Study of Slow Gait Speed and Mortality

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Methods

The statistical data analysis of this study was conducted by SAS studio in Mac version. Since slow gait speed created from gait speed and mortality were both dichotomous variables, logistic regression tests were conducted. First of all, proc means procedure was used to summarize counts, means, and standard deviations of all continuous variables, and proc freq procedure was used to make frequency tables for categorial variables in which frequencies and percentages were shown. To find the association between slow gait speed and mortality, two logistic regression analyses were done. In this case, slow gait speed was the exposure and mortality was the outcome. By putting merely slow gait speed and mortality in the model statement in the first round, a crude odds ratio was derived. By adding all other variables into the model statement in the second round, an adjusted odds ratio by all other variables was derived. To figure out the association between slow gait speed and the other covariates, a logistic regression analysis was done with slow gait speed as the outcome and all other variables except mortality as risk factors. As a result, the odds ratios for the association between slow gait speed and each covariate was obtained by adjusting for the rest of the covariates. To determine if sex was an effect modifier on the association between slow gait speed and mortality, an interaction in logistic regression model was conducted, and odds ratios for both females and males regards to the association were gained respectively. Finally, to select the possible factors that could confound the association between slow gait speed and mortality, a stepwise regression procedure focusing on confounding that excluded exposure in the model was used, and summary of stepwise selection was obtained.

Results

The counts, means, and standard deviations of age at enrollment, age at last contact, heaviest weight lifted with right hand, speed to walk a 4-meter distance, lung function measure, cognitive score, and BMI among patients in this study were summarized in Table 1. The frequencies and percentages of females vs. males, alive vs. non-alive, slow gait speed vs. high gait speed, smoker vs. non-smoker, high education level vs. low education level were summarized in Table 2.

Variable	N	Mean	Std Dev
Age_enrollment	2038	86.43	9.13
Age_last_cintact	2038	90.11	8.69
grip_strength	1969	21.74	9.47
gait_speed	1894	0.77	0.27
fev1	1629	1.83	0.67
DSST	1802	31.53	13.95
BMI	1919	17.41	2.95

Table 1. *Summary of Patients' Characteristics (Continuous Variables) by n, mean, and standard deviation*

	Sex		Alive		Slow_gait_speed		Smoke		High_ed	
	Female	Male	Yes	No	<0.6	>=0.6	Yes	No	Yes	No
Frequency	1090	948	1311	722	647	1391	1122	906	1161	871
Percent	53.48	46.52	64.49	35.51	31.75	68.25	55.33	44.67	57.14	42.86

Table 2. *Summary of Patients' Characteristics (Categorical Variables) by frequency and percent*

According to the crude odds ratio in Table 3, patients whose gait speed were lower than 0.6 m/s significantly had 0.17 times the odds (83% decrease) of being alive at the end of the study compared to those who had a gait speed equal or higher than 0.6 m/s, with 95% of (0.14, 0.21) and p-value of <0.0001. According to the adjusted odds ratio, patients with low gait speed significantly had 0.60 times the odds (40% decrease) of being alive at the end of the study compared to those with high gait speed, with 95% CI of (0.41, 0.89) and p-value=0.0108, after adjusting for sex, age at enrollment, age at last contact, grip strength, measure of lung function, smoking status, education level, cognitive score, and BMI.

	Odds Ratio	Wald Chi-square	95% Wald CI	Pr>ChiSq
Crude slow_gait_speed	0.17	289.69	(0.14, 0.21)	<0.0001
Adjusted slow_gait_speed	0.60	6.50	(0.41, 0.89)	0.0108

Table 3. *Crude association (OR) between slow gait speed and mortality with ChiSqs, CIs, p-values; Adjusted association (OR) between slow gait speed and mortality with ChiSqs, CIs, p-values, after adjusting for patients' characteristics*

According to Table 4, there were significant evidence that one year increase in age at enrollment increased the odds of low gait speed by 46% with 95% CI of (1.31, 1.62) and p-value<0.0001, one year increase in age at last contact decreased the odds of low gait speed by 25% with 95% CI of (0.68, 0.83) and p-value<0.0001, one kilogram increase in grip strength decreased the odds of low gait speed by 7% with 95% CI of (0.90, 0.96) and p-value<0.0001, one unit increase in cognitive score decreased the odds of low gait speed by 5% with 95% CI of (0.94, 0.97) and p-value<0.0001, one unit increase in BMI increased the odds of low gait speed by 17% with 95% CI of (1.11, 1.24) and p-value<0.0001, after adjusting for rest of the variables in the table for each covariate. The associations between low gait speed and sex, measure of lung function, smoking status, education level were all non-significant, after adjusting for rest of the variables in the table for each covariate.

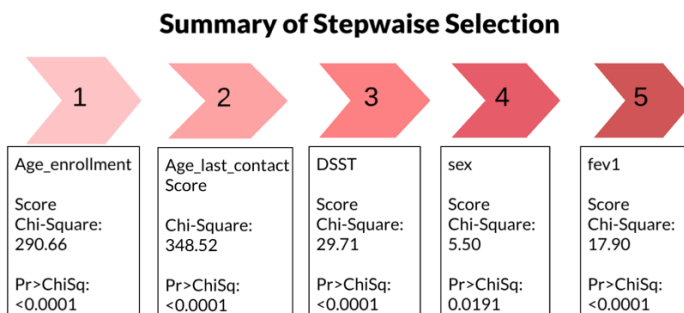|	Odds Ratio	Wald Chi-square	95% Wald CI	Pr>ChiSq
sex	0.98	0.0086	(0.63, 1.52)	0.9261
Age-enrollment	1.46	47.67	(1.31, 1.62)	<0.0001
Age_last_contact	0.75	28.78	(0.68, 0.83)	<0.0001
grip_strength	0.93	24.05	(0.90, 0.96)	<0.0001
fev1	0.77	2.48	(0.55, 1.07)	0.1151
smoke	0.76	0.070	(0.69, 1.33)	0.7921
high_ed	1.21	1.50	(0.89, 1.65)	0.2205
DSST	0.95	42.30	(0.94, 0.97)	<0.0001
BMI	1.17	32.18	(1.11, 1.24)	<0.0001

Table 4. *Adjusted association (OR) between slow gait speed and each covariate with ChiSqs, CIs, p-values, after adjusting for other patients' characteristics*

According to Table 5, sex did not significantly modify the association between low gait speed and mortality with a p-value of 0.8521, meaning that the association was the same in males and females. While not considering the significance, patients with low gait speed had 0.58 times the odds (42% decrease, 95% CI=(0.35, 0.97)) of being alive among females compared to those with high gait speed, after adjusting for all other covariates in the study. Patients with low gait speed had 0.63 times the odds (37% decrease, 95% CI=(0.36, 1.10)) of being alive among males compared to those with high gait speed, after adjusting for all other covariates in the study.

	Wald Chi-square	Pr>ChiSq
slow_gait_speed*sex	0.035	0.8521
	Exponentiated OR	Exponentiated 95% Wald CI for OR
Female	0.58	(0.35, 0.97)
Male	0.63	(0.36, 1.10)

Table 5. *Interaction between slow gait speed and sex; ORs and CIs for the association between slow gait speed and mortality, stratified by sex*

The results from stepwise regression focusing on confounding indicated that age at enrollment, age at last contact, cognitive score, sex, and lung function could confound the association between slow gait speed and mortality. Figure 1 shows the order of the variables being selected in each step.

Summary of Stepwaise Selection

1	2	3	4	5
Age_enrollment Score Chi-Square: 290.66 Pr>ChiSq: <0.0001	Age_last_contact Score Chi-Square: 348.52 Pr>ChiSq: <0.0001	DSST Score Chi-Square: 29.71 Pr>ChiSq: <0.0001	sex Score Chi-Square: 5.50 Pr>ChiSq: 0.0191	fev1 Score Chi-Square: 17.90 Pr>ChiSq: <0.0001

Figure 1. Possible confounders for the association between slow gait speed and mortality in 5 steps

Discussions and Conclusions

It can be concluded that patients with low gait speed had a 40% decrease in odds of being alive at the end of the study compared to those with high gait speed, after adjusting for covariates. There were associations between low gait speed and age at enrollment, age at last contact, grip strength, cognitive score, BMI, but not with sex, lung function, smoking status, education level. Sex was not an effect modifier on the association between low gait speed and mortality. Age at enrollment, age at last contact, cognitive score, sex, and lung function could confound the association between slow gait speed and mortality. The strength of the study was the detailed and relatively accurate data collected from the patient database during a long period of 8 years. One limitation could be that missing data was not accounted for. Future studies can focus on determining if other covariates can be effect modifiers on the association between low gait speed and mortality or the effects of all confounders selected.

<u>Appendix</u>

```
proc import out=project
        datafile="/home/u63582559/BS852/BS852 Mini Project/project_data.csv"
        DBMS=csv replace;
        getnames=yes;
run;
data project_1;
        set project;
        if gait_speed<0.6 then slow_gait_speed=1;
        else if gait_speed>=0.6 then slow_gait_speed=0;
        if alive="Yes" then alivee=1;
        else if alive="No" then alivee=0;
        if sex=2 then sex=1;
        else if sex=1 then sex=0;
run;
proc means data=project_1 descending;
        var age_enrollment age_last_contact grip_strength gait_speed fev1 DSST BMI;
run;
proc freq data=project_1;
        tables sex alive slow_gait_speed smoke high_ed;
run;
/*Q1*/
proc logistic descending;
        model alivee (event="1") = slow_gait_speed;
run;
proc logistic;
        class sex (ref="0") / param=ref descending;
        model alivee (event="1") = slow_gait_speed sex age_enrollment age_last_contact
grip_strength fev1 smoke high_ed DSST BMI;
run;
```

```
/*Q2*/

proc logistic descending;

        class sex (ref="0") / param=ref;

        model slow_gait_speed = sex age_enrollment age_last_contact grip_strength fev1 smoke
high_ed DSST BMI;

run;

/*Q3*/

proc logistic descending;

        class sex (ref='0') / param=ref;

        model alivee (event='1') = age_enrollment age_last_contact grip_strength fev1 smoke
high_ed DSST BMI slow_gait_speed | sex;

        estimate "Male" slow_gait_speed 1 / exp cl;

        estimate "Female" slow_gait_speed 1 slow_gait_speed*sex 1/ exp cl;

run;

/*Q4*/

proc logistic descending;

        class sex (ref="0") / param=ref;

        model alivee (event="1") = sex age_enrollment age_last_contact grip_strength fev1 smoke
high_ed DSST BMI / selection=stepwise sle=0.15;

run;
```