

Online Supplemental Material

The prognostic significance of body mass index and metabolic parameter variabilities in predialysis chronic kidney disease: a nationwide observational cohort study

Authors

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Supplemental Table 1. Risk of adverse outcomes according to baseline body mass index in predialysis CKD patients.

Outcome	Baseline BMI exposure ^a		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model		Age, sex, and number of exams adjusted model		Multivariable model ^b	
							HR (95% CI)	P	adjusted HR (95% CI)	P	adjusted HR (95% CI)	P
All-cause mortality	Continuous		NA				0.772 (0.752, 0.792)	< 0.001	0.844 (0.822, 0.867)	< 0.001	0.822 (0.791, 0.854)	< 0.001
	Categorical	Q1 (12.33–22.59)	21198	1781	82119	21.69	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
		Q2 (22.60–24.61)	21138	1182	82694	14.29	0.657 (0.611, 0.707)		0.703 (0.653, 0.757)		0.702 (0.648, 0.761)	
		Q3 (24.61–26.72)	21130	950	83102	11.43	0.525 (0.485, 0.568)		0.598 (0.552, 0.647)		0.584 (0.532, 0.642)	
		Q4 (26.73–46.43)	21170	869	83267	10.44	0.479 (0.442, 0.52)		0.642 (0.591, 0.697)		0.583 (0.519, 0.656)	
Myocardial infarction	Continuous		NA				0.963 (0.924, 1.003)	0.07	0.999 (0.959, 1.042)	0.97	0.901 (0.848, 0.956)	< 0.001
	Categorical	Q1 (12.33–22.59)	21198	475	81498	5.83	Reference	0.10	Reference	0.74	Reference	0.003
		Q2 (22.60–24.61)	21138	463	82012	5.65	0.967 (0.851, 1.099)		0.973 (0.856, 1.106)		0.880 (0.768, 1.01)	
		Q3 (24.61–26.72)	21130	483	82369	5.86	1.003 (0.884, 1.139)		1.037 (0.913, 1.177)		0.863 (0.742, 1.004)	
		Q4 (26.73–46.43)	21170	418	82618	5.06	0.866 (0.76, 0.988)		0.974 (0.853, 1.112)		0.699 (0.579, 0.845)	
Stroke	Continuous		NA				0.958 (0.926, 0.991)	0.01	1.007 (0.973, 1.042)	0.70	0.914 (0.870, 0.961)	< 0.001
	Categorical	Q1 (12.33–22.59)	21198	706	80982	8.72	Reference	0.04	Reference	0.61	Reference	0.002
		Q2 (22.60–24.61)	21138	660	81645	8.08	0.926 (0.833, 1.03)		0.947 (0.852, 1.054)		0.866 (0.772, 0.97)	
		Q3 (24.61–26.72)	21130	684	81963	8.35	0.956 (0.86, 1.062)		1.014 (0.912, 1.127)		0.858 (0.757, 0.972)	
		Q4 (26.73–46.43)	21170	616	82290	7.49	0.857 (0.77, 0.955)		1.001 (0.897, 1.116)		0.737 (0.631, 0.862)	
Kidney replacement therapy	Continuous		NA				0.837 (0.812, 0.864)	< 0.001	0.806 (0.782, 0.832)	< 0.001	0.852 (0.813, 0.894)	< 0.001
	Categorical	Q1 (12.33–22.59)	21198	1092	80429	13.58	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
		Q2 (22.60–24.61)	21138	789	81571	9.67	0.709 (0.647, 0.777)		0.672 (0.613, 0.736)		0.752 (0.68, 0.831)	
		Q3 (24.61–26.72)	21130	741	82024	9.03	0.661 (0.602, 0.726)		0.605 (0.551, 0.664)		0.695 (0.619, 0.78)	
		Q4 (26.73–46.43)	21170	654	82277	7.95	0.582 (0.528, 0.641)		0.521 (0.473, 0.575)		0.612 (0.528, 0.709)	

HR = hazard ratio, CI = confidence interval

^a The ranges of the BMI values in the quartile grades are presented within the parentheses.

^b Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

Supplemental Table 2. Risk of adverse outcomes according to body mass index variability by other indexes in predialysis CKD patients.

Metabolic parameter	Outcome	Variability independent of mean exposure		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model adjusted HR (95% CI)	P	Age, sex, and number of exams adjusted adjusted HR (95% CI)		P	Multivariable model ^a adjusted HR (95% CI)	P
Standard deviation	All-cause mortality	Continuous		NA				1.309 (1.275, 1.344)	< 0.001	1.262 (1.229, 1.295)	< 0.001		1.193 (1.162, 1.225)	<0.001
		Categorical	Q1 (low)	21159	882	82887	10.64	Reference		Reference			Reference	
			Q2	21159	936	83387	11.22	1.051 (0.959, 1.152)	<0.001	1.092 (0.996, 1.197)	<0.001		1.064 (0.971, 1.167)	< 0.001
			Q3	21159	1115	83214	13.40	1.255 (1.149, 1.371)		1.256 (1.15, 1.372)			1.163 (1.064, 1.271)	
	Myocardial infarction	Continuous		NA				1.133 (1.087, 1.181)	< 0.001	1.112 (1.067, 1.159)	< 0.001		1.067 (1.024, 1.112)	0.002
		Categorical	Q1 (low)	21159	401	82326	4.87	Reference		Reference			Reference	
			Q2	21159	408	82762	4.93	1.009 (0.879, 1.158)	<0.001	1.026 (0.894, 1.178)	<0.001		1.004 (0.874, 1.153)	0.016
			Q3	21159	468	82490	5.67	1.161 (1.016, 1.326)		1.157 (1.012, 1.322)			1.097 (0.96, 1.254)	
	Stroke	Continuous		NA				1.127 (1.089, 1.166)	< 0.001	1.096 (1.059, 1.134)	< 0.001		1.056 (1.021, 1.093)	0.002
		Categorical	Q1 (low)	21159	582	81965	7.10	Reference		Reference			Reference	
			Q2	21159	608	82368	7.38	1.039 (0.927, 1.164)	<0.001	1.063 (0.949, 1.191)	<0.001		1.047 (0.935, 1.174)	0.015
			Q3	21159	663	82124	8.07	1.136 (1.016, 1.27)		1.13 (1.011, 1.263)			1.079 (0.965, 1.207)	
	Kidney replacement therapy	Continuous		NA				1.142 (1.107, 1.178)	< 0.001	1.19 (1.153, 1.228)	< 0.001		1.060 (1.027, 1.094)	<0.001
		Categorical	Q1 (low)	21159	696	81911	8.50	Reference		Reference			Reference	
			Q2	21159	742	82293	9.02	1.059 (0.955, 1.175)	<0.001	1.055 (0.951, 1.171)	<0.001		0.961 (0.866, 1.067)	< 0.001
			Q3	21159	840	81924	10.25	1.206 (1.091, 1.333)		1.232 (1.114, 1.362)			1.004 (0.908, 1.111)	
Coefficient of variation	All-cause mortality	Continuous		NA				1.366 (1.331, 1.403)	< 0.001	1.296 (1.262, 1.33)	< 0.001		1.199 (1.167, 1.231)	<0.001
		Categorical	Q1 (low)	21159	847	82941	10.21	Reference		Reference			Reference	
			Q2	21158	879	83492	10.53	1.027 (0.935, 1.129)	<0.001	1.068 (0.971, 1.173)	<0.001		1.035 (0.941, 1.137)	< 0.001
			Q3	21160	1104	83188	13.27	1.296 (1.185, 1.417)		1.297 (1.186, 1.419)			1.171 (1.07, 1.281)	
	Myocardial infarction	Continuous		NA				1.14 (1.094, 1.188)	< 0.001	1.113 (1.068, 1.16)	< 0.001		1.072 (1.028, 1.117)	0.001
		Categorical	Q1 (low)	21159	410	82362	4.98	Reference		Reference			Reference	
			Q2	21158	388	82885	4.68	0.937 (0.816, 1.077)	<0.001	0.959 (0.834, 1.102)	<0.001		0.943 (0.82, 1.083)	0.003
			Q3	21160	470	82465	5.70	1.141 (1, 1.303)		1.145 (1.002, 1.307)			1.093 (0.956, 1.248)	
	Stroke	Continuous		NA				1.128 (1.09, 1.168)	< 0.001	1.128 (1.053, 1.128)	< 0.001		1.056 (1.020, 1.093)	0.002
		Categorical	Q1 (low)	21159	584	82010	7.12	Reference		Reference			Reference	
			Q2	21158	610	82452	7.40	1.038 (0.927, 1.163)	<0.001	1.07 (0.955, 1.199)	<0.001		1.06 (0.946, 1.187)	0.015
			Q3	21160	652	82111	7.94	1.114 (0.997, 1.246)		1.115 (0.997, 1.247)			1.075 (0.961, 1.202)	
Actual real variability	All-cause mortality	Continuous		NA				1.291 (1.258, 1.325)	< 0.001	1.236 (1.204, 1.269)	< 0.001		1.179 (1.148, 1.210)	<0.001
		Categorical	Q1 (low)	21158	877	83157	10.55	Reference		Reference			Reference	
			Q2	21160	953	83298	11.44	1.083 (0.988, 1.187)	<0.001	1.072 (0.978, 1.175)	<0.001		1.057 (0.964, 1.159)	< 0.001
			Q3	21159	1179	82982	14.21	1.347 (1.234, 1.47)		1.308 (1.198, 1.428)			1.207 (1.105, 1.317)	
	Myocardial infarction	Continuous		NA				1.128 (1.082, 1.175)	< 0.001	1.101 (1.057, 1.148)	< 0.001		1.060 (1.017, 1.105)	0.006
		Categorical	Q1 (low)	21158	399	82571	4.83	Reference		Reference			Reference	
			Q2	21160	411	82699	4.97	1.027 (0.895, 1.178)	<0.001	1.022 (0.89, 1.173)	<0.001		0.997 (0.869, 1.145)	0.03
			Q3	21159	481	82259	5.85	1.209 (1.059, 1.381)		1.19 (1.042, 1.359)			1.13 (0.989, 1.291)	
	Stroke	Continuous		NA				1.118 (1.08, 1.157)	< 0.001	1.078 (1.042, 1.116)	< 0.001		1.042 (1.007, 1.079)	0.02
		Categorical	Q1 (low)	21158	590	82220	7.18	Reference		Reference			Reference	
			Q2	21160	614	82273	7.46	1.04 (0.929, 1.164)	<0.001	1.038 (0.927, 1.162)	<0.001		1.018 (0.909, 1.14)	0.09
			Q3	21159	657	81891	8.02	1.118 (1.001, 1.25)		1.092 (0.977, 1.22)			1.043 (0.933, 1.166)	
Actual real variability	Kidney replacement therapy	Continuous		NA				1.396 (1.255, 1.552)	< 0.001	1.256 (1.129, 1.398)	< 0.001		1.134 (1.018, 1.263)	
		Categorical	Q1 (low)	21159	805	80495	10.00	1.099 (1.066, 1.134)	< 0.001	1.158 (1.123, 1.195)	< 0.001		1.052 (1.019, 1.086)	0.002
			Q2	21158	712	82136	8.67	Reference		Reference			Reference	
			Q3	21160	791	82104	9.63	1.111 (1.004, 1.23)	<0.001	1.078 (0.974, 1.193)	<0.001		1.02 (0.922, 1.129)	0.002
	Kidney replacement therapy	Continuous		NA				1.339 (1.214, 1.476)	< 0.001	1.548 (1.403, 1.708)	< 0.001		1.011 (0.915, 1.118)	
		Categorical	Q1 (low)	21159	927	80365	11.53	Reference		Reference			1.18 (1.068, 1.303)	
			Q2	21159	846	81697	10.36	1.196 (1.083, 1.322)		1.235 (1.118, 1.364)			1.011 (0.915, 1.118)	
			Q4 (high)	21159	927	80365	11.53	1.339 (1.214, 1.476)		1.548 (1.403, 1.708)			1.18 (1.068, 1.303)	

HR = hazard ratio, CI = confidence interval

^a Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

The P values for the correlation (by Pearson’s correlation) between other body mass index variability indices with variation independent mean were P = 0.974 (standard deviation), P < 0.001 (coefficient of variation), and P < 0.001 (average real variability), respectively.

Supplemental Table 3. Interaction term analysis results for the subgroup analysis.

Variable to divide subgroups	Outcome	Interaction term P values in the multivariable model ^a
Sex	All-cause mortality	0.09
	Myocardial infarction	0.20
	Stroke	0.84
	Kidney replacement therapy	0.66
Baseline BMI ≥ 25 kg/m ²	All-cause mortality	0.03
	Myocardial infarction	0.88
	Stroke	0.41
	Kidney replacement therapy	0.04
Baseline diabetes mellitus	All-cause mortality	0.32
	Myocardial infarction	0.19
	Stroke	0.71
	Kidney replacement therapy	0.001
eGFR < 60 mL/min/1.73 m ²	All-cause mortality	0.79
	Myocardial infarction	0.47
	Stroke	0.75
	Kidney replacement therapy	0.01
BMI slope	All-cause mortality	0.08
	Myocardial infarction	0.70
	Stroke	0.64
	Kidney replacement therapy	0.16

BMI = body mass index, KRT = kidney replacement therapy

^a Interaction term with the variable dividing the subgroup and the variability of BMI (VIM quartile) was included in the multivariable model adjusted for adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

Supplemental Table 4. Risk of adverse outcomes according to body mass index variability in predialysis CKD patients stratified by sex.

Subgroup	Outcome	BMI variability independent of mean exposure		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model		Age, sex, and number of exams adjusted model		Multivariable model ^a	
								HR (95% CI)	P	adjusted HR (95% CI)	P	adjusted HR (95% CI)	P
Male	All-cause mortality	Continuous		NA				1.402 (1.355, 1.45)	< 0.001	1.305 (1.262, 1.349)	< 0.001	1.198 (1.158, 1.24)	< 0.001
		Categorical	Q1 (low)	11397	547	44438	12.31	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	11096	603	43672	13.81	1.116 (0.994, 1.253)		1.159 (1.032, 1.301)		1.119 (0.997, 1.257)	
			Q3	10421	690	40656	16.97	1.376 (1.23, 1.54)		1.359 (1.214, 1.52)		1.209 (1.08, 1.353)	
			Q4 (high)	8751	1072	33196	32.29	2.638 (2.38, 2.924)		2.187 (1.972, 2.425)		1.719 (1.546, 1.911)	
	Myocardial infarction	Continuous		NA				1.169 (1.103, 1.238)	< 0.001	1.138 (1.074, 1.205)	< 0.001	1.088 (1.027, 1.153)	0.004
		Categorical	Q1 (low)	11397	227	44116	5.15	Reference	< 0.001	Reference	< 0.001	Reference	0.02
			Q2	11096	231	43310	5.33	1.032 (0.859, 1.239)		1.058 (0.881, 1.271)		1.033 (0.86, 1.242)	
			Q3	10421	239	40305	5.93	1.15 (0.959, 1.379)		1.153 (0.961, 1.382)		1.087 (0.906, 1.304)	
			Q4 (high)	8751	270	32839	8.22	1.604 (1.345, 1.914)		1.484 (1.243, 1.771)		1.298 (1.084, 1.554)	
	Stroke	Continuous		NA				1.13 (1.077, 1.185)	< 0.001	1.09 (1.039, 1.143)	< 0.001	1.054 (1.004, 1.106)	0.03
		Categorical	Q1 (low)	11397	331	43911	7.54	Reference	< 0.001	Reference	< 0.001	Reference	0.13
			Q2	11096	350	43071	8.13	1.077 (0.927, 1.251)		1.117 (0.961, 1.299)		1.102 (0.948, 1.281)	
			Q3	10421	339	40117	8.45	1.121 (0.963, 1.304)		1.127 (0.968, 1.311)		1.074 (0.923, 1.251)	
			Q4 (high)	8751	363	32673	11.11	1.478 (1.273, 1.715)		1.328 (1.144, 1.542)		1.200 (1.031, 1.397)	
	Kidney replacement therapy	Continuous		NA				1.234 (1.188, 1.282)	< 0.001	1.244 (1.197, 1.292)	< 0.001	1.066 (1.026, 1.108)	0.001
		Categorical	Q1 (low)	11397	474	43750	10.83	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	11096	535	42866	12.48	1.149 (1.015, 1.3)		1.113 (0.983, 1.26)		0.967 (0.854, 1.095)	
			Q3	10421	575	39725	14.47	1.337 (1.184, 1.51)		1.314 (1.164, 1.484)		1.081 (0.957, 1.221)	
			Q4 (high)	8751	652	32184	20.26	1.889 (1.679, 2.127)		1.921 (1.707, 2.162)		1.182 (1.047, 1.335)	
Female	All-cause mortality	Continuous		NA				1.405 (1.345, 1.467)	< 0.001	1.277 (1.223, 1.333)	< 0.001	1.188 (1.138, 1.241)	< 0.001
		Categorical	Q1 (low)	9762	300	38502	7.79	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	10063	275	39827	6.90	0.885 (0.751, 1.042)		0.906 (0.769, 1.067)		0.874 (0.742, 1.03)	
			Q3	10738	415	42527	9.76	1.248 (1.076, 1.448)		1.187 (1.023, 1.377)		1.091 (0.94, 1.266)	
			Q4 (high)	12408	880	48364	18.20	2.338 (2.051, 2.666)		1.849 (1.62, 2.11)		1.515 (1.325, 1.732)	
	Myocardial infarction	Continuous		NA				1.128 (1.063, 1.198)	< 0.001	1.083 (1.02, 1.15)	0.009	1.048 (0.987, 1.113)	0.124
		Categorical	Q1 (low)	9762	183	38245	4.78	Reference	< 0.001	Reference	0.005	Reference	0.049
			Q2	10063	157	39582	3.97	0.827 (0.669, 1.024)		0.84 (0.679, 1.04)		0.833 (0.673, 1.031)	
			Q3	10738	231	42156	5.48	1.141 (0.94, 1.385)		1.12 (0.922, 1.36)		1.084 (0.893, 1.317)	
			Q4 (high)	12408	301	47943	6.28	1.311 (1.091, 1.576)		1.175 (0.977, 1.413)		1.07 (0.887, 1.29)	
	Stroke	Continuous		NA				1.142 (1.087, 1.2)	< 0.001	1.086 (1.034, 1.141)	0.001	1.054 (1.003, 1.107)	0.04
		Categorical	Q1 (low)	9762	253	38097	6.64	Reference	< 0.001	Reference	0.006	Reference	0.18
			Q2	10063	260	39388	6.60	0.994 (0.836, 1.181)		1.012 (0.851, 1.204)		1.004 (0.844, 1.194)	
			Q3	10738	313	41990	7.45	1.121 (0.95, 1.323)		1.096 (0.929, 1.294)		1.062 (0.9, 1.254)	
			Q4 (high)	12408	457	47633	9.59	1.446 (1.24, 1.686)		1.263 (1.083, 1.474)		1.158 (0.99, 1.354)	
	Kidney replacement therapy	Continuous		NA				1.219 (1.153, 1.289)	< 0.001	1.237 (1.169, 1.308)	< 0.001	1.083 (1.023, 1.146)	0.006
		Categorical	Q1 (low)	9762	172	38303	4.49	Reference	< 0.001	Reference	< 0.001	Reference	0.02
			Q2	10063	219	39530	5.54	1.233 (1.01, 1.506)		1.191 (0.975, 1.454)		1.056 (0.864, 1.29)	
			Q3	10738	257	42171	6.09	1.356 (1.118, 1.644)		1.324 (1.091, 1.606)		1.045 (0.861, 1.269)	
			Q4 (high)	12408	392	47773	8.21	1.837 (1.536, 2.198)		1.889 (1.579, 2.26)		1.274 (1.063, 1.527)	

HR = hazard ratio, CI = confidence interval

^a Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

Supplemental Table 5. Risk of adverse outcomes according to body mass index variability in predialysis CKD patients stratified by baseline body mass index ≥ 25 kg/m².

Subgroup	Outcome	BMI variability independent of mean exposure		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model		Age, sex, and number of exams adjusted model		Multivariable model ^a	
								HR (95% CI)	P	adjusted HR (95% CI)	P	adjusted HR (95% CI)	P
BMI ≥ 25 kg/m ²	All-cause mortality	Continuous		NA				1.268 (1.213, 1.326)	< 0.001	1.269 (1.214, 1.326)	< 0.001	1.21 (1.158, 1.266)	< 0.001
		Categorical	Q1 (low)	10578	352	41638	8.45	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	9767	319	38633	8.26	0.974 (0.837, 1.133)		1.033 (0.888, 1.203)		1.011 (0.868, 1.176)	
			Q3	9303	423	36671	11.54	1.361 (1.182, 1.568)		1.442 (1.252, 1.662)		1.347 (1.169, 1.552)	
			Q4 (high)	8173	515	31807	16.19	1.921 (1.678, 2.2)		1.947 (1.698, 2.232)		1.697 (1.479, 1.947)	
	Myocardial infarction	Continuous		NA				1.097 (1.031, 1.168)	0.004	1.1 (1.033, 1.171)	0.003	1.061 (0.996, 1.13)	0.07
		Categorical	Q1 (low)	10578	212	41328	5.13	Reference	0.003	Reference	0.004	Reference	0.08
			Q2	9767	172	38369	4.48	0.871 (0.712, 1.065)		0.897 (0.734, 1.098)		0.883 (0.722, 1.08)	
			Q3	9303	204	36334	5.61	1.092 (0.901, 1.323)		1.121 (0.924, 1.359)		1.066 (0.879, 1.292)	
			Q4 (high)	8173	205	31496	6.51	1.27 (1.048, 1.539)		1.282 (1.057, 1.556)		1.149 (0.946, 1.396)	
	Stroke	Continuous		NA				1.086 (1.031, 1.143)	0.002	1.082 (1.027, 1.14)	0.003	1.046 (0.993, 1.102)	0.09
		Categorical	Q1 (low)	10578	300	41151	7.29	Reference	0.01	Reference	0.02	Reference	0.33
			Q2	9767	275	38170	7.20	0.988 (0.839, 1.163)		1.03 (0.874, 1.213)		1.016 (0.862, 1.197)	
			Q3	9303	300	36169	8.29	1.137 (0.969, 1.335)		1.173 (1, 1.377)		1.123 (0.957, 1.319)	
			Q4 (high)	8173	287	31371	9.15	1.256 (1.069, 1.477)		1.246 (1.059, 1.467)		1.123 (0.953, 1.324)	
	Kidney replacement therapy	Continuous		NA				1.185 (1.127, 1.246)	< 0.001	1.238 (1.176, 1.303)	< 0.001	1.088 (1.034, 1.146)	0.001
		Categorical	Q1 (low)	10578	289	41246	7.01	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	9767	290	38219	7.59	1.081 (0.918, 1.272)		1.051 (0.893, 1.238)		0.84 (0.712, 0.991)	
			Q3	9303	318	36176	8.79	1.255 (1.07, 1.472)		1.283 (1.094, 1.505)		1.037 (0.883, 1.218)	
			Q4 (high)	8173	361	31248	11.55	1.66 (1.422, 1.937)		1.878 (1.607, 2.195)		1.21 (1.033, 1.418)	
BMI < 25 kg/m ²	All-cause mortality	Continuous		NA				1.391 (1.346, 1.438)	< 0.001	1.289 (1.247, 1.332)	< 0.001	1.164 (1.125, 1.203)	< 0.001
		Categorical	Q1 (low)	10581	495	41301	11.99	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	11392	559	44867	12.46	1.035 (0.917, 1.168)		1.065 (0.944, 1.202)		1.035 (0.917, 1.168)	
			Q3	11856	682	46513	14.66	1.219 (1.086, 1.369)		1.184 (1.054, 1.329)		1.057 (0.941, 1.187)	
			Q4 (high)	12986	1437	49753	28.88	2.414 (2.179, 2.673)		2.008 (1.811, 2.226)		1.524 (1.372, 1.694)	
	Myocardial infarction	Continuous		NA				1.17 (1.107, 1.237)	< 0.001	1.124 (1.064, 1.188)	< 0.001	1.084 (1.024, 1.147)	0.005
		Categorical	Q1 (low)	10581	198	41033	4.83	Reference	< 0.001	Reference	< 0.001	Reference	0.03
			Q2	11392	216	44523	4.85	1.001 (0.826, 1.214)		1.02 (0.841, 1.237)		0.997 (0.822, 1.209)	
			Q3	11856	266	46127	5.77	1.191 (0.991, 1.431)		1.175 (0.977, 1.412)		1.123 (0.933, 1.35)	
			Q4 (high)	12986	366	49287	7.43	1.54 (1.296, 1.831)		1.385 (1.164, 1.649)		1.243 (1.04, 1.485)	
	Stroke	Continuous		NA				1.161 (1.108, 1.215)	< 0.001	1.101 (1.051, 1.153)	< 0.001	1.059 (1.011, 1.11)	0.02
		Categorical	Q1 (low)	10581	284	40857	6.95	Reference	< 0.001	Reference	< 0.001	Reference	0.03
			Q2	11392	335	44290	7.56	1.087 (0.928, 1.273)		1.113 (0.95, 1.304)		1.099 (0.938, 1.288)	
			Q3	11856	352	45937	7.66	1.101 (0.942, 1.288)		1.082 (0.925, 1.265)		1.038 (0.887, 1.214)	
			Q4 (high)	12986	533	48935	10.89	1.569 (1.359, 1.812)		1.363 (1.178, 1.576)		1.221 (1.053, 1.417)	
	Kidney replacement therapy	Continuous		NA				1.165 (1.12, 1.212)	< 0.001	1.229 (1.18, 1.28)	< 0.001	1.044 (1.002, 1.087)	0.04
		Categorical	Q1 (low)	10581	357	40807	8.75	Reference	< 0.001	Reference	< 0.001	Reference	0.17
			Q2	11392	464	44176	10.50	1.199 (1.044, 1.376)		1.178 (1.026, 1.352)		1.087 (0.946, 1.249)	
			Q3	11856	514	45720	11.24	1.284 (1.122, 1.47)		1.313 (1.147, 1.503)		1.075 (0.939, 1.231)	
			Q4 (high)	12986	683	48710	14.02	1.613 (1.419, 1.834)		1.868 (1.643, 2.124)		1.16 (1.017, 1.322)	

HR = hazard ratio, CI = confidence interval

^a Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

Supplemental Table 6. Risk of adverse outcomes according to body mass index variability in predialysis CKD patients stratified by the presence of diabetes mellitus.

Subgroup	Outcome	BMI variability independent of mean exposure		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model		Age, sex, and number of exams adjusted model		Multivariable model ^a	
								HR (95% CI)	P	adjusted HR (95% CI)	P	adjusted HR (95% CI)	P
DM (+)	All-cause mortality	Continuous		NA				1.309 (1.256, 1.365)	< 0.001	1.291 (1.239, 1.346)	< 0.001	1.221 (1.171, 1.274)	< 0.001
		Categorical	Q1 (low)	5809	323	22600	14.29	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	5919	344	23242	14.80	1.03 (0.885, 1.199)		1.078 (0.926, 1.255)		1.044 (0.897, 1.215)	
			Q3	6196	471	24029	19.60	1.371 (1.19, 1.579)		1.397 (1.212, 1.609)		1.292 (1.121, 1.49)	
			Q4 (high)	7095	797	27017	29.50	2.075 (1.823, 2.361)		2.036 (1.787, 2.319)		1.737 (1.522, 1.982)	
	Myocardial infarction	Continuous		NA				1.053 (0.99, 1.12)	0.100	1.045 (0.982, 1.112)	0.16	1.015 (0.953, 1.08)	0.65
		Categorical	Q1 (low)	5809	186	22338	8.33	Reference	0.11	Reference	0.20	Reference	0.49
			Q2	5919	170	22982	7.40	0.885 (0.719, 1.09)		0.893 (0.725, 1.1)		0.876 (0.711, 1.079)	
			Q3	6196	196	23720	8.26	0.992 (0.812, 1.212)		0.99 (0.81, 1.211)		0.952 (0.778, 1.164)	
			Q4 (high)	7095	250	26663	9.38	1.129 (0.934, 1.365)		1.107 (0.914, 1.34)		1.014 (0.835, 1.23)	
	Stroke	Continuous		NA				1.108 (1.052, 1.167)	< 0.001	1.094 (1.039, 1.152)	< 0.001	1.071 (1.017, 1.129)	0.01
		Categorical	Q1 (low)	5809	242	22198	10.90	Reference	< 0.001	Reference	0.006	Reference	0.06
			Q2	5919	245	22819	10.74	0.984 (0.824, 1.176)		1.016 (0.85, 1.213)		1.006 (0.842, 1.202)	
			Q3	6196	288	23510	12.25	1.124 (0.948, 1.334)		1.135 (0.956, 1.347)		1.107 (0.932, 1.314)	
			Q4 (high)	7095	381	26430	14.42	1.324 (1.127, 1.556)		1.287 (1.095, 1.514)		1.211 (1.028, 1.427)	
	Kidney replacement therapy	Continuous		NA				1.158 (1.107, 1.212)	< 0.001	1.222 (1.167, 1.279)	< 0.001	1.099 (1.049, 1.151)	< 0.001
		Categorical	Q1 (low)	5809	302	22184	13.61	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	5919	315	22765	13.84	1.014 (0.866, 1.187)		0.984 (0.84, 1.153)		0.827 (0.705, 0.969)	
			Q3	6196	390	23424	16.65	1.226 (1.055, 1.424)		1.256 (1.081, 1.46)		1.071 (0.92, 1.245)	
			Q4 (high)	7095	530	26189	20.24	1.499 (1.301, 1.726)		1.727 (1.499, 1.991)		1.21 (1.047, 1.399)	
DM (-)	All-cause mortality	Continuous		NA				1.383 (1.336, 1.431)	< 0.001	1.279 (1.236, 1.324)	< 0.001	1.181 (1.141, 1.223)	< 0.001
		Categorical	Q1 (low)	15350	524	60339	8.68	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	15240	534	60257	8.86	1.017 (0.902, 1.148)		1.053 (0.933, 1.187)		1.028 (0.911, 1.16)	
			Q3	14963	634	59155	10.72	1.23 (1.095, 1.38)		1.217 (1.084, 1.366)		1.101 (0.98, 1.237)	
			Q4 (high)	14064	1155	54543	21.18	2.44 (2.201, 2.706)		2.003 (1.805, 2.224)		1.607 (1.444, 1.788)	
	Myocardial infarction	Continuous		NA				1.185 (1.121, 1.252)	< 0.001	1.144 (1.083, 1.209)	< 0.001	1.118 (1.057, 1.182)	< 0.001
		Categorical	Q1 (low)	15350	224	60022	3.73	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	15240	218	59910	3.64	0.971 (0.806, 1.17)		0.999 (0.829, 1.204)		0.994 (0.825, 1.198)	
			Q3	14963	274	58741	4.66	1.244 (1.043, 1.484)		1.247 (1.045, 1.489)		1.212 (1.015, 1.446)	
			Q4 (high)	14064	321	54120	5.93	1.589 (1.339, 1.884)		1.442 (1.214, 1.713)		1.351 (1.135, 1.609)	
	Stroke	Continuous		NA				1.118 (1.068, 1.17)	< 0.001	1.064 (1.017, 1.114)	0.007	1.045 (0.998, 1.094)	0.06
		Categorical	Q1 (low)	15350	342	59810	5.72	Reference	< 0.001	Reference	0.03	Reference	0.17
			Q2	15240	365	59640	6.12	1.069 (0.922, 1.239)		1.099 (0.948, 1.273)		1.098 (0.947, 1.272)	
			Q3	14963	364	58596	6.21	1.085 (0.936, 1.257)		1.076 (0.928, 1.248)		1.053 (0.908, 1.221)	
			Q4 (high)	14064	439	53876	8.15	1.427 (1.238, 1.643)		1.236 (1.071, 1.425)		1.172 (1.013, 1.354)	
	Kidney replacement therapy	Continuous		NA				1.169 (1.12, 1.22)	< 0.001	1.222 (1.17, 1.276)	< 0.001	1.047 (1.003, 1.094)	0.04
		Categorical	Q1 (low)	15350	344	59870	5.75	Reference	< 0.001	Reference	< 0.001	Reference	0.03
			Q2	15240	439	59631	7.36	1.279 (1.111, 1.473)		1.236 (1.073, 1.424)		1.159 (1.006, 1.335)	
			Q3	14963	442	58472	7.56	1.313 (1.141, 1.512)		1.325 (1.15, 1.525)		1.056 (0.917, 1.217)	
			Q4 (high)	14064	514	53769	9.56	1.672 (1.459, 1.917)		1.887 (1.645, 2.164)		1.207 (1.05, 1.387)	

DM = diabetes mellitus, HR = hazard ratio, CI = confidence interval

^a Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.

Supplemental Table 7. Risk of adverse outcomes according to body mass index variability in predialysis CKD patients stratified by baseline eGFR < 60 mL/min/1.73 m².

Subgroup	Outcome	BMI variability independent of mean exposure		N	Event	Follow-up person-years	Incidence rate (/1000PY)	Univariable model		Age, sex, and number of exams adjusted model		Multivariable model ^a	
								HR (95% CI)	P	adjusted HR (95% CI)	P	adjusted HR (95% CI)	P
Baseline eGFR < 60	All-cause mortality	Continuous		NA				1.358 (1.321, 1.396)	< 0.001	1.291 (1.256, 1.327)	< 0.001	1.191 (1.158, 1.224)	< 0.001
		Categorical	Q1 (low)	17594	769	68941	11.15	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	17485	786	68984	11.39	1.018 (0.921, 1.124)		1.051 (0.952, 1.161)		1.014 (0.918, 1.121)	
			Q3	17586	1000	69142	14.46	1.293 (1.177, 1.42)		1.283 (1.167, 1.409)		1.151 (1.047, 1.265)	
			Q4 (high)	18084	1784	69639	25.62	2.302 (2.116, 2.505)		2.035 (1.868, 2.216)		1.621 (1.486, 1.769)	
	Myocardial infarction	Continuous		NA				1.153 (1.104, 1.205)	< 0.001	1.126 (1.078, 1.177)	< 0.001	1.082 (1.035, 1.131)	< 0.001
		Categorical	Q1 (low)	17594	350	68439	5.11	Reference	< 0.001	Reference	< 0.001	Reference	0.002
			Q2	17485	341	68462	4.98	0.971 (0.836, 1.127)		0.988 (0.851, 1.147)		0.97 (0.836, 1.127)	
			Q3	17586	415	68503	6.06	1.181 (1.024, 1.361)		1.177 (1.021, 1.357)		1.122 (0.973, 1.294)	
			Q4 (high)	18084	520	68939	7.54	1.476 (1.289, 1.69)		1.386 (1.209, 1.588)		1.232 (1.072, 1.415)	
	Stroke	Continuous		NA				1.132 (1.092, 1.174)	< 0.001	1.092 (1.053, 1.133)	< 0.001	1.057 (1.019, 1.097)	0.003
		Categorical	Q1 (low)	17594	510	68138	7.48	Reference	< 0.001	Reference	< 0.001	Reference	0.02
			Q2	17485	530	68096	7.78	1.039 (0.92, 1.173)		1.065 (0.943, 1.203)		1.053 (0.932, 1.189)	
			Q3	17586	567	68222	8.31	1.109 (0.984, 1.25)		1.101 (0.977, 1.241)		1.059 (0.939, 1.194)	
			Q4 (high)	18084	742	68504	10.83	1.45 (1.295, 1.623)		1.314 (1.173, 1.472)		1.193 (1.063, 1.339)	
	Kidney replacement therapy	Continuous		NA				1.17 (1.134, 1.208)	< 0.001	1.246 (1.206, 1.287)	< 0.001	1.059 (1.025, 1.094)	< 0.001
		Categorical	Q1 (low)	17594	618	68087	9.08	Reference	< 0.001	Reference	< 0.001	Reference	0.002
			Q2	17485	726	67912	10.69	1.176 (1.057, 1.309)		1.149 (1.032, 1.28)		0.990 (0.888, 1.102)	
			Q3	17586	804	67885	11.84	1.305 (1.175, 1.449)		1.351 (1.217, 1.501)		1.059 (0.953, 1.177)	
			Q4 (high)	18084	995	68104	14.61	1.621 (1.466, 1.792)		1.927 (1.743, 2.132)		1.170 (1.056, 1.296)	
Baseline eGFR ≥ 60	All-cause mortality	Continuous		NA				1.383 (1.267, 1.51)	< 0.001	1.34 (1.229, 1.461)	< 0.001	1.242 (1.138, 1.355)	< 0.001
		Categorical	Q1 (low)	3565	78	13998	5.57	Reference	< 0.001	Reference	< 0.001	Reference	< 0.001
			Q2	3674	92	14516	6.34	1.132 (0.837, 1.531)		1.219 (0.901, 1.649)		1.192 (0.881, 1.613)	
			Q3	3573	105	14042	7.48	1.34 (1, 1.796)		1.44 (1.074, 1.931)		1.337 (0.996, 1.794)	
			Q4 (high)	3075	168	11921	14.09	2.538 (1.94, 3.319)		2.376 (1.813, 3.115)		1.921 (1.458, 2.532)	
	Myocardial infarction	Continuous		NA				1.016 (0.898, 1.148)	0.81	1.011 (0.894, 1.142)	0.87	0.983 (0.869, 1.111)	0.78
		Categorical	Q1 (low)	3565	60	13922	4.31	Reference	0.45	Reference	0.61	Reference	0.70
			Q2	3674	47	14430	3.26	0.753 (0.514, 1.103)		0.785 (0.536, 1.151)		0.791 (0.539, 1.161)	
			Q3	3573	55	13958	3.94	0.914 (0.634, 1.317)		0.951 (0.66, 1.372)		0.919 (0.636, 1.327)	
			Q4 (high)	3075	51	11844	4.31	1.002 (0.69, 1.455)		0.984 (0.676, 1.432)		0.909 (0.622, 1.328)	
	Stroke	Continuous		NA				1.077 (0.974, 1.191)	0.15	1.066 (0.965, 1.178)	0.21	1.036 (0.937, 1.146)	0.49
		Categorical	Q1 (low)	3565	74	13870	5.34	Reference	0.55	Reference	0.60	Reference	0.81
			Q2	3674	80	14363	5.57	1.047 (0.763, 1.436)		1.102 (0.803, 1.512)		1.094 (0.797, 1.501)	
			Q3	3573	85	13884	6.12	1.148 (0.841, 1.568)		1.214 (0.888, 1.658)		1.168 (0.854, 1.597)	
			Q4 (high)	3075	78	11802	6.61	1.239 (0.902, 1.703)		1.199 (0.871, 1.651)		1.102 (0.798, 1.522)	
	Kidney replacement therapy	Continuous		NA				1.291 (1.102, 1.512)	0.002	1.328 (1.132, 1.557)	< 0.001	1.199 (1.02, 1.409)	0.03
		Categorical	Q1 (low)	3565	28	13967	2.00	Reference	< 0.001	Reference	< 0.001	Reference	0.01
			Q2	3674	28	14483	1.93	0.958 (0.567, 1.617)		0.959 (0.568, 1.622)		0.915 (0.541, 1.549)	
			Q3	3573	28	14011	2.00	0.994 (0.589, 1.678)		1.018 (0.602, 1.72)		0.879 (0.518, 1.49)	
			Q4 (high)	3075	49	11854	4.13	2.078 (1.306, 3.307)		2.253 (1.414, 3.589)		1.698 (1.056, 2.729)	

HR = hazard ratio, CI = confidence interval

^a Multivariable model was adjusted for age, sex, number of exams, current-smoking, drinking alcohol, regular physical activity, low income state, history of diabetes mellitus, hypertension, dyslipidemia, cancer, chronic lung disease, baseline body mass index, waist circumference, fasting glucose, systolic BP, diastolic BP, high-density lipoprotein, baseline eGFR, presence of dipstick albuminuria, and eGFR variability during the exposure assessment period.