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Erratum to "An Analysis of Risk Factors Affecting Cerebrovascular Disease" [Health, 14 (2022) 866-882]

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Abstract

The original version of this article (Nawata, K. (2022) "An analysis of risk factors affecting cerebrovascular disease," Health, 14, 866-882. DOI: https://doi.org/10.4236/health.2022.148061) was published as some results data reported mistakenly. The author wishes to correct the errors.

Keywords

Erratum

1. Background

The risk factors for cerebrovascular disease were analyzed using data from 2,868,568 medical checkups obtained from the JMDC Claims Database.

2. Results

Age and heart disease history were very important nonmodifiable factors. The OR comparing persons aged 70 to those aged 50 was 2.33 with a 95% CI of 2.18 - 2.48. A heart disease history was also an especially important factor (OR 2.12, 95% CI 1.91 - 2.33). Among the modifiable factors, recent large weight change was a very important factor, changing the risk of cerebrovascular disease by about 25%. Other significant modifiable factors were diastolic blood pressure, urine protein and sleeping well; each of these changed the risk of cerebrovascular disease by about 10%. Taking medications to control hypertension, hyperglycemia and hypercholesterolemia respectively increased the risk of cerebrovascular disease. In particular, taking antihypertensive medications nearly doubled the risk (OR 1.73, 95% CI 1.68 - 1.85).

3. Data and Models

Data

Excluding the observations with missing values of covariates, 2,868,568 observations satisfy these criteria, and 6553 observations or 0.23% experienced cerebrovascular disease at year t + 1 among the total observations.

4. Results of Estimation

The results of the estimation are given in Table 2, and we obtained similar results in both models. Among the nonmodifiable variables, the estimates of *Age* and *Heart_D* were positive. The t-values were quite large, and they were significant at any reasonable significance level. The estimates of other nonmodifiable variables were not significant at the 5% level. For modifiable variables, the estimates of other nonmodifiable variables were not significant at the 5% level. For modifiable variables, the estimates of *DBP, GGP, U_Protein*, and *Weight_1* were positive and significant at the 1% level in both models. The estimates of *SBP, HbA1c and Weight_20* were positive and significant at the 5% level in Model B. On the other hand, the estimates of *HDL, ALT, Speed* and *Sleep* were negative and significant at the 1% level in both models. The estimates of *LDL* were negative and significant at the 5% and 1% level in Model A and Model B, respectively. The estimate of ALT was and significant at the 5% level in Model A.

For three dummy variables represent taking medications, the estimates of *M_Antihypertensive* and *M_Cholestrol* were positive, and their t-values were quite large and significant at any reasonable significance level in Model A. The estimate of *M_Glucose* was positive and significant at the 5% level. Especially, the estimate and t-value of *M_Antihypertensive* were 0.551 and 16.69, respectively.

Table 1. Summary of covariates.

Variable	Summary		Variable	Summary
	Average	SD		
Age	47.75	9.51	*U_Protein*	1: 89.42%; 2: 7.63%; 3: 2.27%; 4: 0.54%; 5: 0.14%
Female	1: 37.8%; 0: 62.2%		*Weight_1*	1: 26.0%, 0: 74.0%
Family	1: 22.2%; 77.8%		*Weight_20*	1: 35.3%; 0: 64.7%
t1	11.01	2.05	*Eat_fast*	1: 32.5%; 67.5%
Heart_D	1: 1.79%, 0: 98.21%		*Late_supper*	1: 32.3%; 0: 67.7%
BMI	22.97	3.65	*No_breakfast*	1: 17.8%; 0: 82.2%
SBP	119.89	16.22	*Exercise*	1: 21.6%; 0: 78.4%
DBP	74.44	11.81	*Activity*	1: 34.9%; 0: 75.1%
HDL	63.41	16.80	*Speed*	1: 45.1%; 0: 54.9%
LDL	121.82	30.85	*Sleep*	1: 59.06%; 0: 40.94%

Continued

Triglyceride	108.39	86.00	*Alcohol_freq*	0: 40.7%, 1: 34.0%; 2: 25.3%
ALT	23.26	17.73	*Alcohol_amount*	0: 40.7%; 1: 22.1%; 2: 22.8%; 3: 10.6%; 4: 3.8%
AST	22.31	10.57	*Smoke*	1: 25.46%; 0: 74.54%
GGP	38.22	45.21	*M_Antihypertensive*	1: 11.29%; 0: 88.71%
B_Sugar	95.54	18.30	*M_Glucose*	1: 3,29%; 0: 96.71%
HbA1c	5.54	0.60	*M_Cholestrol*	1: 7.67%; 0: 92.33%
U_Sugar	1: 97.80%; 2: 0.46%; 3: 0.54%; 4: 0.39%; 5: 0.79%			

SD: Standard Deviation.

Table 2. Results of estimation.

Variable	Model A			Model B		
	Estimate	SE	t-value	Estimate	SE	t-value
Constant	−8.7254	0.2012	−43.3561	−9.6449	0.1889	−51.0527
Age	0.0422	0.0016	25.7707	0.0514	0.0016	32.8643
Female	−0.0690	0.0422	−1.6375	−0.0709	0.0420	−1.6851
Family	−0.0766	0.0467	−1.6404	−0.0722	0.0467	−1.5472
t1	0.0016	0.0064	0.2441	0.0010	0.0064	0.1601
Heart_D	0.7507	0.0512	14.6561	0.9474	0.0502	18.8857
BMI	−0.0082	0.0047	−1.7637	0.0059	0.0046	1.2829
SBP	0.00147	0.0012	1.1979	0.00286	0.0012	2.3341
DBP	0.00778	0.0018	4.4423	0.00776	0.0018	4.4247
HDL	−0.0043	0.0010	−4.4181	−0.0049	0.0010	−5.0129
LDL	−0.0009	0.0004	−2.1359	−0.0027	0.0004	−6.3425
Triglyceride	−0.00004	0.00015	−0.2597	0.0000	0.0001	−0.2322
ALT	−0.0026	0.0013	−2.0658	−0.0020	0.0013	−1.5883
AST	0.00073	0.0018	0.3950	0.0004	0.0018	0.2457
GGP	0.0009	0.0003	3.4723	0.0011	0.0003	4.0616
B_Sugar	−0.0001	0.0009	−0.0658	0.0003	0.0009	0.3867
HbA1c	0.0097	0.0294	0.3301	0.0546	0.0278	1.9621
U_Sugar	0.0111	0.0255	0.4352	0.0191	0.0259	0.7352
U_Protein	0.1377	0.0206	6.6985	0.1697	0.0206	8.2238
Weight_1	0.2209	0.0285	7.7484	0.2209	0.0285	7.7454
Weight_20	0.0521	0.0310	1.6813	0.0684	0.0309	2.2118
Eat_fast	−0.0138	0.0272	−0.5062	−0.0023	0.0272	−0.0831
Late_supper	0.0499	0.0284	1.7546	0.0416	0.0284	1.4657
No_breakfast	0.0569	0.0353	1.6149	0.0431	0.0352	1.2240

Continued

Exercise	0.0043	0.0315	0.1377	0.0011	0.0315	0.0344
Activity	−0.0064	0.0280	−0.2269	−0.0093	0.0280	−0.3323
Speed	−0.0828	0.0261	−3.1719	−0.0952	0.0261	−3.6506
Sleep	−0.1183	0.0257	−4.6048	−0.1164	0.0257	−4.5274
Alcohol_freq	−0.0099	0.0241	−0.4128	−0.0116	0.0240	−0.4815
Alcohol_amount	−0.0169	0.0165	−1.0223	−0.0110	0.0165	−0.6646
Smoke	−0.0213	0.0305	−0.6982	−0.0505	0.0304	−1.6602
M_Antihypertensive	0.5505	0.0330	16.6869			
M_Glucose	0.1226	0.0592	2.0706			
M_Cholestrol	0.2826	0.0369	7.6638			
Log Likelihood		−44790.25			−44997.19	
No. of cases		0: 2,861,608; 1: 6553; total 28,682,161			0: 2,861,608; 1:6553; total 2,868,568	

SE: Standard Error.

5. Discussion

For an individual without a history of cerebrovascular disease, the overall probability of developing cerebrovascular disease within one year was very small, with a gross rate of just 0.23%. Therefore, the odds ratio (OR) and confidence interval (CI) are approximately equal to the probability ratio (PR) and its CI as shown in Appendix A. As shown in Figure 1, the OR comparing persons aged 60 to those aged 50 is 1.53 with a 95% CI of 1.48 - 1.57, and the OR comparing persons aged 70 to those aged 50 is the 2.33 with a 95% CI of 2.18 - 2.48. The risk of persons aged 70 is almost twice as large as that of those aged 50. The OR for a heart disease history (comparing those with and without a heart disease history) is 2.12 with a CI of 95% 1.91 - 2.33. This means that individuals with a history of heart disease will have cerebrovascular disease at rates more than double those without a heart disease history. It is necessary for these individuals to pay special attention to prevention of cerebrovascular disease. Since cerebrovascular disease, especially stroke, is a medical emergency, it is also important to ensure that medical personnel know these facts for proper treatments.

Figure 2 shows the ORs and 95% CIs of the modifiable variables whose estimates are significant at the 5% level in Model A, except for dummy variables that represent taking medications. For these variables, not only estimates but also their distributions are also important. Let z be a variable of interest. When z is a numerical variable, the OR is calculated by comparing z and (z + one standard deviation). When z is a dummy variable, the OR is calculated comparing z = 0 and 1. For *U_Protein*, the majority of the values are 1 or 2, so that the OR is calculated comparing *U_Protein* = 1 and 2. Among these variables, HDL level (*HDL*) and recent large weight change (3 kg or more within a year, *Weight_1*) are important factors. The OR of *Triglyceride* is 0.93 with a 95% CI of 0.92 - 0.96.

The fact that a higher HDL level reduces the risk of cerebrovascular disease seems inconsistent with the expected result. The OR of *HDL* is 0.93 with a 95% CI of 0.92 - 0.96. The fact that a higher HDL level reduces the risk of cerebrovascular disease seems inconsistent with the expected result. For example, the CDC [58] advises on its website to "limit foods high in saturated fat. Saturated fats come from animal products..." However, Sauvaget *et al.* [59] reported that higher consumption of animal fat and cholesterol appeared to reduce the risk of deaths from cerebral infarction in Japan. Their finding is consistent with the result of this study. The OR of *Weight_1* is 1.25 with a 95% CI of 1.21 - 1.28. This means that recent large (≥3-kg) weight change would increase the risk of the cerebrovascular disease by 25% or more, and individuals in this category should recognize this fact. The ORs (95% CIs) of other important variables are 1.10 (1.05 - 1.14) for *DBP*, 1.15 (1.10 - 1.19) for *U_Protein*, 0.92 (0.87 - 0.97) for *Speed*, and 0.89 (0.84 - 0.93) for *SLEEP*. The risks of cerebrovascular disease change about 10% by these variables. The ORs (95% CIs) for *LDL*, *ALT* and *GGP* are 0.97 (0.95 - 1.00), 0.95 (0.91 - 1.00), and 1.04 (1.02 - 1.07), respectively. The effects of these variables on the risks of cerebrovascular disease are relatively small.

For dummy variables that represent taking medications, the ORs (95% CIs) are 1.73 (1.68 - 1.79) for *M_Antihypertensive*, 1.13 (1.06 - 1.20) for *M_Glucose* and 1.33 (1.28 - 1.38) for *M_Cholesterol*.

6. Conclusion

In this study, we analyzed the risk factors for cerebrovascular disease using data from 2,868,568 medical checkups obtained from the JMDC Claims Database. Among the nonmodifiable factors, age and a history of heart disease are important risk factors. The risk of persons aged 70 is twice as large as that of those aged 50. A heart disease history is also an especially important factor; the risk more than doubles.

Among the modifiable factors, recent large weight change is a very important factor, and it increases the risk of cerebrovascular disease about 25%. *DBP*, *U_Protein*, and *Sleep* are other important modifiable factors, which change the risk of cerebrovascular disease by about 10%.

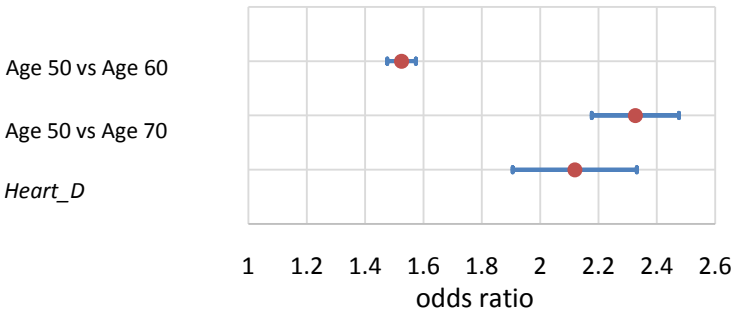

Figure 1. Odds ratios and 95% confidence intervals of nonmodifiable variables.

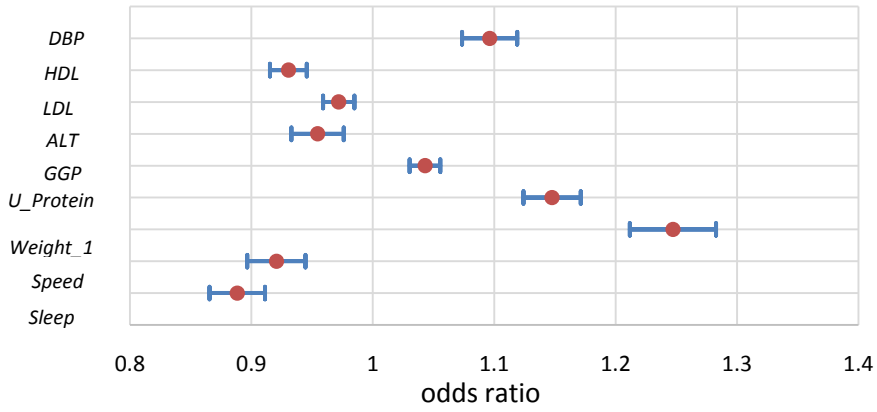

Figure 2. Odds ratios and 95% confidence intervals of modifiable variables.

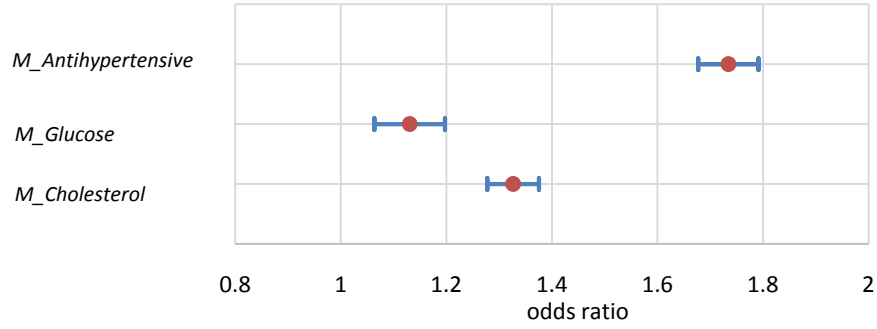

Figure 3. Odds ratios and 95% confidence intervals of dummy variables taking medications.