

Supplementary Materials

Longitudinal Data to Enhance Dynamic Stroke Risk Prediction

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Table S1. The p-value table for 12 numerical features to distinguish the main numerical and remaining factors. All the p-values were calculated between the stroke and no stroke groups by Welch's t-test. The second to the fourth columns are based on single-time measurement data. The fifth to the sixth columns are based on the difference between two measurements. The * represents the p-value <0.05, indicating that this feature has significant differences between two groups. (Number of stroke individual/Number of no stroke individual)

Features	P-values			Difference between 2008-2011 (61/162)	Difference between 2011-2014 (12/162)
	2008 (94/223)	2011 (49/174)	2014 (12/162)		
Systolic Blood Pressure	0.0489*	0.0438*	0.5671	0.0411*	0.4190
Diastolic Blood Pressure	0.9836	0.8408	0.0635	0.8922	0.0136*
Total Cholesterol	0.0288*	0.3171	0.3845	0.1564	0.7766
High-density Lipoprotein Total Cholesterol	0.0072*	0.0372*	0.7919	0.1531	0.7060
Red Blood Cell Count	0.1070	0.0956	0.5697	0.0449*	0.0376*
Platelet Count	0.0211*	0.0001*	0.0504	0.7890	0.5694
Age	0.0106*	0.3064	0.4139	NA	NA
Smoke	0.3397	0.1460	0.0582	0.3065	0.6608
Erythrocyte Hematocrit	0.3816	0.0964	0.8487	0.8136	0.4302
Blood Urea Nitrogen	0.9450	0.0744	0.5826	0.1128	0.4100
Hemoglobin	0.3242	0.1660	0.8517	0.0798	0.1016
Glucose	0.7586	0.6968	0.3416	0.1461	0.5186

Table S2. The goodness of fit of the mixed linear-effects model from Equations (10) to (21). All values are measured by R^2 . In general, $R^2 > 0.5$ is acceptable.

	Model for $\tilde{T}_i \leq \tau$	Model for $\tilde{T}_i > \tau$
Systolic Blood Pressure	0.553	0.743
Diastolic Blood Pressure	0.567	0.680
Total Cholesterol	0.888	0.594
High-density Lipoprotein Cholesterol	0.707	0.764
Platelet Count	0.926	0.691
Red Blood Cell Count	0.893	0.675

Table S3. The fixed effect coefficients β obtained from Equations (10) to (21) and were estimated after m th iteration of the EM algorithm. It was then used in the probability density function of multivariate normal

distribution, $f(Y|\tilde{T}, Z)$, by Equation (7) and (8). Factors corresponding to β can be found in Equations (10) to (21). Model for $\tilde{T}_i \leq \tau$ are used for stroke individuals, and Model for $\tilde{T}_i > \tau$ are used for non-stroke individuals.

	Model for $\tilde{T}_i \leq \tau$	Model for $\tilde{T}_i > \tau$	
Systolic Blood Pressure			
β_{01}	184.042	β_{01}^e	147.451
β_{11}	-4.197	β_{11}^e	-0.949
β_{21}	0.210	β_{21}^e	0.416
β_{31}	-1.521	β_{31}^e	10.494
β_{41}	1.022	β_{41}^e	3.072
β_{51}	-0.804	β_{51}^e	19.315
β_{61}	-10.318	β_{61}^e	-0.288
β_{71}	13.362	β_{71}^e	-2.829
β_{81}	-13.264	β_{81}^e	0.399
β_{91}	-9.095		
β_{101}	-6.533		
β_{111}	-11.685		
β_{121}	1.273		
Diastolic Blood Pressure			
β_{02}	74.031	β_{02}^e	72.442
β_{12}	-2.188	β_{12}^e	-2.944
β_{22}	-0.889	β_{22}^e	-0.066
β_{32}	0.436	β_{32}^e	-0.897
β_{42}	-3.958	β_{42}^e	0.084
β_{52}	3.210	β_{52}^e	0.903
β_{62}	-0.573	β_{62}^e	5.127
β_{72}	1.556	β_{72}^e	2.688
β_{82}	6.514	β_{82}^e	-1.611
β_{92}	0.531	β_{92}^e	5.239
β_{102}	4.050	β_{102}^e	2.627
β_{112}	-0.452	β_{112}^e	-0.278
Total Cholesterol			
β_{03}	0.831	β_{03}^e	3.017
β_{13}	-0.722	β_{13}^e	-0.417
β_{23}	0.026	β_{23}^e	-0.010
β_{33}	0.698	β_{33}^e	0.407
β_{43}	0.026	β_{43}^e	0.845
β_{53}	-0.349	β_{53}^e	0.826
β_{63}	0.038	β_{63}^e	0.013
β_{73}	0.683	β_{73}^e	0.454
β_{83}	0.142	β_{83}^e	-0.088

	β_{93}	-0.293	β_{93}^e	1.248
	β_{103}	-0.743	β_{103}^e	0.089
	β_{113}	-0.488	β_{113}^e	-0.454
	β_{123}	0.089	β_{123}^e	-0.345
	β_{133}	0.215	β_{133}^e	-0.140
			β_{143}^e	0.413
			β_{153}^e	-0.021
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High-density Lipoprotein Cholesterol		β_{04}	0.668	β_{04}^e
		β_{14}	-0.024	β_{14}^e
		β_{24}	0.006	β_{24}^e
		β_{34}	-0.157	β_{34}^e
		β_{44}	0.008	
		β_{54}	0.002	
		β_{64}	-0.034	
		β_{74}	0.065	
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Red Blood Cell Count		β_{05}	-0.430	β_{05}^e
		β_{15}	4.326	β_{15}^e
		β_{25}	-1.080	β_{25}^e
		β_{35}	0.025	β_{35}^e
		β_{45}	0.216	β_{45}^e
		β_{55}	0.252	β_{55}^e
		β_{65}	0.948	β_{65}^e
		β_{75}	1.209	
		β_{85}	1.157	
		β_{95}	1.313	
		β_{105}	0.044	
		β_{115}	-0.002	
		β_{125}	0.264	
		β_{135}	-0.084	
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Platelet Count		β_{06}	245.591	β_{06}^e
		β_{16}	-12.999	β_{16}^e
		β_{26}	179.506	β_{26}^e
		β_{36}	6.994	β_{36}^e
		β_{46}	19.717	β_{46}^e
		β_{56}	17.908	β_{56}^e
		β_{66}	49.036	β_{66}^e
		β_{76}	33.338	β_{76}^e
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β_{86}	28.976	β_{86}^e	-9.245
β_{96}	8.155		
β_{106}	-44.896		
β_{116}	4.343		

Table S4. The random effect covariance structure table Ω for the stroke individual with $\tilde{T}_i \leq \tau$ obtained from Equations (10) to (15) and were estimated after m th iteration of the EM algorithm. It was then used in the probability density function of multivariate normal distribution, $f(Y|\tilde{T}, Z)$, in Equation (7). Referring to the Row and Column name, we can receive specific Ω_{gg} and $\Omega_{g_1g_2}$ ($g_1 \neq g_2$), where g is used to index the main numerical factors.

	Ω_1	Ω_2	Ω_3	Ω_4	Ω_5	Ω_6
Ω_1	487.634	-135.073	84.854	-9.987	4.026	-0.962
	-135.073	42.962	-15.875	3.679	-0.248	0.230
Ω_2	84.854	-15.875	29.146	-0.693	1.045	-0.138
	-9.987	3.679	-0.694	0.504	0.346	-0.039
Ω_3	4.026	-0.248	1.045	0.346	1.574	-0.266
	-0.962	0.230	-0.138	-0.039	-0.266	0.073
Ω_4	0.004	0.012	-0.119	0.023	0.132	-0.031
	-0.238	0.124	0.045	0.016	-0.017	0.004
Ω_5	-1.710	0.747	-0.453	-0.057	-0.002	-0.018
	-1.847	0.546	-0.599	-0.034	0.001	0.004
Ω_6	51.453	11.989	-92.336	6.370	5.947	0.495
	-21.191	9.332	21.514	-1.376	0.864	0.2223

Table S5. The random effect covariance structure table Ω^e for the LTS individual with $\tilde{T}_i > \tau$ obtained from Equations (16) to (21) and were estimated after m th iteration of the EM algorithm. It was then used in the probability density function of multivariate normal distribution, $f(Y|\tilde{T}, Z)$, in Equation (8). Referring to the Row and Column name, we can receive Ω_{gg}^e and $\Omega_{g_1g_2}^e$ ($g_1 \neq g_2$), where g is used to index the main numerical factors.

	Ω_1^e	Ω_2^e	Ω_3^e	Ω_4^e	Ω_5^e	Ω_6^e
Ω_1^e	128.704	-23.288	51.531	-9.839	-0.344	-0.307
	-23.288	8.583	-6.534	3.295	0.046	0.016
Ω_2^e	51.531	-6.534	36.490	-5.111	1.677	-0.202
	-9.839	3.295	-5.111	1.724	-0.253	0.023
Ω_3^e	-0.344	0.046	1.677	-0.253	0.718	-0.098
	-0.307	0.016	-0.202	0.023	-0.098	0.022
Ω_4^e	0.528	-0.251	0.907	-0.209	0.158	-0.013
	-0.072	0.015	-0.057	0.012	-0.022	0.003
Ω_5^e	2.087	-1.015	-0.791	0.202	0.243	-0.079
	-0.410	0.190	0.170	-0.040	-0.063	0.020
Ω_6^e	155.399	-78.526	-27.519	7.911	20.548	-3.308
	-24.672	11.218	6.736	-1.347	-3.676	0.912