

Association Between Diabetes And Stroke: A Longitudinal Data Analysis Among Older Americans Aged 55 and Above

Diabetes (diabetes mellitus) is a condition that causes blood sugar (glucose) to buildup in the blood and prevent oxygen and nutrients from getting to various parts of the body, including the brain. Stroke occurs when the blood supply to part of your brain is interrupted or reduced, preventing brain tissue from getting oxygen and nutrients. Brain cells begin to die in minutes.

In the United States, diabetes is the seventh leading cause of death and 65% of these deaths are attributable to cardiovascular diseases or stroke or to both. Stroke is the leading cause of long-term adult disability and the fifth leading cause of death in the United States, with $\approx 795,000$ stroke events each year.

The study aim to investigate the prevalence of diabetes in stroke and to examine the association of several confound variables with diabetes on stroke.



The War Baby data (first cohort in 1998) from RANDHRS was used for this analysis and after screening for several inclusion and exclusion criteria, a total of 16,401 participants were further longitudinally analyzed using generalized estimating equation (GEE).

GEE considers the dependency of observations by specifying a working correlation structure and therefore, an acceptable working correlation structure was determined.

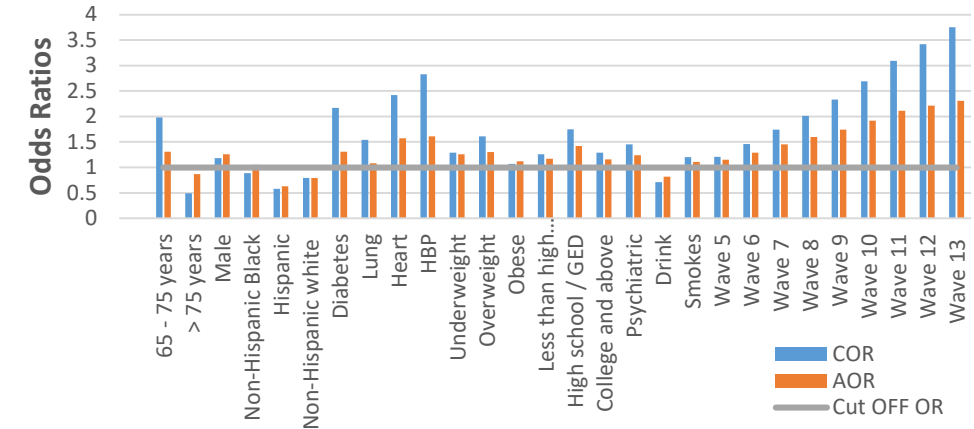
To avoid estimation biases, collinearity assumption was tested to ensure no correlation exist among the predicting variables (below 0.8). Also, tolerance and variance inflation factors (VIFs) were tested, and no value was below 0.1 or above 10 respectively.

Some Coding Snippet for the Project

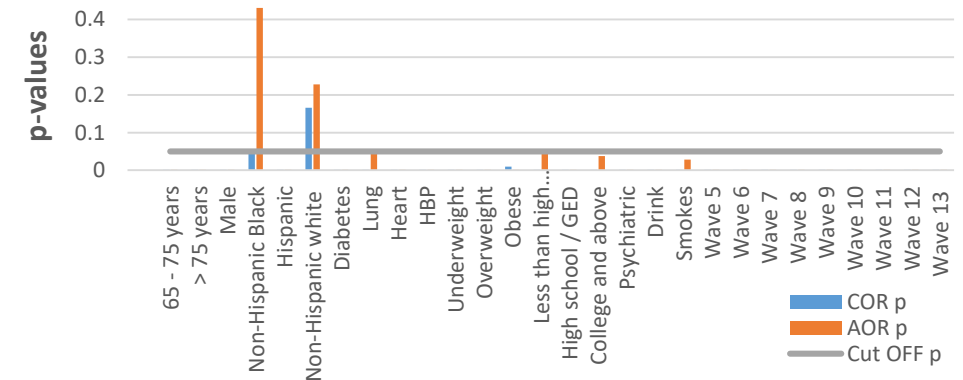
```
/* This code combine Questions #4, #5  
Data step3(rename=(a=Wave)); set sta  
ARRAY AR_all {11, 4:13} r4BMI--r13  
r4proxy--r13proxy r4heart--r13heart  
DO a = 4 to 13;  
BMI = AR_all {1, a} ;  
Diabetes = AR_all {2, a} ;  
Age = AR_all {3, a} ;  
Stroke = AR_all {4, a} ;  
HBP = AR_all {5, a} ;  
Smoking = AR_all {6, a} ;  
Proxy = AR_all {7, a} ;  
Heart = AR_all {8, a} ;  
Lung = AR_all {9, a} ;  
Psychiatric = AR_all {10, a} ;  
Drink = AR_all {11, a} ;  
output ;end;  
keep a raeduc Drink Psychiatric 1  
run;
```

```
*21. Calculating for Odd Ratio (OR)GEE Exchangeable;  
proc gee data=step14;  
class HHIDPN RAGENDER (ref='Female') weight(ref='Normal o  
education(ref='College and above') Psychiatric(ref='0') dr  
model stroke(EVENT='1') = RAGENDER diabetes weight Age Ra  
repeated subject=HHIDPN / corr=exch;  
estimate "OR Age 65 - 75" age -1 1 0 / exp cl;  
estimate "OR Age >75" age -1 0 1 / exp cl;  
estimate "OR Male" RAGENDER 1 -1 / exp cl;  
estimate "OR Diabetes" Diabetes 1 -1 / exp cl;  
estimate "OR Obese" weight -1 1 0 0 / exp cl;  
estimate "OR Overweight" weight -1 0 1 0 / exp cl;  
estimate "OR Underweight" weight -1 0 0 1 / exp cl;  
estimate "OR Hispanics" race 1 -1 0 0 / exp cl;  
estimate "OR NHB" race 0 -1 1 0 / exp cl;  
estimate "OR NHW" race 0 -1 0 1 / exp cl;
```

```
*21. Calculating for Raw Odd Ratio (OR)GEE Exchangeable for wave;  
proc gee data=step14;  
class HHIDPN wave(ref='4');  
model stroke (EVENT='1')= wave / dist=bin link=logit;  
repeated subject=HHIDPN / corr=exch;  
estimate "OR wave5" wave 1 0 0 0 0 0 0 0 -1 / exp cl;  
estimate "OR wave6" wave 0 1 0 0 0 0 0 0 -1 / exp cl;  
estimate "OR wave7" wave 0 0 1 0 0 0 0 0 -1 / exp cl;  
estimate "OR wave8" wave 0 0 0 1 0 0 0 0 -1 / exp cl;  
estimate "OR wave9" wave 0 0 0 0 1 0 0 0 -1 / exp cl;  
estimate "OR wave10" wave 0 0 0 0 0 1 0 0 -1 / exp cl;  
estimate "OR wave11" wave 0 0 0 0 0 0 1 0 -1 / exp cl;  
estimate "OR wave12" wave 0 0 0 0 0 0 0 1 -1 / exp cl;  
estimate "OR wave13" wave 0 0 0 0 0 0 0 0 1 -1 / exp cl;  
run;
```



The odds of having stroke were all statistically significant ($p < 0.05$) except, for NHB & NHW participants and Participants with less than high school. The risk of having stroke after adjustment was 31% significantly higher than participants that are not diabetic. The odds of having stroke after adjustment is significantly higher in all confounding variables compared to their reference groups except for participants aged >75 years, Hispanics, NHW, and participants that drinks.



The findings on the risk of having strokes aligns with literature finding which ranges from 20 to 33%. However, further investigation is required to explore why:

- Older male adults are more prevalent to stroke compared to women,
- Older adult aged 75 years and older are less prone to stroke, and
- Hispanic participants are at lower risk of stroke compare to other races.

Hypertension (High Blood Pressure) is a leading clear route to stroke in this report compared to other confound variables.