Post-dialysis hemoglobin is associated with one year mortality in hemodialysis patients.
Result from a cohort study from the dialysis registry in Japan

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OBJECTIVES

Pre-dialysis hemoglobin of hemodialysis patients is used as the main index in anemia treatment and is obviously associated with mortality. In However, the association between post-dialysis hemoglobin(post-Hb) and mortality has not been evaluated well.

METHODS

Study Design: Retrospective cohort study using data from the Japan renal data registry (JRDR), the nationwide annual survey of dialysis patients in Japan.
Setting and Participants: Data from JRDR (2008-2009), including 39,307 adult hemodialysis (HD) patients who had pre- and post-dialysis hemoglobin levels, and the outcome at December 2009.
Predictor: Post-Hb deciles were calculated and categorized. We defined the fifth decile as the reference category.
Outcomes: all-cause mortality within 1 year
Stastical Analysis and Measurements: Kaplan–Meier Curve estimates of the survival time were computed and compared between deciles of post-Hb using a two-sided log-rank test. Hazard ratio(HR)s were estimated using a cox propotional hazard model for the association between post-dialysis hemoglobin and mortality, adjusting for potential confounders such as age, sex, pre-dialysis hemoglobin, serum albumin, cardiovascular disease, primary cause of ESRD, dialysis vintage, Kt/V, %⊿body weight and post-dialysis body weight. The results of the univariate and multivariate analyses are expressed as HRs with 95 % confidence interval(CI)s and a P value. $P<0.05$ was considered statistically significant in all calculations.
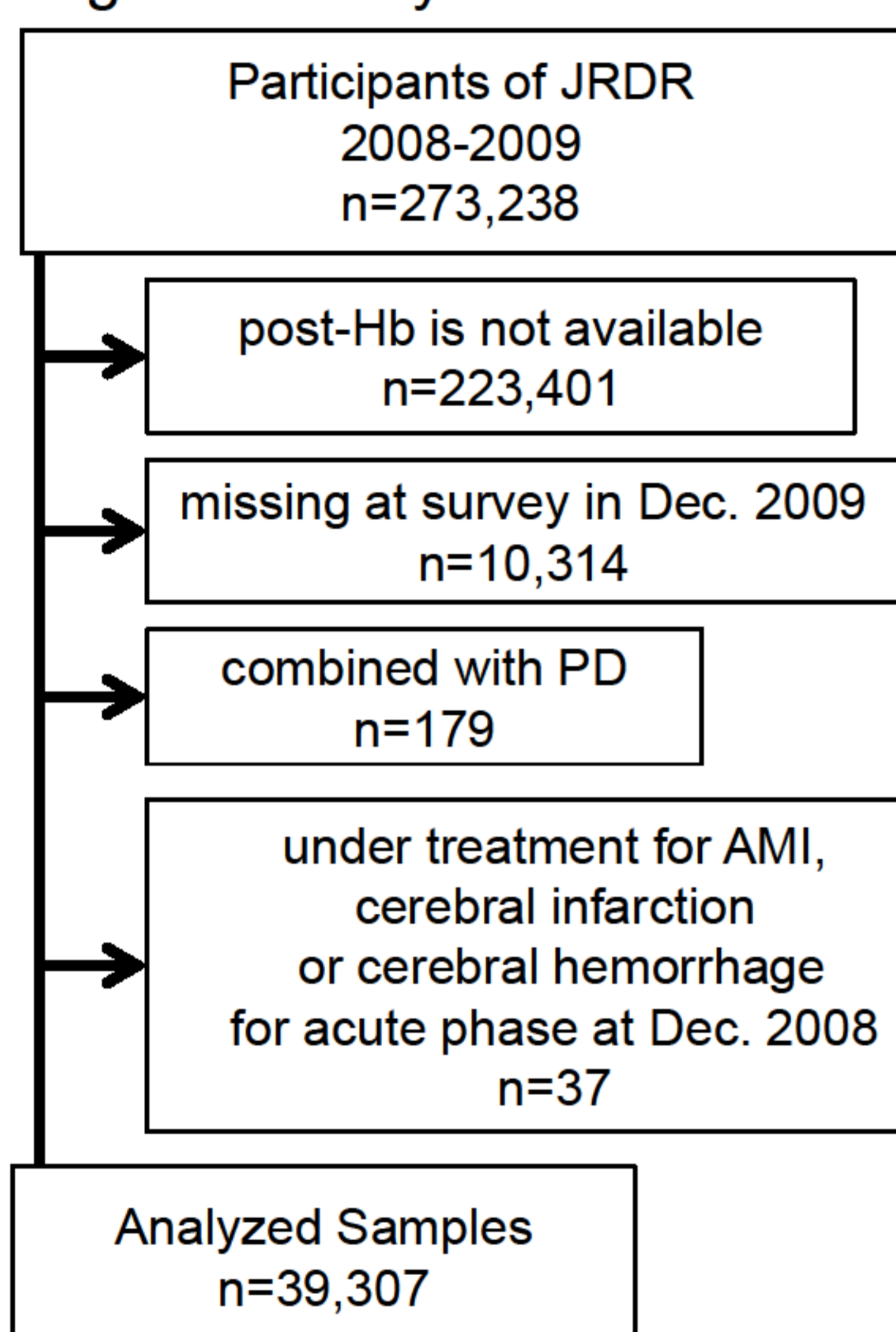
RESULTS

Figure1 Study Profile

Participants of JRDR 2008-2009
n=273,238

→ post-Hb is not available n=223,401

→ missing at survey in Dec. 2009 n=10,314

→ combined with PD n=179

→ under treatment for AMI, cerebral infarction or cerebral hemorrhage for acute phase at Dec. 2008 n=37

Analyzed Samples n=39,307

Table1 Baseline Characteristics: Variables are presented as mean(SD) or n(%)

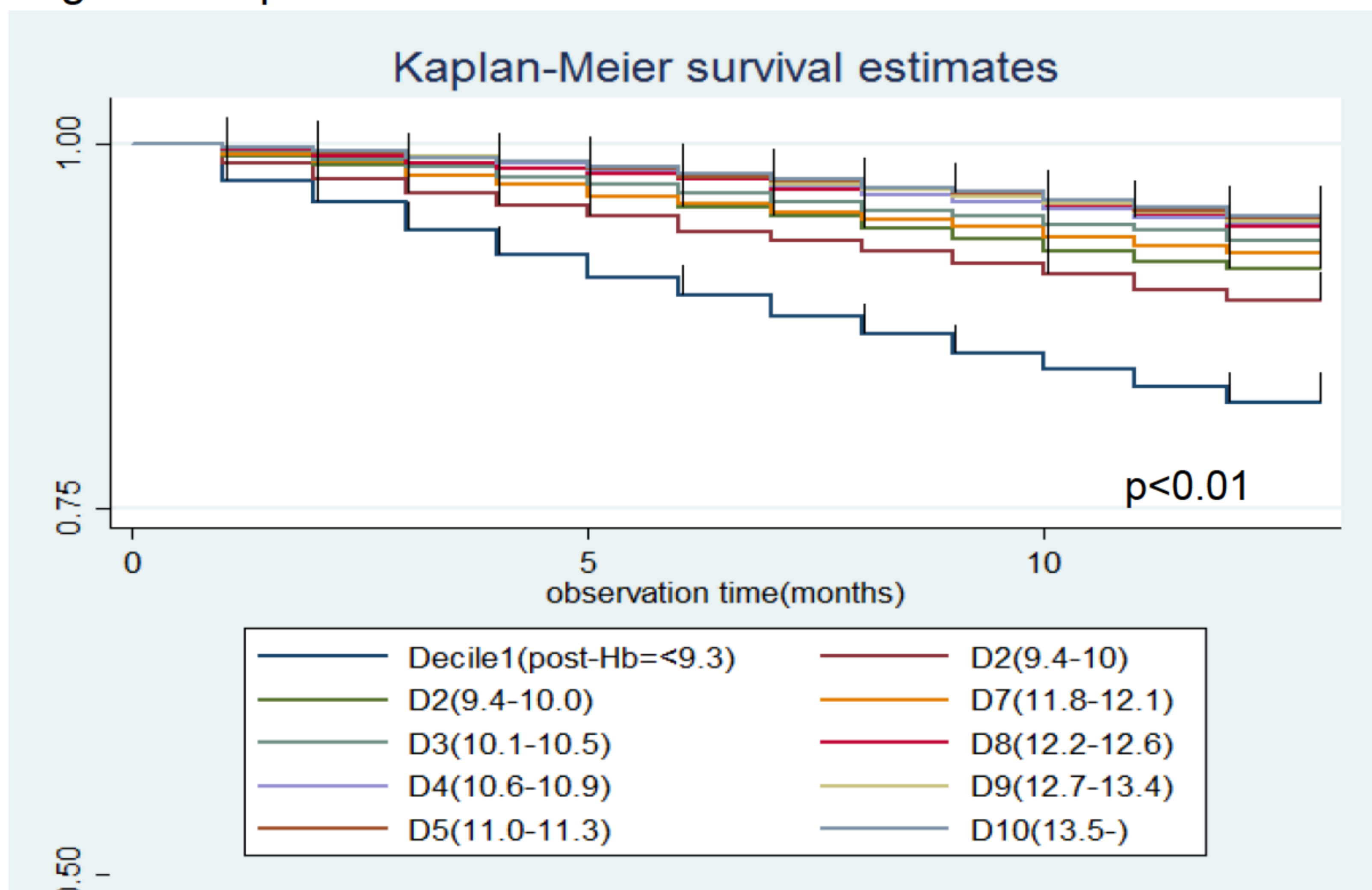|	All	Decile1	D2	D3	D4	D5	D6	D7	D8	D9	D10
N	39,307	4,215	3,955	4,108	3,845	4,243	4,021	3,589	3,799	3,872	3,660
Post-Hb range		=<9.3	9.4-10.0	10.1-10.5	10.6-10.9	11.0-11.3	11.4-11.7	11.8-12.1	12.2-12.6	12.7-13.4	13.5=<
Age(years)	65.2(12)	68.3(11)	67.5(12)	66.8(11)	66.2(12)	65.8(12)	65.4(12)	64.4(12)	63.7(12)	62.5(12)	60.6(12)
Women	15,046(38)	1,765(42)	1,660(42)	1,653(40)	1,540(40)	1,669(40)	1,559(39)	1,342(37)	1,389(37)	1,381(36)	1,058(29)
Dialysis vintage(years)	19.4(14)	17.5(14)	18.9(14)	19.0(14)	20.1(14)	19.9(14)	20.2(14)	19.9(14)	19.6(14)	19.7(14)	19.6(14)
Diabetes	13,711(34)	1,540(36)	1,513(38)	1,513(36)	1,391(36)	1,530(36)	1,379(34)	1,259(35)	1,235(32)	1,215(31)	1,136(31)
Cardiovascular disease	8,591(25)	1,066(29)	931(27)	941(27)	822(25)	866(24)	811(24)	793(25)	801(25)	796(24)	744(23)
Vascular Access											
AVF	33,448(90)	3,456(86)	3,268(88)	3,493(90)	3,260(90)	3,625(90)	3442(91)	3,105(90)	3,275(91)	3,351(92)	3,173(91)
AVG	2,670(7)	313(8)	311(8)	271(7)	268(7)	311(8)	254(7)	248(7)	252(7)	221(6)	221(6)
Others	1,094(3)	232(6)	149(4)	112(3)	99(3)	105(3)	88(2)	80(2)	75(2)	74(2)	80(2)
Serum Albumin(g/dl)	3.6(0.43)	3.3(0.56)	3.6(0.47)	3.6(0.43)	3.6(0.42)	3.7(0.39)	3.7(0.38)	3.7(0.37)	3.7(0.37)	3.7(0.37)	3.7(0.36)
Pre-Hb(g/dl)											
<10	14,952(39)	4,024(98)	3,319(86)	2,744(68)	1,856(49)	1,378(33)	830(21)	430(12)	250(7)	98(3)	23(0)
10=< and <12	20,570(53)	88(2)	525(14)	1,283(32)	1,895(50)	2,774(66)	3,092(78)	3,010(85)	3,243(86)	3,089(81)	1,571(44)
12=<	3,163(8)	6(0)	9(0)	10(0)	16(0)	55(1)	55(1)	105(3)	272(7)	648(17)	2,010(56)
%⊿BW	4.8(19)	4.3(30)	4.3(9.6)	4.3(9.2)	4.5(15)	5.0(24)	4.5(3.4)	5.4(28)	5.1(14)	5.4(21)	5.6(16)
Post-dialysis BW(kg)	53.7(11)	52.3(10)	52.0(10)	52.5(11)	53.2(11)	53.4(11)	53.8(11)	54.3(11)	54.7(11)	55.1(12)	57.2(13)
Kt/V	1.37(0.3)	1.2(0.3)	1.3(0.3)	1.3(0.3)	1.3(0.3)	1.3(0.2)	1.3(0.3)	1.4(0.2)	1.4(0.2)	1.4(0.2)	1.4(0.2)

Figure2 Kaplan-Meier Time-to-Event Curve

Kaplan-Meier survival estimates

p<0.01

observation time(months)

— Decile1(post-Hb=<9.3)
— D2(9.4-10.0)
— D3(10.1-10.5)
— D4(10.6-10.9)
— D5(11.0-11.3)
— D2(9.4-10)
— D7(11.8-12.1)
— D8(12.2-12.6)
— D9(12.7-13.4)
— D10(13.5-)

Table2 Deciles of post-Hb and hazard ratios for mortality within 1 year.

	Crude analysis			Multivariable analysis		
	HR	95%CI	P value	HR	95%CI	P value
Decile1(D1)	2.86	2.49-3.28	<0.01	1.81	1.52-2.17	<0.01
D2	1.67	1.43-1.94	<0.01	1.50	1.25-1.80	<0.01
D3	1.31	1.12-1.53	<0.01	1.25	1.04-1.50	0.01
D4	1.14	0.97-1.25	0.09	1.07	0.89-1.29	0.44
D5	(Reference)			(Reference)		
D6	0.85	0.71-1.01	0.06	0.92	0.76-1.12	0.44
D7	0.75	0.67-0.97	0.02	0.83	0.68-1.02	0.09
D8	0.73	0.66-0.96	0.02	0.91	0.75-1.12	0.41
D9	0.70	0.62-0.90	<0.01	0.82	0.66-1.02	0.07
D10	0.70	0.61-0.89	<0.01	0.80	0.63-1.03	0.08

Mean(SD) post-dialysis hemoglobin level was 11.3(1.6) g/dL in our cohort. Of 39,307 patients during follow-up, 3,127 (7.9%) died, 89(0.23%) received kidney transplantation and 19 (0.05%) ceased HD for any reason.

CONCLUSIONS

The association between post-dialysis hemoglobin and one year all-cause mortality in hemodialysis patients is negative correlation in post-Hb<11g/dl. One-year all-cause mortality risk plateaued as post-dialysis hemoglobin level reaching 11g/dL.