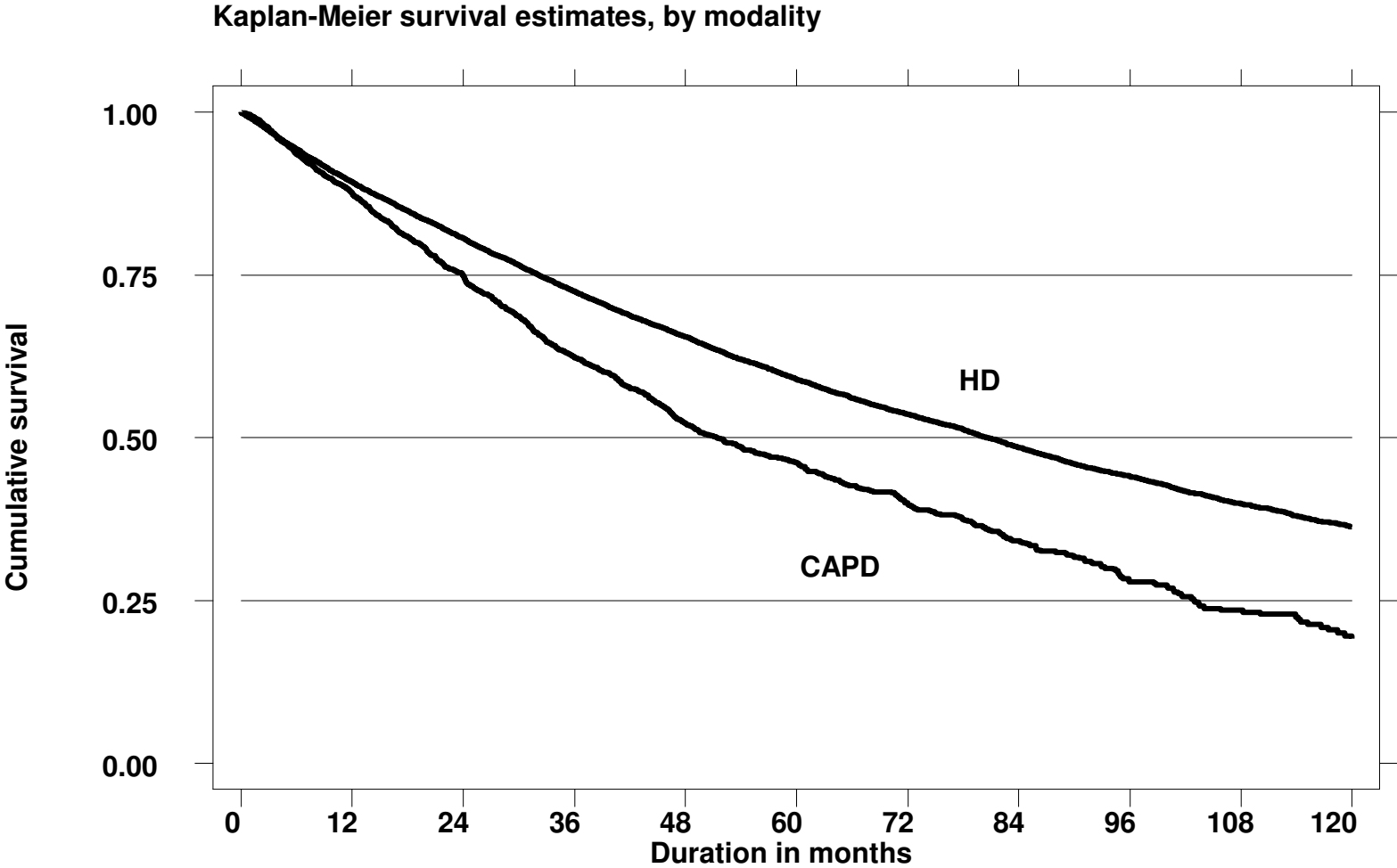
  

Year	2003		2004		2005		2006		2007	
	no	%	no	%	no	%	no	%	no	%
Cardiovascular	324	28	333	26	357	25	469	28	423	25
Died at home	291	25	304	24	315	22	346	21	307	18
Sepsis	183	16	154	12	161	11	206	12	165	10
CAPD peritonitis	11	1	13	1	18	1	21	1	14	1
GIT bleed	28	2	24	2	28	2	26	2	24	1
Cancer	27	2	20	2	28	2	36	2	26	2
Liver disease	23	2	29	2	25	2	32	2	33	2
Withdrawal	26	2	9	1	11	1	22	1	26	2
Others	160	14	317	25	398	28	383	23	521	31
Unknown	84	7	69	5	79	6	132	8	139	8
TOTAL	1157	100	1272	100	1420	100	1673	100	1678	100

**Table 4.2.1(a): Patient survival by dialysis modality analysis censored for change of modality**

Dialysis modality Interval (month)	CAPD			HD			All Dialysis		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	3427	94	0	23081	94	0	26508	94	0
12	2812	88	1	19945	89	0	22757	89	0
24	1866	75	1	15139	81	0	17005	80	0
36	1228	62	1	11553	72	0	12781	71	0
48	804	52	1	8781	66	0	9585	64	0
60	530	46	1	6619	59	0	7149	57	0
72	334	40	1	5011	54	0	5345	52	0
84	207	34	1	3759	49	0	3965	47	0
96	117	28	2	2821	44	0	2937	43	0
108	76	24	2	2070	40	0	2145	38	0
120	42	19	2	1505	36	1	1547	35	1

Figure 4.2.1(a): Patient survival by dialysis modality analysis censored for change of modality

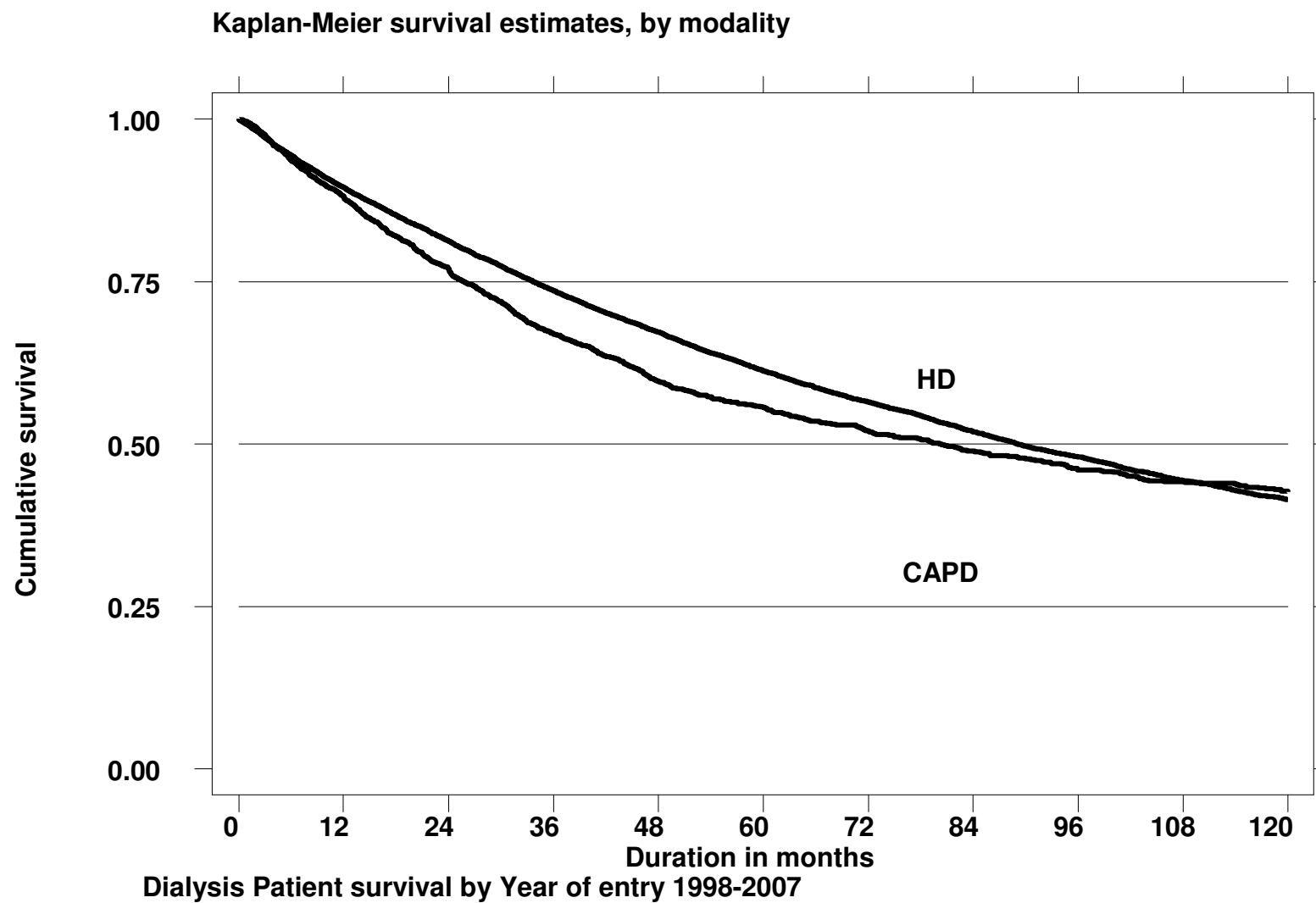


Dialysis Patient Survival by Dialysis Modality 1998-2007

**Table 4.2.1(b) ii: Patient survival by dialysis modality analysis as per ITT**

Dialysis modality Interval (month)	CAPD			HD			All Dialysis		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	3552	94	0	23531	94	0	27064	94	0
12	3066	88	1	20727	89	0	23793	89	0
24	2304	77	1	16192	81	0	18496	81	0
36	1742	67	1	12634	74	0	14376	73	0
48	1328	60	1	9834	67	0	11162	66	0
60	1021	56	1	7611	61	0	8631	60	0
72	781	52	1	5912	56	0	6693	56	0
84	591	49	1	4567	52	0	5157	52	0
96	452	46	1	3535	48	0	3986	48	0
108	351	44	1	2708	44	0	3057	44	0
120	271	43	1	2068	41	0	2339	42	0

Figure 4.2.1(b)ii: Patient survival by dialysis modality analysis as per ITT

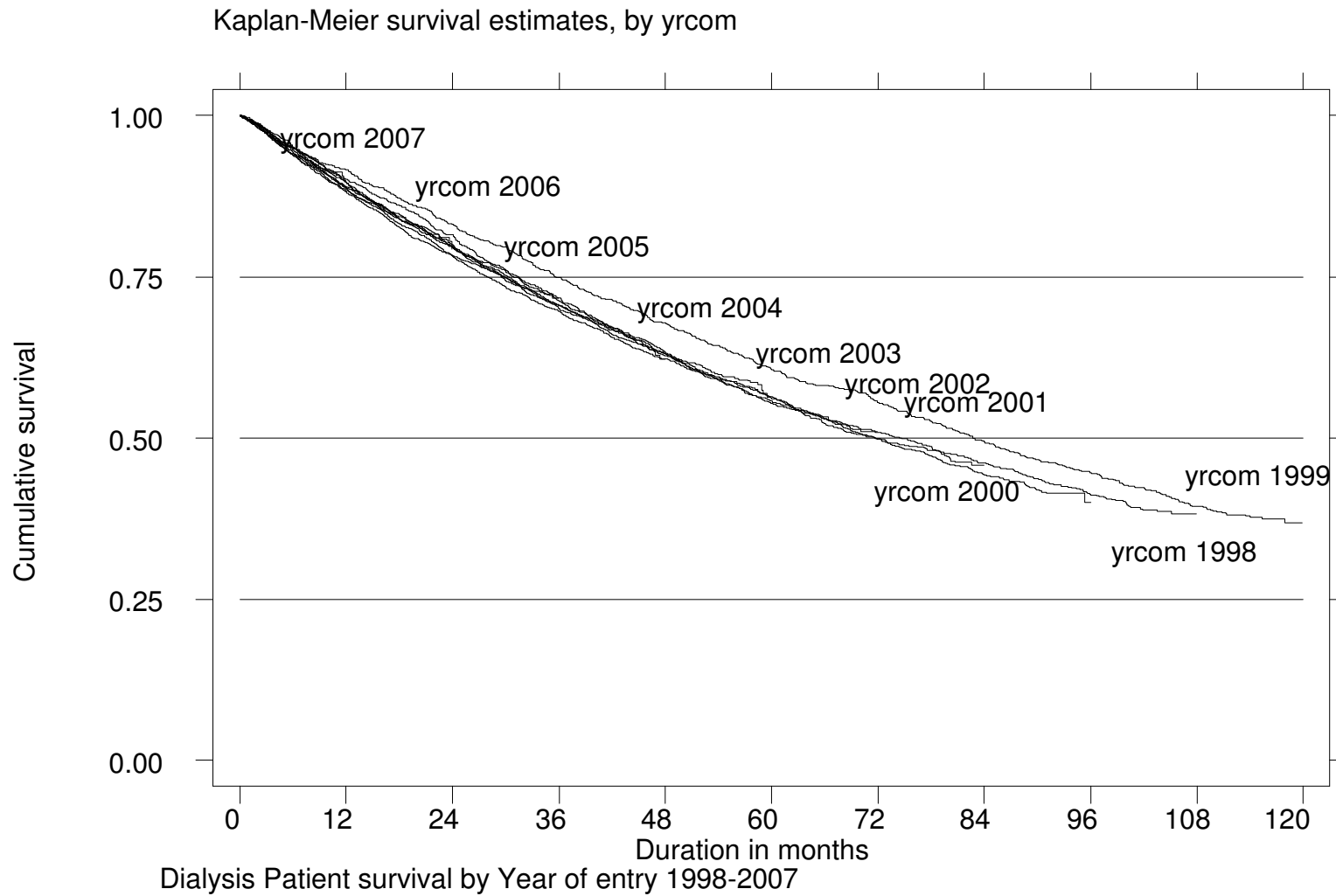




**Table 4.2.2: Unadjusted patient survival by year of entry, 1998-2007**

Year Interval (months)	1998			1999			2000			2001		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	1245	95	1	1511	95	1	1807	95	1	2071	94	1
12	1179	91	1	1411	90	1	1667	90	1	1888	89	1
24	1039	83	1	1214	81	1	1415	80	1	1604	78	1
36	915	75	1	1038	72	1	1225	71	1	1388	70	1
48	804	68	1	894	63	1	1059	63	1	1207	62	1
60	710	61	1	789	56	1	919	56	1	1044	55	1
72	637	56	1	703	51	1	800	50	1	927	50	1
84	556	49	1	623	46	1	698	44	1	-	.	.
96	496	45	1	548	41	1	-	.	.	-	.	.
108	434	39	1	-	.	.	-	.	.	-	.	.
Year Interval (months)	2002			2003			2004			2005		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	2353	95	0	2530	94	0	2845	95	0	3012	94	0
12	2176	90	1	2334	89	1	2616	89	1	2767	88	1
24	1844	80	1	2020	79	1	2269	80	1	2383	78	1
36	1597	70	1	1745	70	1	1952	71	1	-	.	.
48	1393	63	1	1534	63	1	-	.	.	-	.	.
60	1215	56	1	-	.	.	-	.	.	-	.	.
Year Interval (months)	2006			2007								
	No.	% Survival	SE	No.	% Survival	SE						
6	3454	94	0	1886	95	0						
12	3194	88	1	-	.	.						

**Figure 4.2.2: Unadjusted patient survival by year of entry, 1998-2007**



**Table 4.2.3: Unadjusted patient survival by age, 1998-2007**

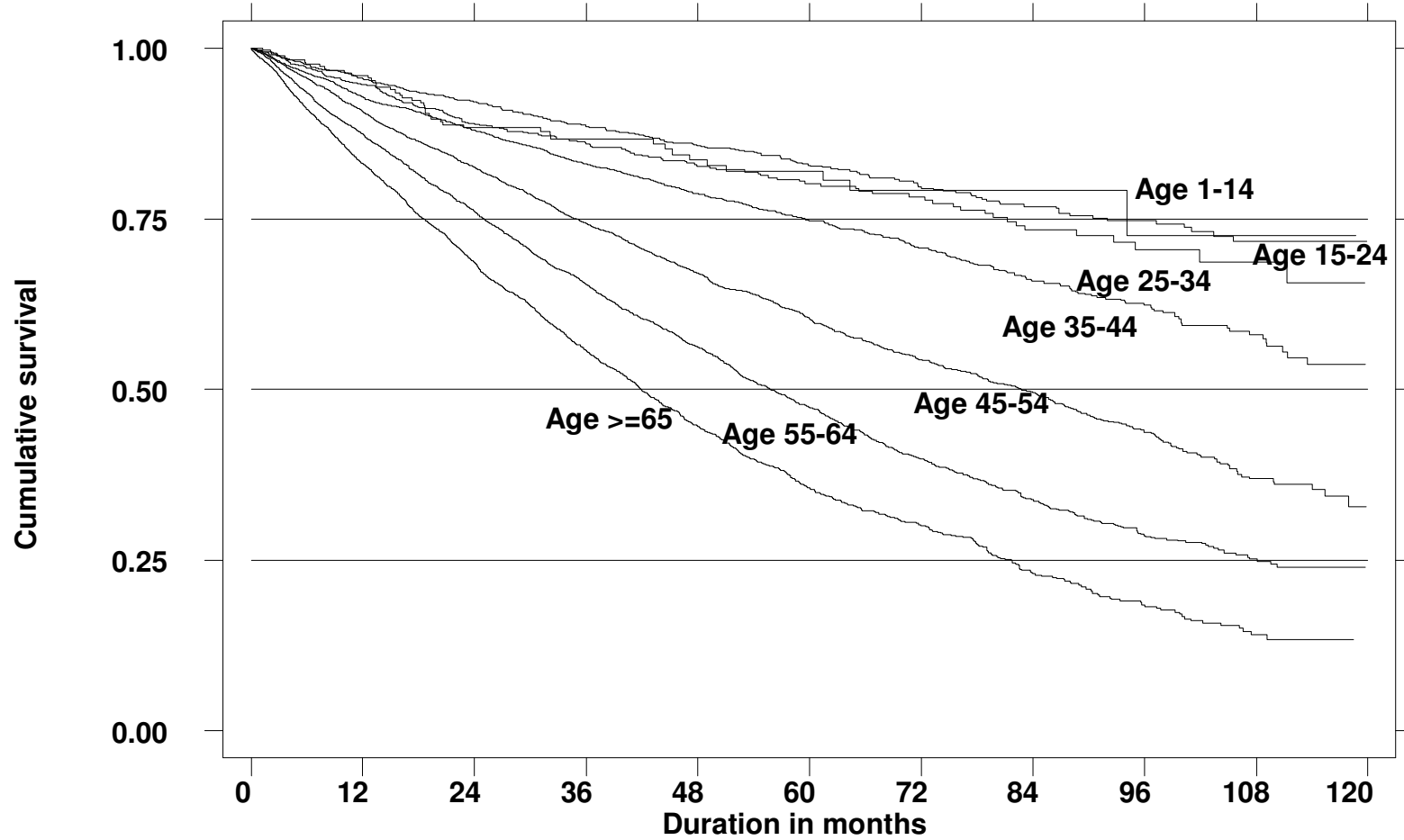
Age group (years) Interval (months)	<=14			15-24			25-34			35-44		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	314	98	1	1021	97	1	1761	98	0	3062	96	0
12	280	96	1	877	95	1	1537	96	0	2651	93	0
24	204	88	2	630	89	1	1170	92	1	2052	88	1
36	141	87	2	481	86	1	924	89	1	1598	83	1
48	104	84	3	350	83	1	723	86	1	1214	79	1
60	71	82	3	249	80	2	537	83	1	916	75	1
72	40	79	3	175	78	2	374	80	1	654	71	1
84	26	79	3	109	73	2	270	77	2	423	66	1
96	11	73	7	62	70	3	169	75	2	243	62	1
108	6	73	7	26	69	3	77	72	2	113	58	2

Age group (years) Interval (months)	45-54			55-64			>=65		
	No.	% Survival	SE	No.	% Survival	SE	No.	% Survival	SE
6	5767	96	0	6198	93	0	4584	91	0
12	4936	91	0	5207	87	0	3743	83	1
24	3593	83	1	3686	76	1	2454	69	1
36	2635	74	1	2522	65	1	1561	56	1
48	1861	67	1	1696	56	1	941	45	1
60	1309	60	1	1061	47	1	534	35	1
72	865	54	1	640	40	1	318	30	1
84	543	50	1	365	34	1	147	23	1
96	300	44	1	195	29	1	70	18	1
108	113	37	2	77	25	1	28	14	1

Figure 4.2.3: Unadjusted patient survival by age, 1998-2007

Kaplan-Meier survival estimates, by agegp



Dialysis Patient Survival by Age, 1998-2007

**Table 4.2.4: Unadjusted patient survival by Diabetes status, 1998-2007**

Diabetes status Interval (months)	Non-diabetic			Diabetic		
	No.	% Survival	SE	No.	% Survival	SE
6	11107	96	0	11599	93	0
12	9631	92	0	9598	86	0
24	7343	86	0	6441	74	0
36	5648	80	0	4209	62	1
48	4223	75	0	2664	52	1
60	3064	70	1	1611	43	1
72	2115	65	1	948	36	1
84	1357	60	1	520	30	1
96	794	56	1	249	24	1
108	333	52	1	102	20	1

Figure 4.2.4: Unadjusted patient survival by Diabetes status, 1998-2007

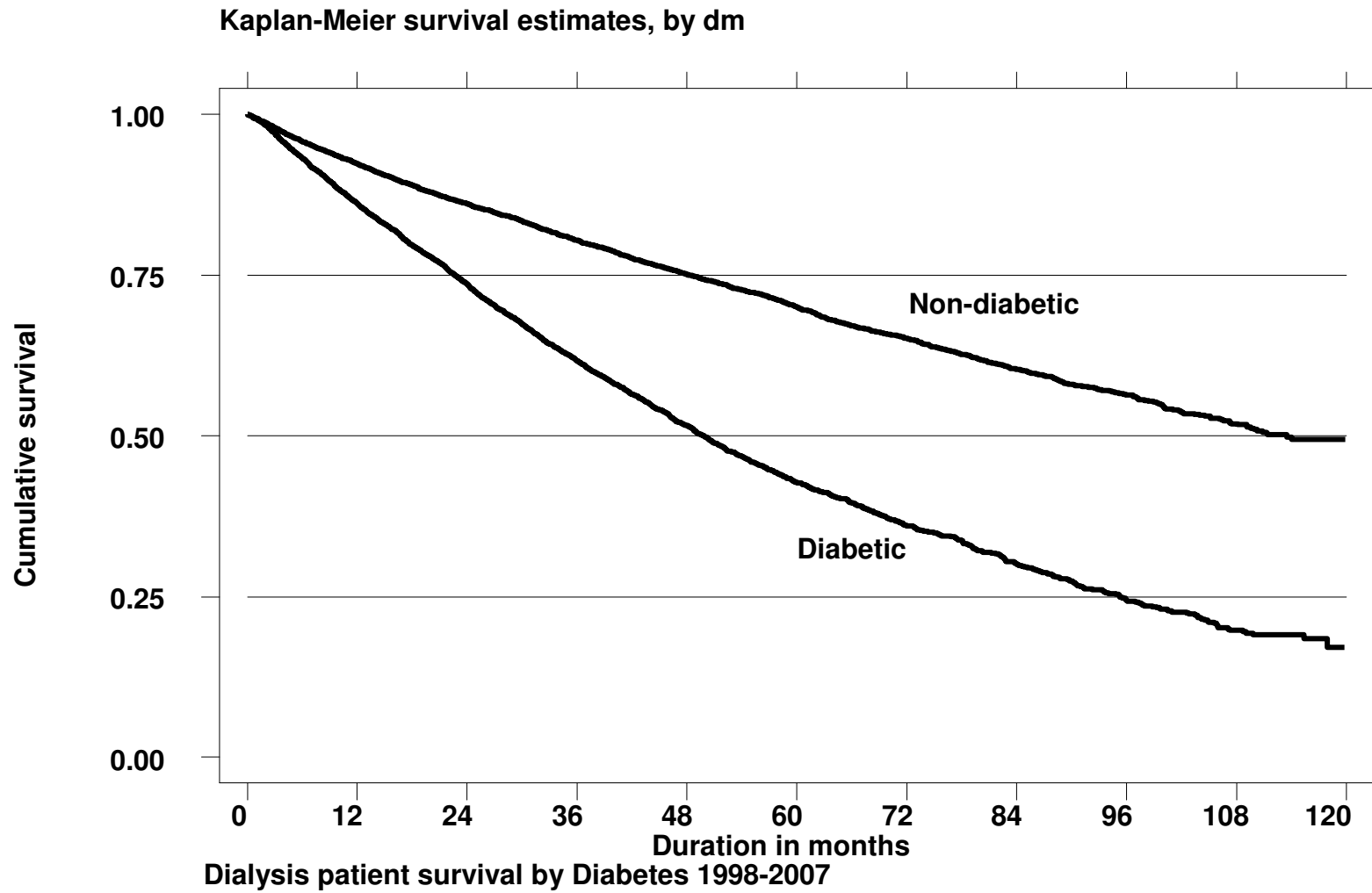
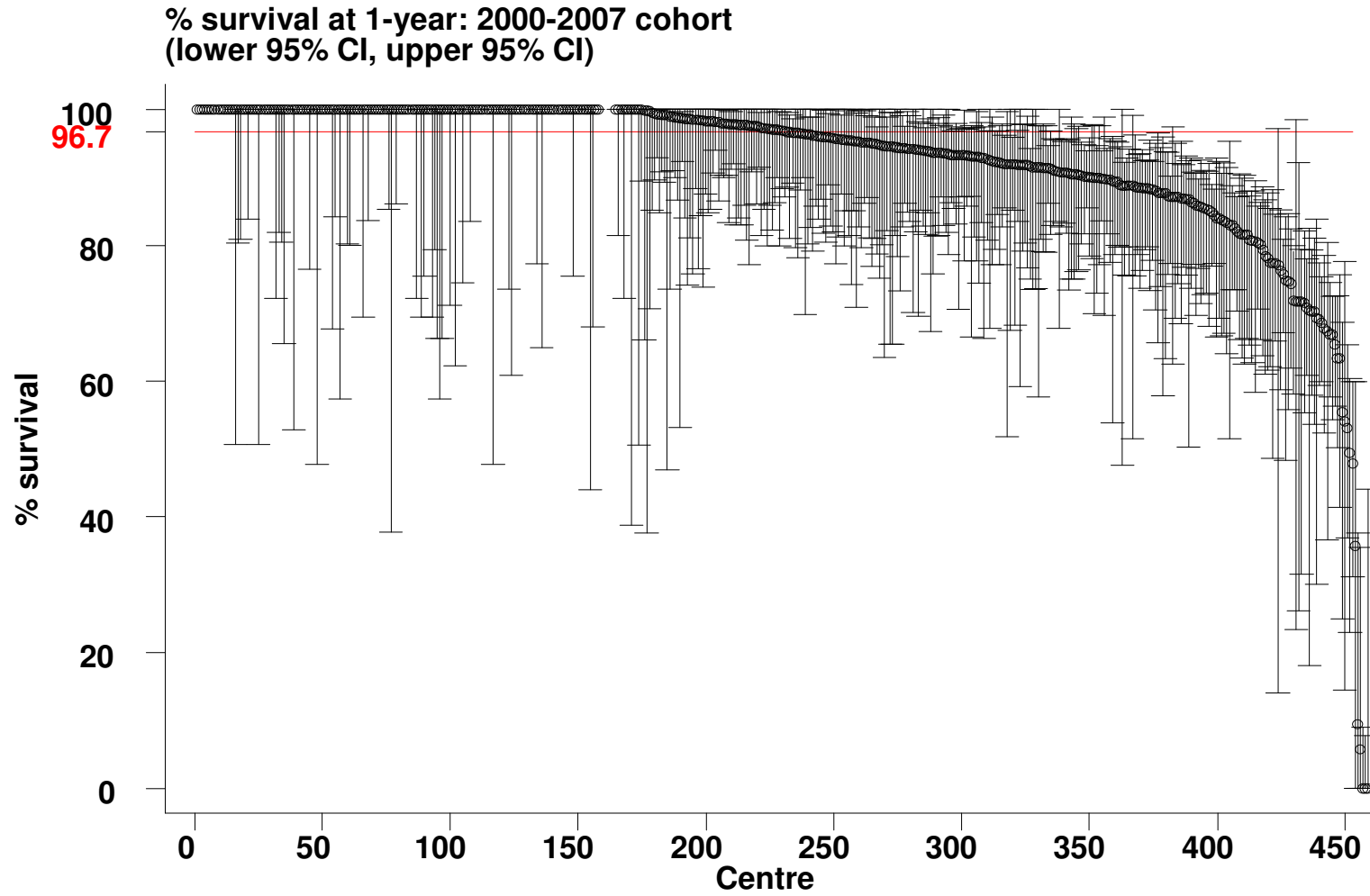
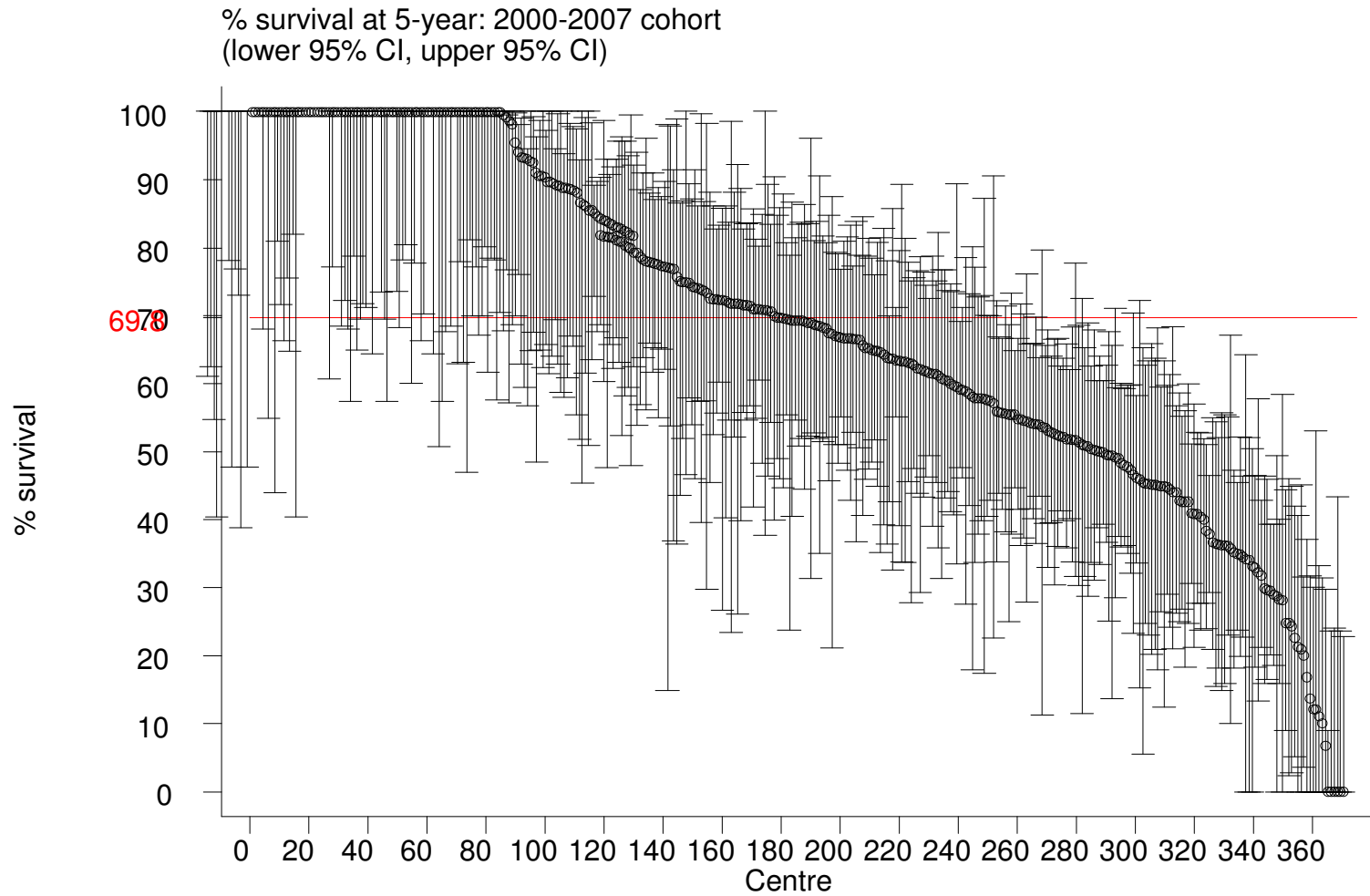


Figure 4.3.1(a): Variation in % Survival at 1-years adjusted to age and diabetes, 2000-2007



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

**Figure 4.3.1(b): Variation in % Survival at 5-years adjusted to age and diabetes, 2000-2007**



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



Figure 4.3.1(c): Funnel plot for adjusted age at 60 and diabetes at 1 year after 90 days survival; 2000-2007 cohorts (HD centres)

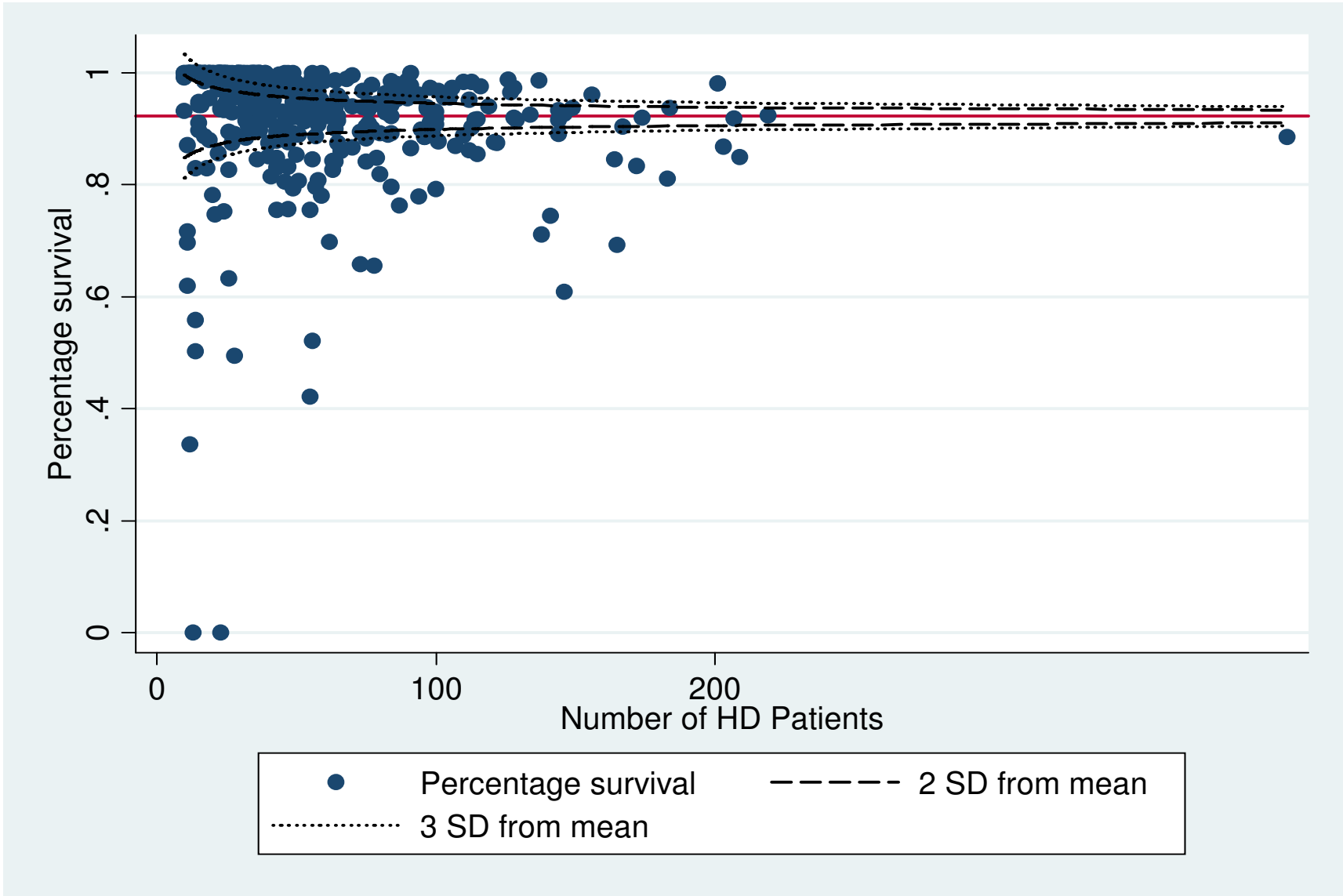


Figure 4.3.1(d): Funnel plot for adjusted age at 60 and diabetes at 5 year after 90 days survival; 2000-2007 cohorts (HD centres)

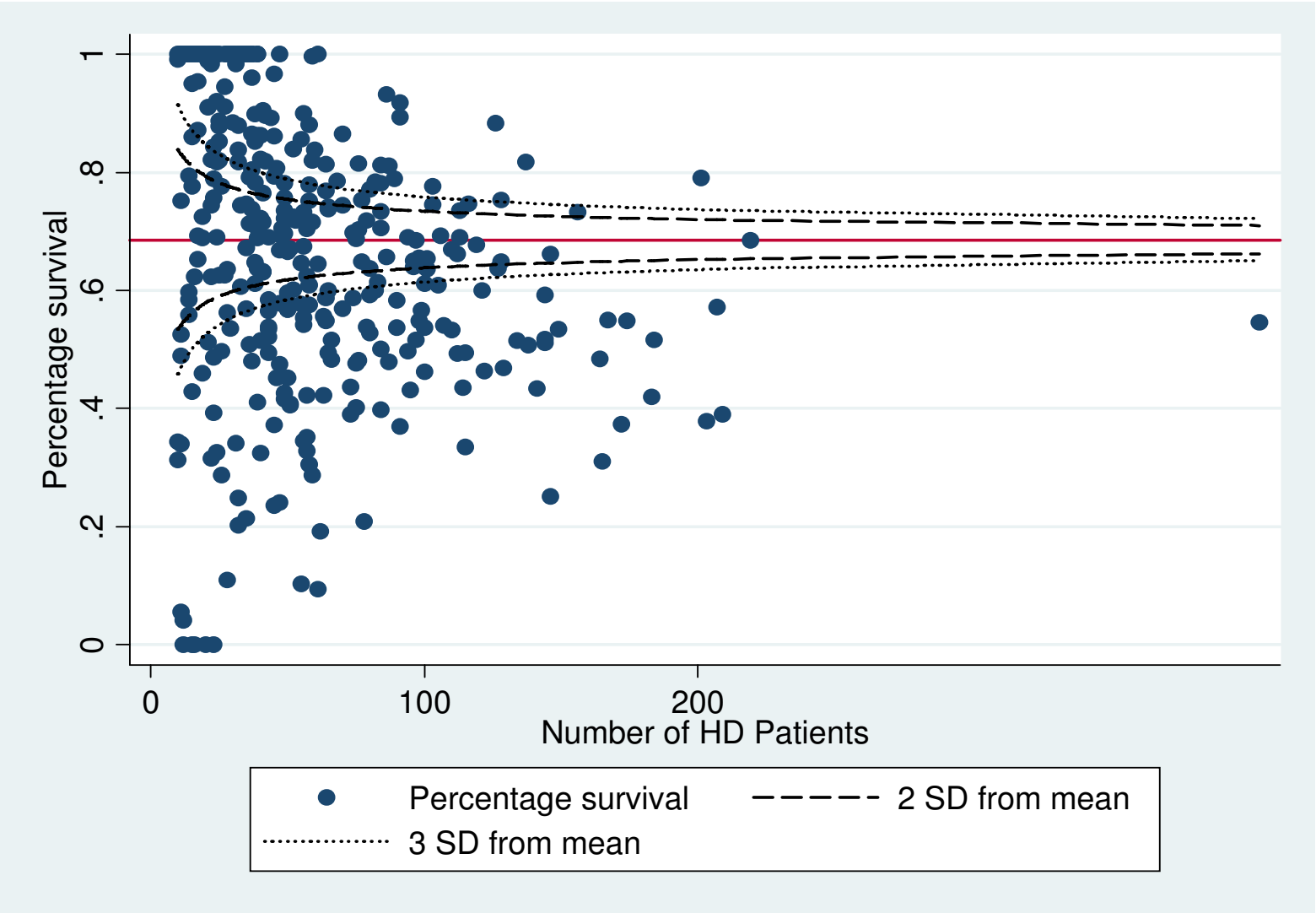
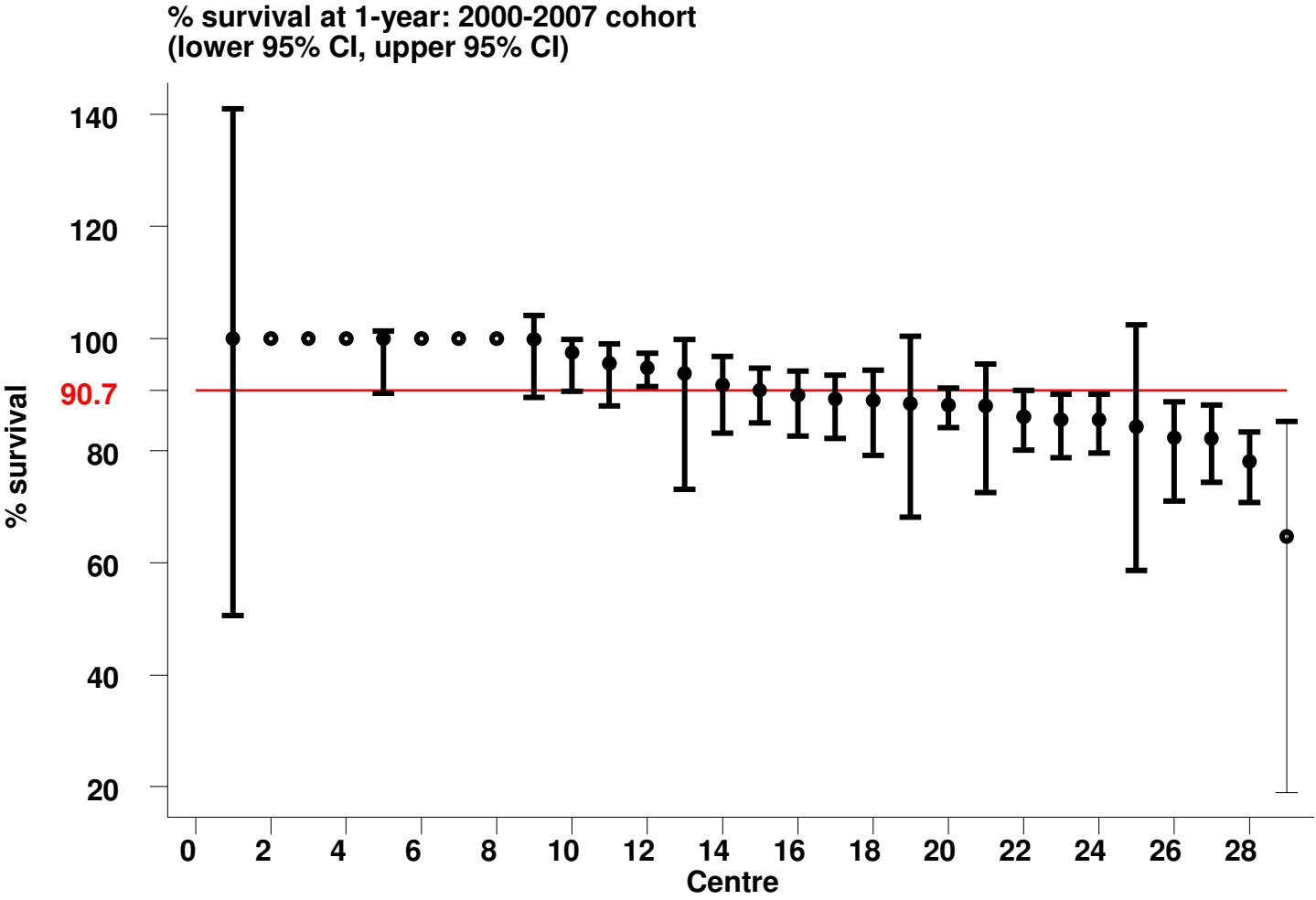
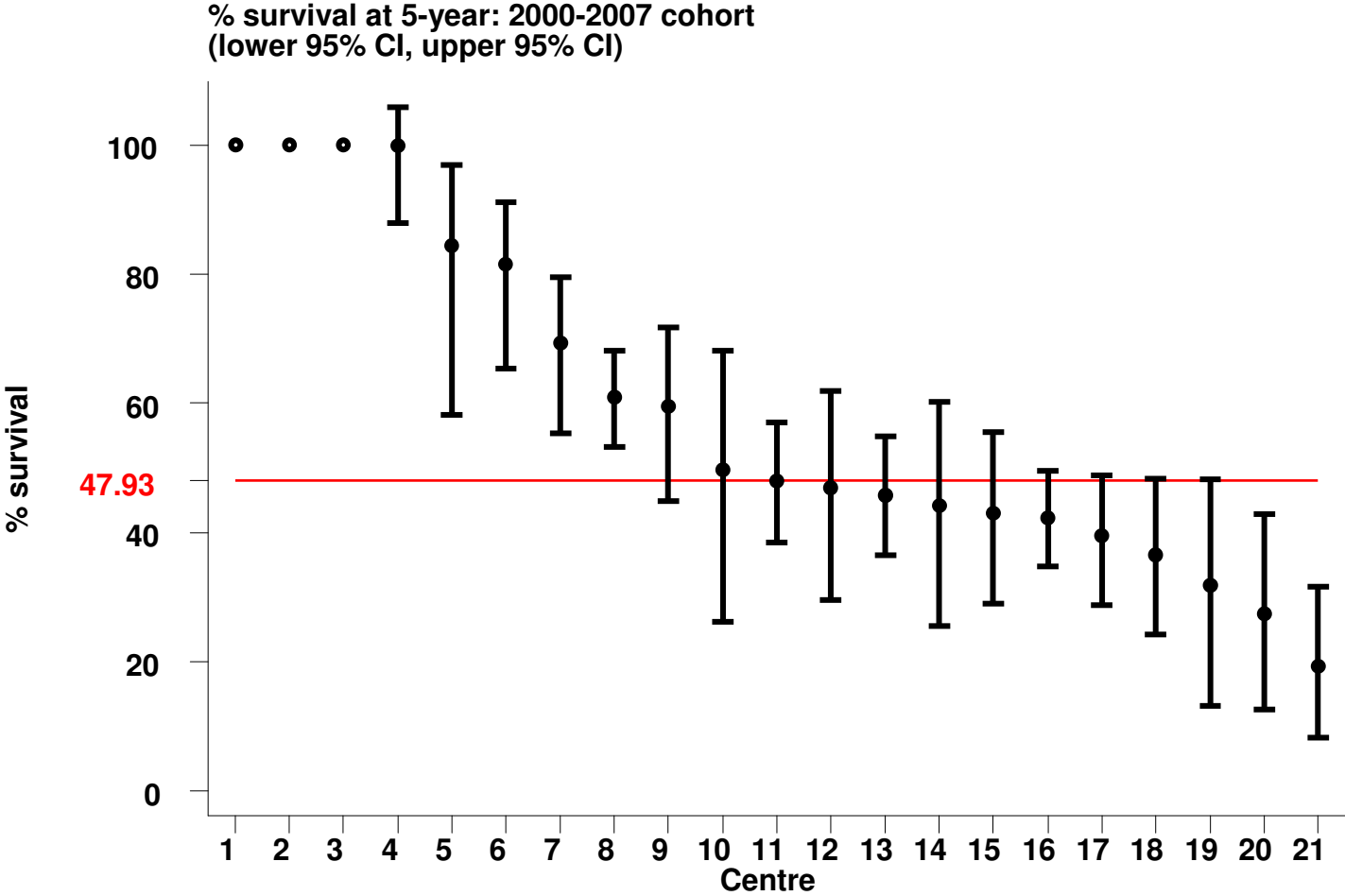


Figure 4.3.2(a): Variation in % Survival at 1-year adjusted to age and diabetes, 2000-2007



\*Horizontal line represents the median % survival among CAPD centres

Figure 4.3.2(b): Variation in % Survival at 5-years adjusted to age and diabetes, 2000-2007



\*Horizontal line represents the median % survival among CAPD centres

Figure 4.3.2(c): Funnel plot for adjusted age at 60 and diabetes at 1 year after 90 days survival; 2000-2007 cohorts (CAPD centres)

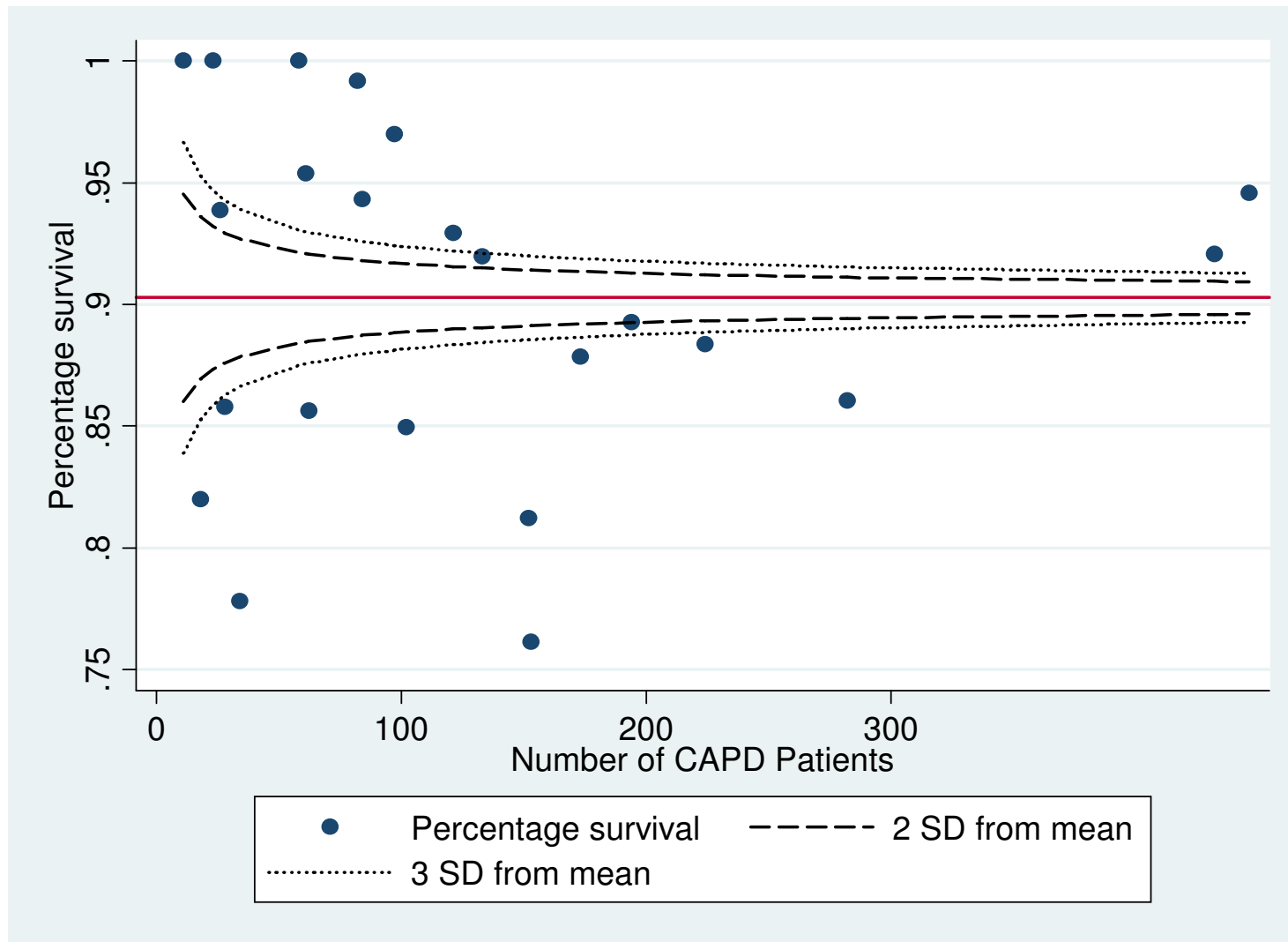
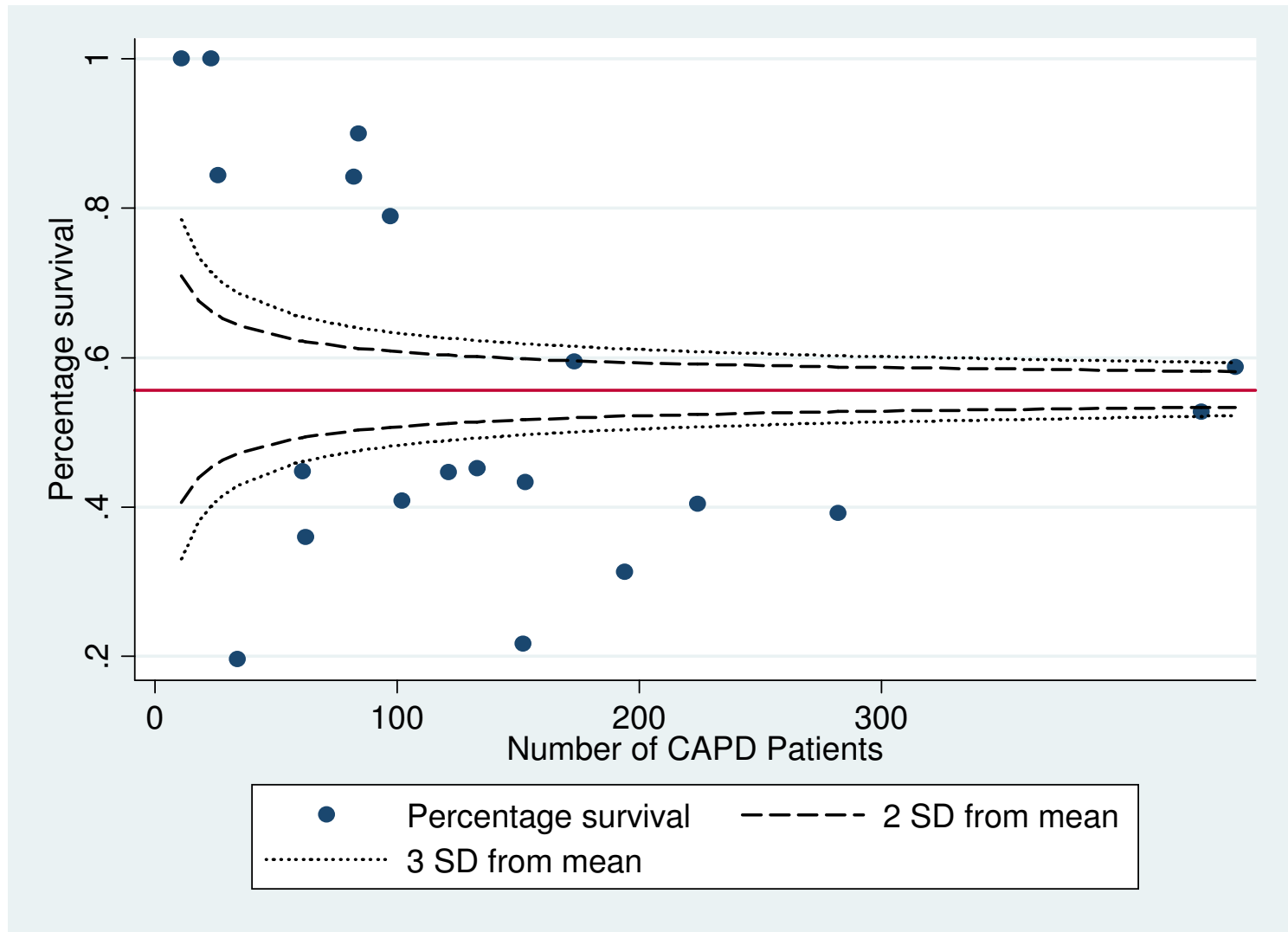


Figure 4.3.2(d): Funnel plot for adjusted age at 60 and diabetes at 5 year after 90 days survival; 2000-2007 cohorts (CAPD centres)



**Table 4.4.1: Adjusted hazard ratio for mortality of dialysis patients (1998-2007 cohort)**

Factors	N	Hazard Ratio	95% CI	P value
<b>Age (years):</b>				
0-14(ref. *)	355	1.00		
15-24	1,154	1.51	(1.08, 2.11)	0.02
25-34	1,987	1.29	(0.93, 1.79)	0.12
35-44	3,443	1.86	(1.35, 2.55)	0.00
45-54	6,553	2.60	(1.90, 3.55)	0.00
55-64	7,235	3.35	(2.45, 4.58)	0.00
>=65	5,528	4.67	(3.41, 6.39)	0.00
<b>Gender:</b>				
Male (ref. *)	14,570	1.00		
Female	11,685	0.87	(0.83, 0.91)	0.00
<b>Primary diagnosis:</b>				
Unknown primary (ref. *)	7,236	1.00		
Diabetes mellitus	13,319	1.49	(1.40, 1.58)	0.00
GN/SLE	2,006	0.89	(0.79, )0.99	0.04
Polycystic kidney	339	1.10	(0.87, 1.38)	0.43
Obstructive nephropathy	823	1.02	(0.89, 1.18)	0.74
Others	2,532	1.01	(0.92, 1.11)	0.83
<b>Year start dialysis:</b>				
Year 1998-9 (ref. *)	2,949	1.00		
Year 2000-2001	4,180	1.07	(0.99, 1.14)	0.06
Year 2002-3	5,267	1.09	(1.02, 1.17)	0.02
Year 2004-7	13,859	1.10	(1.02, 1.18)	0.01
<b>Modality:</b>				
HD (ref*)	22,793	1.00		
CAPD	3,462	1.30	(1.20, 1.41)	0.00
<b>BMI:</b>				
<18.5	2,432	1.56	(1.41, 1.73)	0.00
18.5-<25	17,597	1.29	(1.21, 1.37)	0.00
>=25 (ref. *)	6,226	1.00		

**Table 4.4.1: Adjusted hazard ratio for mortality of dialysis patients (1998-2007 cohort)**

Factors	N	Hazard Ratio	95% CI	P value
Serum albumin (g/L):				
<30	1,574	4.29	(3.88, 4.74)	0.00
30-<35	3,426	2.43	(2.25, 2.63)	0.00
35-<40	12,417	1.76	(1.66, 1.87)	0.00
>=40 (ref.*)	8,838	1.00		
Serum cholesterol (mmol/L):				
<3.2	960	1.12	(0.99, 1.27)	0.07
3.2-<5.2	19,202	1.16	(1.10, 1.23)	0.00
>=5.2 (ref.*)	6,093	1.00		
KT/V				
<1	589	1.49	(1.28, 1.73)	0.00
1-<1.2	2,053	1.06	(0.97, 1.17)	0.20
1.2-<1.4 (ref.*)	5,577	1.00		
1.4-<1.6	7,896	0.99	(0.94, 1.06)	0.96
>=1.6	10,140	0.82	(0.77, 0.89)	0.00
Diastolic BP (mmHg):				
<70	3,044	0.92	(0.85, 0.99)	0.03
70-<80	9,732	0.97	(0.92, 1.02)	0.27
80-<90 (ref.*)	10,282	1.00		
90-<100	2,619	1.07	(0.98, 1.17)	0.15
>=100	578	1.96	(1.69, 2.28)	0.00
Hemoglobin:				
<8	2,373	3.42	(3.08, 3.80)	0.00
8-<9	3,819	2.23	(2.02, 2.46)	0.00
9-<10	10,667	2.26	(2.06, 2.47)	0.00
10-<11	5,288	1.26	(1.14, 1.39)	0.00
11-<12 (ref.*)	2,729	1.00		
>=12	1,379	1.01	(0.88, 1.17)	0.87



**Table 4.4.1: Adjusted hazard ratio for mortality of dialysis patients (1998-2007 cohort)**

Factors	N	Hazard Ratio	95% CI	P value
Serum calcium (mmol/L):				
<2.2	8,160	0.82	(0.77, 0.86)	0.00
2.2-<2.6 (ref.*)	17,463	1.00		
>=2.6	632	1.72	(1.52, 1.95)	0.00
Calcium Phosphate product (mmol <sup>2</sup> /L <sup>2</sup> ):				
<3.5	8,564	1.01	(0.93, 1.10)	0.84
3.5-<4.5 (ref.*)	12,014	1.00		
4.5-<5.5	3,985	0.67	(0.61, 0.74)	0.00
>=5.5	1,692	0.61	(0.51, 0.73)	0.00
Serum Phosphate (mmol/L):				
<1.6	9,111	0.89	(0.82, 0.97)	0.01
1.6-<2.0 (ref.*)	11,571	1.00		
2.0-<2.2	2,349	1.00	(0.90, 1.12)	0.95
2.2-<2.4	1,454	1.13	(0.98, 1.30)	0.09
2.4-<2.6	875	1.37	(1.13, 1.65)	0.00
>=2.6	895	1.85	(1.50, 2.28)	0.00
HBsAg:				
Negative (ref.*)	25,203	1.00		
Positive	1,052	1.16	(1.05, 1.28)	0.00
Anti-HCV:				
Negative (ref.*)	25,145	1.00		
Positive	1,110	0.86	(0.78, 0.95)	0.00
Cardiovascular disease (CVD):				
No CVD (ref.*)	21,248	1.00		
CVD	5,007	1.31	(1.24, 1.37)	0.00

Figure 4.4.1(a): Adjusted hazard ratio for mortality of dialysis patients by diastolic blood pressure (1998-2007 cohort)

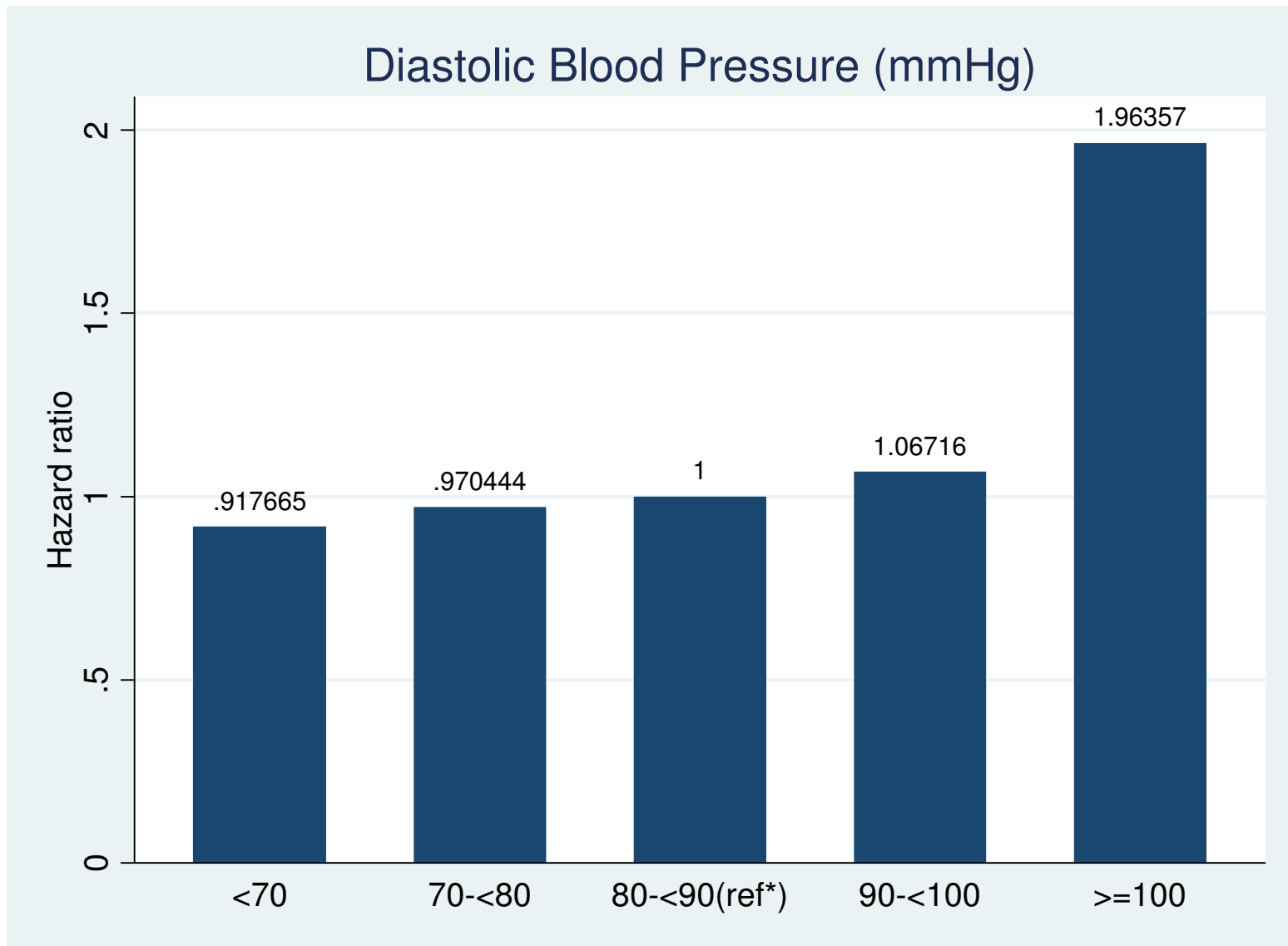


Figure 4.4.1(b): Adjusted hazard ratio for mortality of dialysis patients by serum phosphate (1998-2007 cohort)

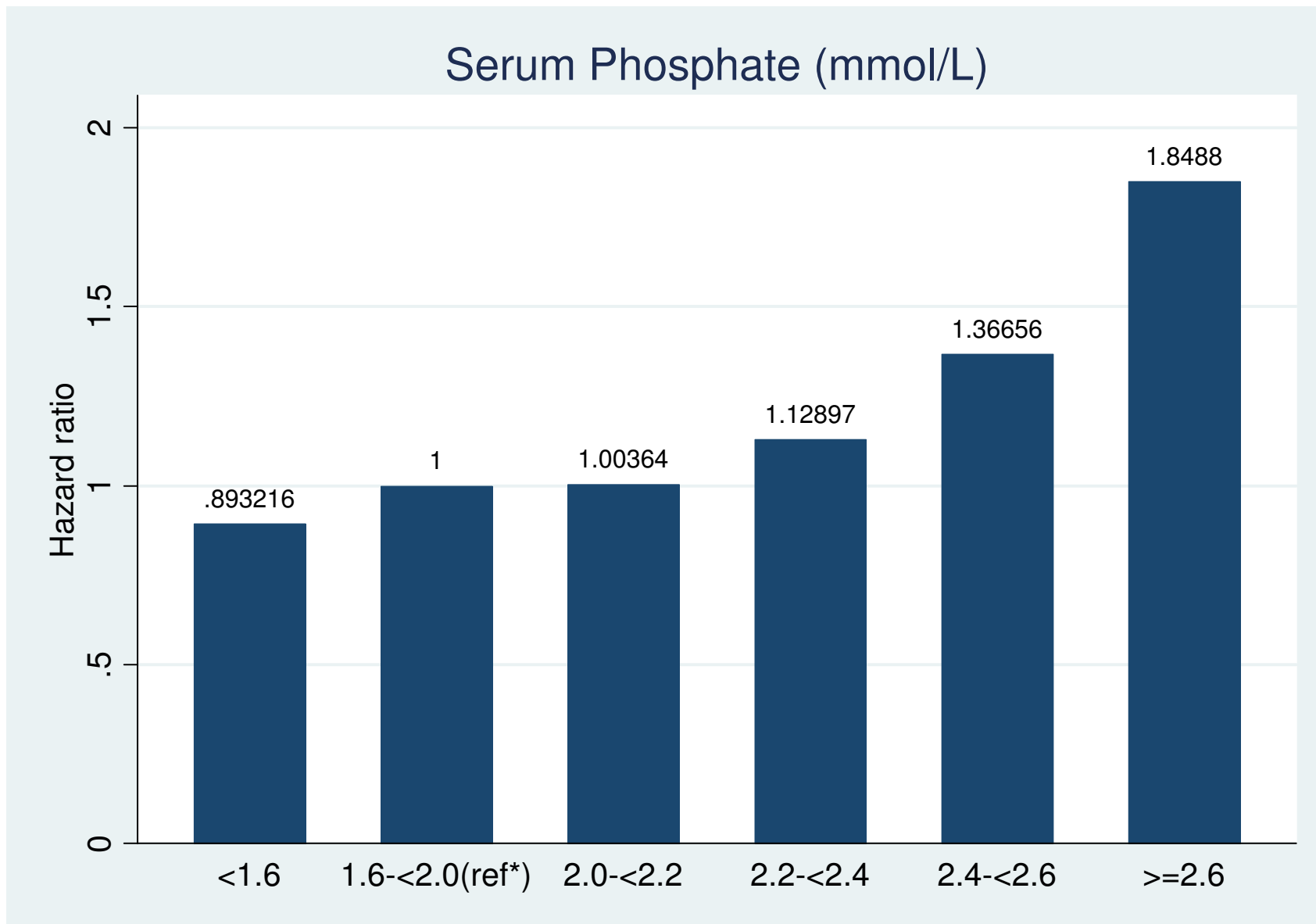


Figure 4.4.1(c): Adjusted hazard ratio for mortality of dialysis patients by KT/V (1998-2007 cohort)

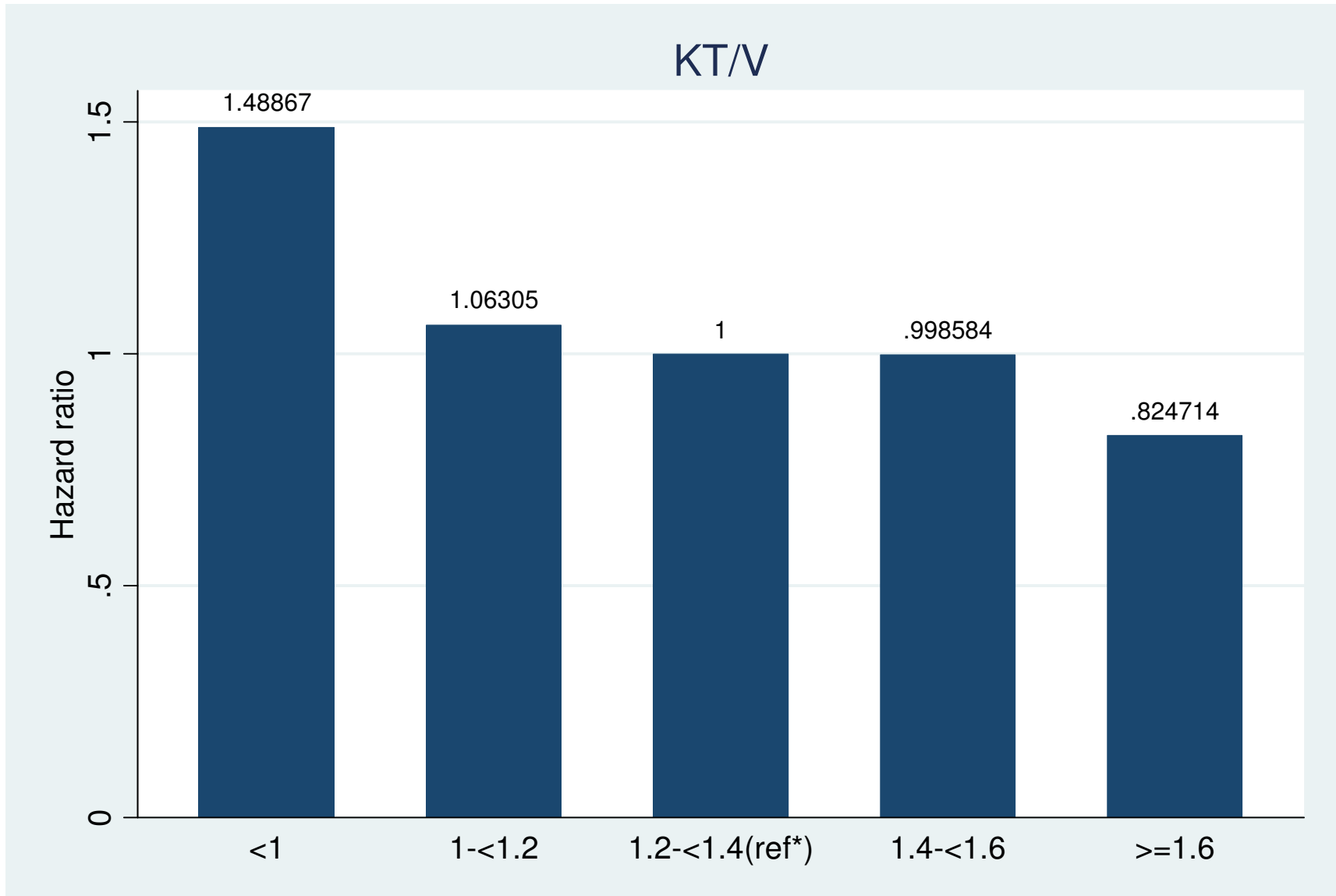
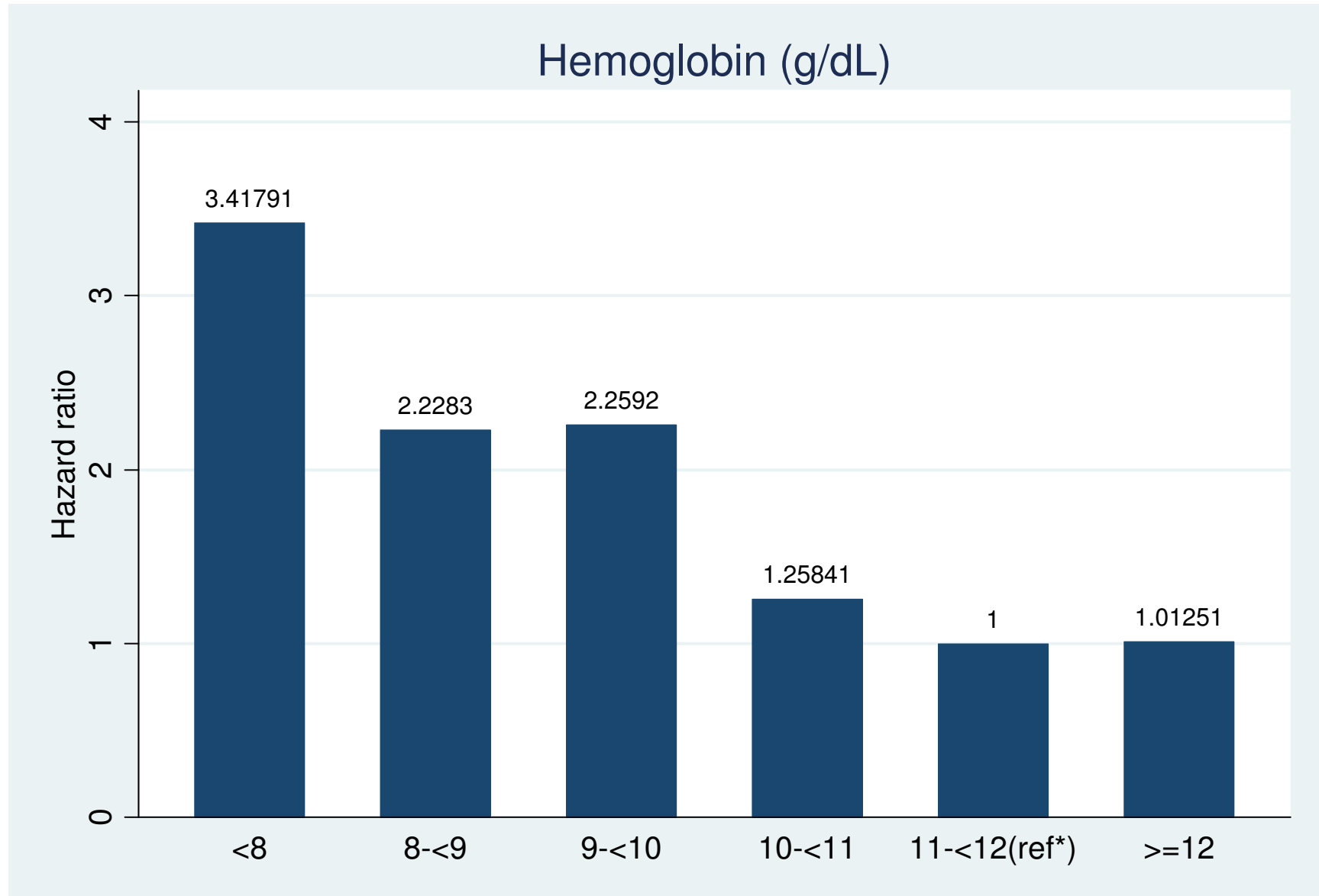


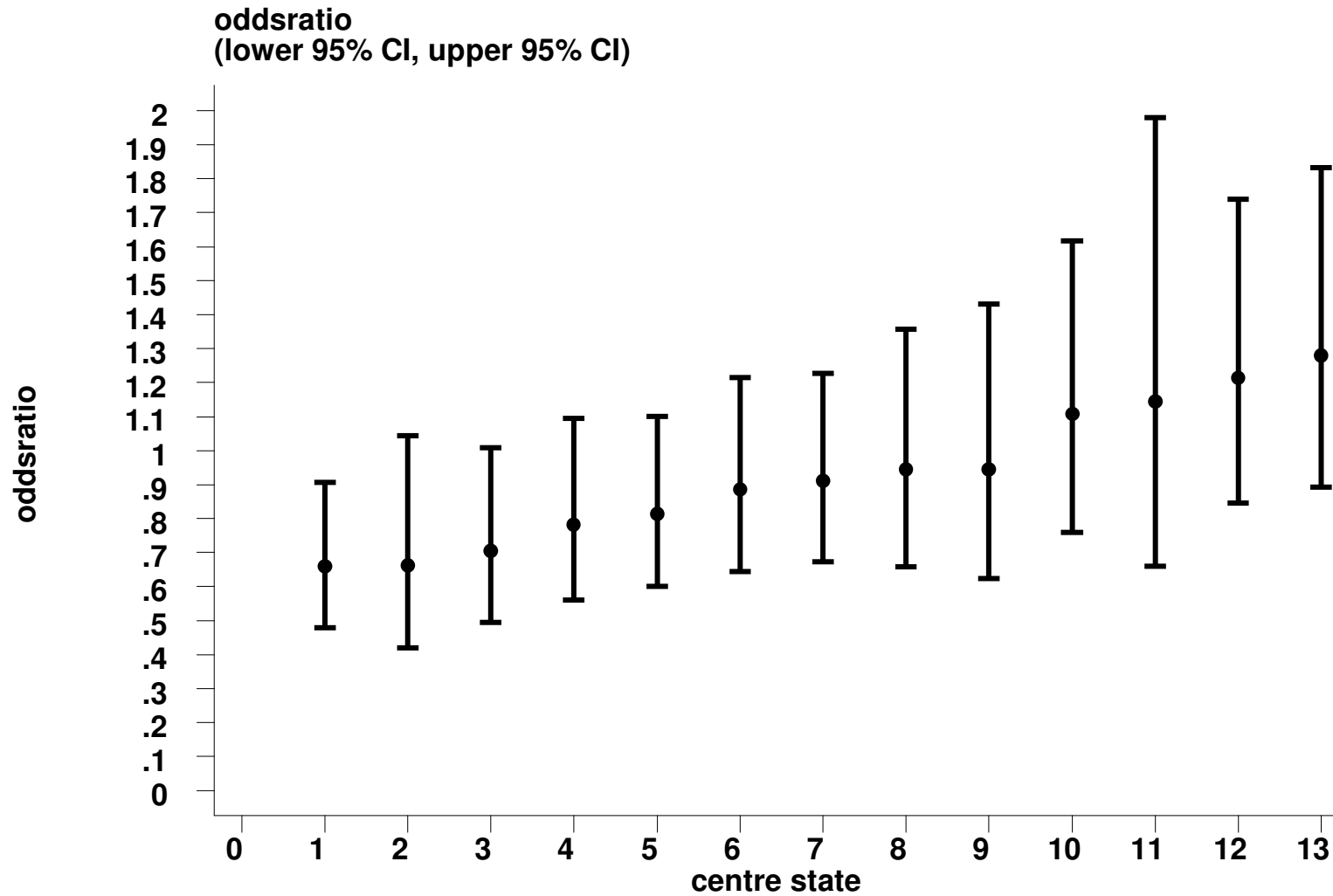
Figure 4.4.1(d): Adjusted hazard ratio for mortality of dialysis patients by hemoglobin (1998-2007 cohort)



**Table 4.4.2: Variation in odds ratio of death by state, dialysis patients 2007**

State	Variation in odds ratio of death						
	Min	5 <sup>th</sup> centile	LQ	Median	UQ	95 <sup>th</sup> centile	Max
	0.659	0.659	0.783	0.91	1.108	1.279	1.279
	Number of centres						Odds ratio
Pulau Pinang	59						0.783
Melaka	30						1.214
Johor	90						0.910
Perak	71						0.885
Selangor and WP Putrajaya	123						0.813
WP Kuala Lumpur	76						0.660
Negeri Sembilan	26						0.662
Kedah	36						0.945
Perlis	3						1.143
Terengganu	16						0.946
Pahang	26						1
Kelantan Darul Naim	26						1.108
Sarawak	38						0.706
Sabah and WPLabuan	35						1.279

Figure 4.4.2: Variation in odds ratio of death by state 2007

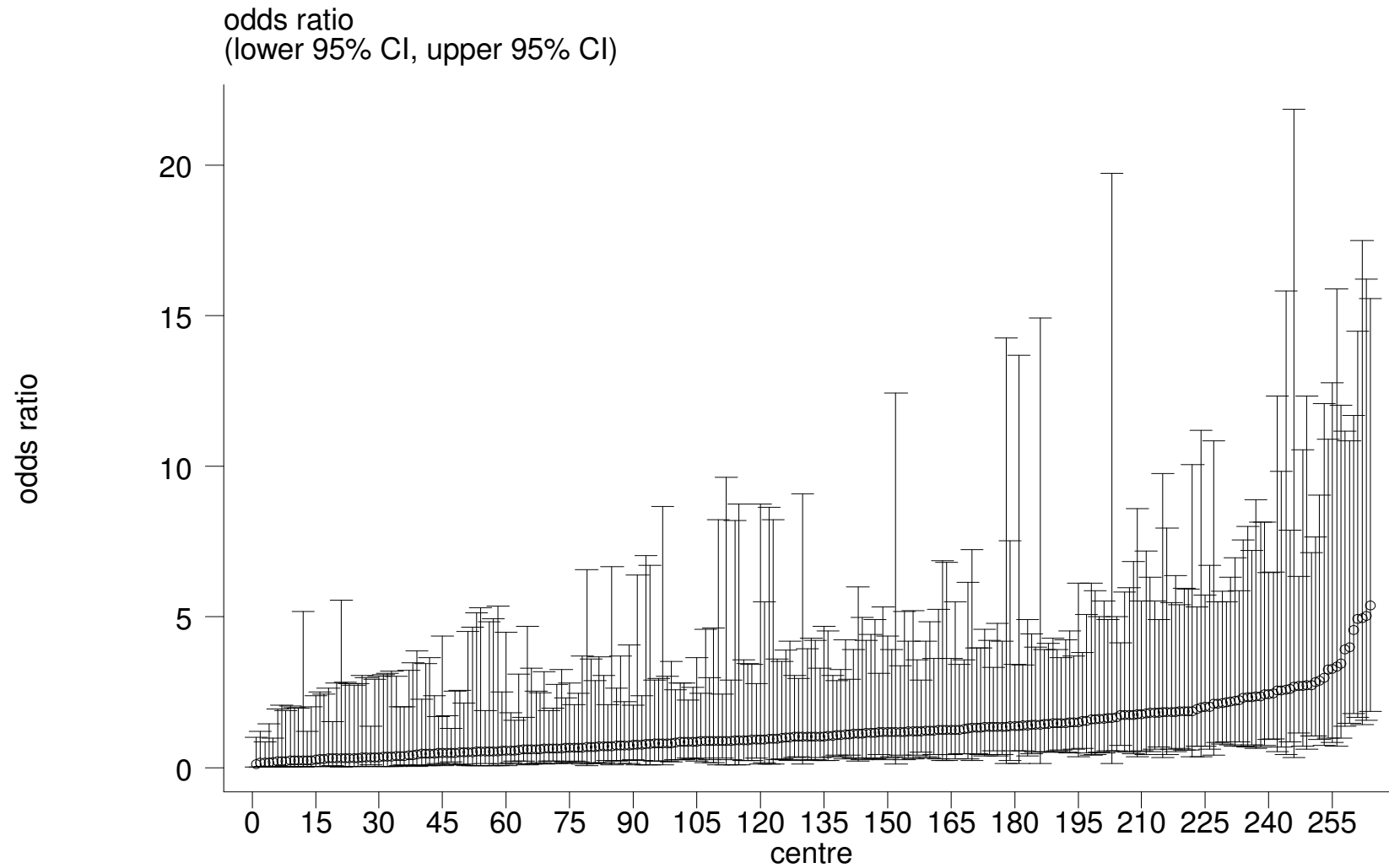


**Table 4.4.3 Variation in odds ratio of death by centre, 1998-2007**

Year	Number of Centre	Min	5 <sup>th</sup> Centile	LQ	Median	UQ	95 <sup>th</sup> Centile	Max
1998	50	0.075	0.194	0.646	0.927	1.719	2.855	5.190
1999	51	0.017	0.236	0.764	1.916	2.810	5.345	11.666
2000	82	0.024	0.069	0.254	0.518	0.930	1.955	3.888
2001	114	0.071	0.344	0.998	1.446	2.687	4.898	7.257
2002	144	0.125	0.466	1.100	1.710	3.013	5.971	10.684
2003	171	0.044	0.112	0.354	0.656	0.946	2.300	3.860
2004	200	0.000	0.000	0.337	0.610	0.837	1.852	6.820
2005	233	0.054	0.131	0.453	0.806	1.227	2.118	7.476
2006	250	0.065	0.165	0.393	0.751	1.065	1.953	8.789
2007	264	0.116	0.240	0.603	1.025	1.597	2.831	5.390



**Figure 4.4.3 Variation in odds ratio of death by centre, 2007**



*\*8 centre were dropped due to very small number of patients*