

Logistic Regression Models with GEE for the VQI FBVAR Dataset

Jennifer Ci, Thu Vu, Lily Hanyi Wang

Variables to adjust for:

- cluster on CENTERID
- AGECAT, GENDER, PREOP_SMOKING, PRIOR_AORSURG, PRIOR_CHF, PREOP_DIALYSIS
- PATHOLOGY, extent

In the model, we merge groups for the **extent**: merge “Juxtarenal AAA” with “Type 4 TAAA”; “Type 1 TAAA”, “Type 2 TAAA”, “Type 3 TAAA”, with “Type 5 TAAA”. Now **extent** is a binary variable, Juxtarenal or not.

Outcome variables:

On this report GEE2:

- POSTOP_CEREBROX, POSTOP_SPINAL_ISCHEMIA, POSTOP_DIALYSIS, POSTOP_LOS, POSTOP_COMPLICATIONS, POSTOP_LEGEMBO, POSTOP_RESPIRATORY, RETX_R_RTOR, BRANCH_POST

On the other report GEE:

- TOTAL_LOS, ICUSTAY, POSTOP_GFR, POSTOP_PRBC, POSTOP_INTISCH

POSTOP_CEREBROX: Post-op Cerebrovascular Stroke:

Also account for ARMNECK_ACCESS

Post-op Cerebrovascular Stroke			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	3.42	1.83, 6.38	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Post-op Cerebrovascular Stroke			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.81	0.91, 3.60	0.091
AGECAT			

¹OR = Odds Ratio, CI = Confidence Interval

Post-op Cerebrovascular Stroke			
Characteristic	OR ¹	95% CI ¹	p-value
<50	—	—	
>79	0.51	0.08, 3.29	0.5
50-59	0.79	0.13, 4.95	0.8
60-69	0.23	0.04, 1.45	0.12
70-79	0.62	0.11, 3.46	0.6
GENDER			
female	—	—	
male	0.49	0.26, 0.90	0.023
PREOP_SMOKING			
No	—	—	
Yes	0.73	0.34, 1.58	0.4
PRIOR_AORSURG			
Both	—	—	
Endo	1.20	0.24, 6.05	0.8
None	1.39	0.28, 6.92	0.7
Open	0.95	0.15, 5.88	>0.9
PRIOR_CHF			
No	—	—	
Yes	2.14	1.07, 4.31	0.032
PREOP_DIALYSIS			
No	—	—	
Yes	1.97	0.46, 8.55	0.4
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	3.44	1.03, 11.6	0.045
Dissection	2.56	0.57, 11.5	0.2
PAU/IMH	1.46	0.21, 10.2	0.7
extent			
Juxtarenal	—	—	
No	1.44	0.68, 3.04	0.3
ARMNECK_ACCESS			
No	—	—	
Yes	2.31	1.26, 4.25	0.007

¹OR = Odds Ratio, CI = Confidence Interval

POSTOP_SPINAL_ISCHEMIA: Post-op Spinal Ischemia

Also account for POSTOP_SPINALDRAIN and OCCLUDED_CELIAC

Post-op Spinal Ischemia			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.56	1.70, 3.86	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Post-op Spinal Ischemia			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.61	1.00, 2.60	0.050
AGECAT			
<50	—	—	
>79	2.19	0.27, 17.7	0.5
50-59	1.99	0.23, 17.3	0.5
60-69	1.63	0.21, 13.0	0.6
70-79	2.13	0.27, 16.6	0.5
GENDER			
female	—	—	
male	0.88	0.58, 1.36	0.6
PREOP_SMOKING			
No	—	—	
Yes	1.22	0.64, 2.32	0.5
PRIOR_AORSURG			
Both	—	—	
Endo	1.23	0.52, 2.95	0.6
None	1.46	0.63, 3.40	0.4
Open	1.47	0.60, 3.63	0.4
PRIOR_CHF			
No	—	—	
Yes	1.06	0.61, 1.83	0.8

¹OR = Odds Ratio, CI = Confidence Interval

Post-op Spinal Ischemia			
Characteristic	OR ¹	95% CI ¹	p-value
PREOP_DIALYSIS			
No	—	—	
Yes	1.16	0.48, 2.83	0.7
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.98	0.43, 2.25	>0.9
Dissection	1.08	0.36, 3.26	0.9
PAU/IMH extent	0.44	0.05, 3.63	0.4
Juxtarenal	—	—	
No	1.01	0.65, 1.57	>0.9
POSTOP_SPINALDRAIN			
No	—	—	
Yes	19.0	11.1, 32.6	<0.001
OCCLUDED_CELIAC			
FALSE	—	—	
TRUE	1.57	0.83, 2.99	0.2

¹OR = Odds Ratio, CI = Confidence Interval

POSTOP_LOS: Length of stay in days between surgery date and discharge date

Length of stay in days between surgery date and discharge date			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	3.39	2.69, 4.29	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Length of stay in days between surgery date and discharge date			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Length of stay in days between surgery date and discharge date		
	OR ¹	95% CI ¹	p-value
Symptomatic	2.46	1.91, 3.17	<0.001
AGECAT			
<50	—	—	
>79	2.28	0.88, 5.88	0.089
50-59	1.93	0.72, 5.21	0.2
60-69	1.55	0.60, 3.96	0.4
70-79	2.49	0.98, 6.35	0.055
GENDER			
female	—	—	
male	0.62	0.50, 0.75	<0.001
PREOP_SMOKING			
No	—	—	
Yes	0.97	0.74, 1.28	0.8
PRIOR_AORSURG			
Both	—	—	
Endo	1.26	0.73, 2.19	0.4
None	0.96	0.57, 1.62	0.9
Open	1.36	0.76, 2.41	0.3
PRIOR_CHF			
No	—	—	
Yes	1.41	1.11, 1.80	0.005
PREOP_DIALYSIS			
No	—	—	
Yes	1.74	1.00, 3.00	0.048
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	1.59	0.96, 2.63	0.069
Dissection	1.96	1.11, 3.45	0.020
PAU/IMH	1.82	0.90, 3.67	0.094
extent			
Juxtarenal	—	—	
No	1.97	1.60, 2.44	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

POSTOP_COMPLICATIONS: Any Complications Post-op

	Any Complications Post-op		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.74	1.37, 2.21	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

	Any Complications Post-op		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.44	1.12, 1.86	0.004
AGECAT			
<50	—	—	
>79	1.17	0.46, 2.97	0.7
50-59	1.29	0.49, 3.42	0.6
60-69	0.97	0.39, 2.41	>0.9
70-79	1.32	0.53, 3.31	0.6
GENDER			
female	—	—	
male	0.65	0.54, 0.78	<0.001
PREOP_SMOKING			
No	—	—	
Yes	1.01	0.79, 1.31	>0.9
PRIOR_AORSURG			
Both	—	—	
Endo	0.95	0.56, 1.60	0.8
None	1.00	0.60, 1.65	>0.9
Open	1.41	0.82, 2.42	0.2
PRIOR_CHF			
No	—	—	
Yes	1.28	1.04, 1.58	0.018
PREOP_DIALYSIS			

¹OR = Odds Ratio, CI = Confidence Interval

	Any Complications Post-op		
Characteristic	OR ¹	95% CI ¹	p-value
No	—	—	
Yes	1.25	0.73, 2.15	0.4
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	1.32	0.82, 2.12	0.3
Dissection	0.94	0.51, 1.73	0.8
PAU/IMH extent	0.77	0.35, 1.70	0.5
Juxtarenal	—	—	
No	1.47	1.21, 1.78	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

RETX_R_RTOR: Re-intervention

	Re-intervention		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.86	1.33, 2.62	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

	Re-intervention		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.48	1.04, 2.09	0.029
AGECAT			
<50	—	—	
>79	0.95	0.28, 3.27	>0.9
50-59	1.41	0.38, 5.19	0.6
60-69	0.70	0.20, 2.44	0.6
70-79	0.94	0.28, 3.14	>0.9
GENDER			

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Re-intervention		
	OR ¹	95% CI ¹	p-value
female	—	—	
male	0.59	0.45, 0.78	<0.001
PREOP_SMOKING			
No	—	—	
Yes	1.29	0.81, 2.05	0.3
PRIOR_AORSURG			
Both	—	—	
Endo	0.95	0.43, 2.09	0.9
None	1.01	0.47, 2.16	>0.9
Open	0.67	0.27, 1.63	0.4
PRIOR_CHF			
No	—	—	
Yes	1.21	0.86, 1.72	0.3
PREOP_DIALYSIS			
No	—	—	
Yes	0.75	0.31, 1.81	0.5
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	1.68	0.88, 3.19	0.12
Dissection	0.64	0.23, 1.78	0.4
PAU/IMH	1.77	0.70, 4.47	0.2
extent			
Juxtarenal	—	—	
No	1.56	1.15, 2.12	0.004

¹OR = Odds Ratio, CI = Confidence Interval

BRANCH_POST: Post-treatment Status of All Branches

Characteristic	Post-treatment Status of All Branches		
	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.28	1.78, 2.91	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Post-treatment Status of All Branches		
	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.64	1.24, 2.16	<0.001
AGECAT			
<50	—	—	
>79	0.78	0.32, 1.90	0.6
50-59	1.00	0.39, 2.58	>0.9
60-69	0.95	0.40, 2.27	>0.9
70-79	0.90	0.38, 2.14	0.8
GENDER			
female	—	—	
male	0.47	0.39, 0.58	<0.001
PREOP_SMOKING			
No	—	—	
Yes	1.08	0.79, 1.48	0.6
PRIOR_AORSURG			
Both	—	—	
Endo	0.79	0.46, 1.35	0.4
None	0.52	0.31, 0.86	0.011
Open	0.69	0.39, 1.23	0.2
PRIOR_CHF			
No	—	—	
Yes	1.43	1.12, 1.82	0.004
PREOP_DIALYSIS			
No	—	—	
Yes	7.90	4.70, 13.3	<0.001
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.77	0.43, 1.37	0.4
Dissection	1.57	0.90, 2.74	0.12
PAU/IMH extent	0.45	0.16, 1.24	0.12

¹OR = Odds Ratio, CI = Confidence Interval

	Post-treatment Status of All Branches		
Characteristic	OR ¹	95% CI ¹	p-value
Juxtarenal	—	—	
No	1.56	1.25, 1.93	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

For the following variables, we need to merge age group “<50” and “50-59” so that there’s no 0 patients on one level.

POSTOP_DIALYSIS: Post-op Dialysis

Also account for OCCLUDED_RENAL

	Post-op Dialysis		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.42	1.44, 4.07	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

	Post-op Dialysis		
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.78	1.01, 3.13	0.047
AGECAT			
<59	—	—	
60-69	0.53	0.22, 1.27	0.2
70-79	0.40	0.17, 0.97	0.042
>79	0.39	0.15, 1.01	0.053
GENDER			
female	—	—	
male	0.62	0.38, 1.00	0.049
PREOP_SMOKING			
No	—	—	
Yes	1.31	0.60, 2.86	0.5

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Post-op Dialysis		
	OR ¹	95% CI ¹	p-value
PRIOR_AORSURG			
Both	—	—	
Endo	1.04	0.26, 4.10	>0.9
None	0.82	0.22, 3.04	0.8
Open	0.58	0.12, 2.80	0.5
PRIOR_CHF			
No	—	—	
Yes	0.74	0.37, 1.45	0.4
PREOP_DIALYSIS			
No	—	—	
Yes	0.00	0.00, 0.00	<0.001
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.33	0.04, 2.96	0.3
Dissection	1.74	0.52, 5.82	0.4
PAU/IMH	2.33	0.51, 10.6	0.3
extent			
Juxtarenal	—	—	
No	0.99	0.58, 1.70	>0.9
OCCLUDED_RENAL			
FALSE	—	—	
TRUE	4.82	2.33, 9.95	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

POSTOP_LEGEMBO: Leg Ischemia/Embol

Characteristic	Leg Ischemia/Embol		
	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.97	1.13, 3.46	0.017

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Leg Ischemia/Embol		
	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.74	0.94, 3.22	0.078
AGECAT			
<59	—	—	
60-69	0.80	0.28, 2.27	0.7
70-79	0.80	0.29, 2.23	0.7
>79	0.67	0.23, 2.00	0.5
GENDER			
female	—	—	
male	0.43	0.28, 0.67	<0.001
PREOP__SMOKING			
No	—	—	
Yes	2.61	0.98, 6.96	0.056
PRIOR__AORSURG			
Both	—	—	
Endo	139,944,960,652,840		
None	162,086,767,451,715		
Open	288,216,346,513,340		
PRIOR__CHF			
No	—	—	
Yes	0.85	0.44, 1.64	0.6
PREOP__DIALYSIS			
No	—	—	
Yes	0.58	0.08, 4.19	0.6
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.87	0.20, 3.86	0.9
Dissection	0.60	0.08, 4.59	0.6
PAU/IMH	2.28	0.49, 10.6	0.3
extent			
Juxtarenal	—	—	
No	1.01	0.61, 1.66	>0.9

¹OR = Odds Ratio, CI = Confidence Interval

POSTOP_RESPIRATORY: Post-op Respiratory

Post-op Respiratory			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.65	1.87, 3.75	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Post-op Respiratory			
Characteristic	OR ¹	95% CI ¹	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.17	1.47, 3.21	<0.001
AGECAT			
<59	—	—	
60-69	0.94	0.44, 1.98	0.9
70-79	1.06	0.50, 2.25	0.9
>79	0.94	0.42, 2.06	0.9
GENDER			
female	—	—	
male	0.66	0.47, 0.92	0.014
PREOP_SMOKING			
No	—	—	
Yes	1.08	0.68, 1.72	0.7
PRIOR_AORSURG			
Both	—	—	
Endo	0.59	0.27, 1.30	0.2
None	0.55	0.26, 1.16	0.11
Open	0.67	0.28, 1.60	0.4
PRIOR_CHF			
No	—	—	
Yes	1.23	0.82, 1.84	0.3
PREOP_DIALYSIS			
No	—	—	

¹OR = Odds Ratio, CI = Confidence Interval

Characteristic	Post-op Respiratory		
	OR ¹	95% CI ¹	p-value
Yes	0.78	0.27, 2.23	0.6
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.60	0.23, 1.55	0.3
Dissection	0.83	0.29, 2.38	0.7
PAU/IMH	1.14	0.33, 4.02	0.8
extent			
Juxtarenal	—	—	
No	1.74	1.25, 2.41	<0.001

¹OR = Odds Ratio, CI = Confidence Interval

Code Appendix

```
knitr::opts_chunk$set(echo = FALSE,message = FALSE,warning = FALSE)
library(tidyverse)
library(table1)
library(dplyr)
library(geepack)
library(gtsummary)
library(broom.mixed)

## ----- working directories for Lily -----
wd_lily = '/Users/hanyiwang/Desktop/Comparative-analysis-of-treatments-of-CAA'
path_lily = c("../data/TEVAR_PROC.csv")

## ----- read data -----
setwd(wd_lily)
TEVAR_PROC = read.csv(path_lily)
## ----- modify dataset -----
TEVAR_PROC = TEVAR_PROC %>%
  mutate(extent = factor(extent,levels = c("Juxtarenal AAA","Type 1 TAAA","Type 2 TAAA","Type 3 TAAA","
  mutate(POSTOP_LOS = case_when(POSTOP_LOS>7 ~ '>7',
                                POSTOP_LOS<=7 ~ '<=7')) %>%

  mutate(POSTOP_CEREBROSX = as.numeric(POSTOP_CEREBROSX == "Yes")) %>%
  mutate(POSTOP_SPINAL_ISCHEMIA = as.numeric(POSTOP_SPINAL_ISCHEMIA == "Yes")) %>%
  mutate(POSTOP_DIALYSIS = as.numeric(POSTOP_DIALYSIS == "Yes")) %>%
  mutate(POSTOP_LOS = as.numeric(POSTOP_LOS != "<=7") ) %>%
  mutate(POSTOP_COMPLICATIONS = as.numeric(POSTOP_COMPLICATIONS == "Yes")) %>%
  mutate(POSTOP_LEGEMBO = as.numeric(POSTOP_LEGEMBO == "Yes")) %>%
  mutate(POSTOP_RESPIRATORY = as.numeric(POSTOP_RESPIRATORY == "Yes")) %>%
  mutate(RETX_R_RTOR = as.numeric(RETX_R_RTOR == "Yes")) %>%
  mutate(BRANCH_POST = as.numeric(BRANCH_POST == "Yes"))

TEVAR_PROC = subset(TEVAR_PROC, !is.na(extent))

## ----- change class of variables -----
names <- c('CENTERID','AGECAT','GENDER','PREOP_SMOKING','PRIOR_AORSURG','PRIOR_CHF','PREOP_DIALYSIS')
TEVAR_PROC[,names] <- lapply(TEVAR_PROC[,names] , factor)

## ----- Post-op Cerebrovascular Stroke -----
## ----- unadjusted -----
POSTOP_CEREBROSX1 = geeglm(POSTOP_CEREBROSX ~ PRESENTATION,
                           data=TEVAR_PROC, family=binomial(link="logit"),
                           id = CENTERID, corstr = "independence")

t1 = POSTOP_CEREBROSX1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner = "**Post-op Cerebrovascular Stroke**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_CEREBROSX2 = geeglm(POSTOP_CEREBROSX ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                           PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent+ARMNECK_ACCESS,
                           family=binomial(link="logit"), data=TEVAR_PROC,
```

```

        id = CENTERID, corstr = "independence")

t2 = POSTOP_CEREBROSX2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Post-op Cerebrovascular Stroke**")%>%as_flex_table()
## ----- Post-op Spinal Ischemia -----
## ----- unadjusted -----
POSTOP_SPINAL_ISCHEMIA1 = geeglm(POSTOP_SPINAL_ISCHEMIA ~ PRESENTATION,
                                data=TEVAR_PROC, family=binomial(link="logit"),
                                id = CENTERID, corstr = "independence")

t1 = POSTOP_SPINAL_ISCHEMIA1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Post-op Spinal Ischemia**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_SPINAL_ISCHEMIA2 = geeglm(POSTOP_SPINAL_ISCHEMIA ~ PRESENTATION+AGECAT+GENDER+
                                PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+
                                PREOP_DIALYSIS+PATHOLOGY+extent+
                                POSTOP_SPINALDRAIN+OCCLUDED_CELIAC,
                                family=binomial(link="logit"), data=TEVAR_PROC,
                                id = CENTERID, corstr = "independence")

t2 = POSTOP_SPINAL_ISCHEMIA2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Post-op Spinal Ischemia**")%>%as_flex_table()

## ----- Length of stay in days between surgery date and discharge date -----
## ----- unadjusted -----
POSTOP_LOS1 = geeglm(POSTOP_LOS~ PRESENTATION,
                    data=TEVAR_PROC, family=binomial(link="logit"),
                    id = CENTERID, corstr = "independence")
# summary(POSTOP_LOS1)

t1 = POSTOP_LOS1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Length of stay in days between surgery date and discharge date**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_LOS2 = geeglm(POSTOP_LOS ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                    PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                    family=binomial(link="logit"), data=TEVAR_PROC,
                    id = CENTERID, corstr = "independence")

```



```

t2 = POSTOP_LOS2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Length of stay in days between surgery date and discharge date**")
## ----- Any Complications Post-op -----
## ----- unadjusted -----
POSTOP_COMPLICATIONS1 = geeglm(POSTOP_COMPLICATIONS~ PRESENTATION,
                                data=TEVAR_PROC, family=binomial(link="logit"),
                                id = CENTERID, corstr = "independence")

t1 = POSTOP_COMPLICATIONS1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Any Complications Post-op**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_COMPLICATIONS2 = geeglm(POSTOP_COMPLICATIONS ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                                PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                                family=binomial(link="logit"), data=TEVAR_PROC,
                                id = CENTERID, corstr = "independence")

t2 = POSTOP_COMPLICATIONS2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Any Complications Post-op**")%>%as_flex_table()
## ----- Re-intervention -----
## ----- unadjusted -----
RETX_R_RTOR1 = geeglm(RETX_R_RTOR~ PRESENTATION,
                      data=TEVAR_PROC, family=binomial(link="logit"),
                      id = CENTERID, corstr = "independence")
# summary(POSTOP_LOS1)

t1 = RETX_R_RTOR1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Re-intervention**")%>%as_flex_table()

## ----- adjusted -----
RETX_R_RTOR2 = geeglm(RETX_R_RTOR ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                      PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                      family=binomial(link="logit"), data=TEVAR_PROC,
                      id = CENTERID, corstr = "independence")

t2 = RETX_R_RTOR2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Re-intervention**")%>%as_flex_table()
## ----- Post-treatment Status of All Branches -----

```

```

## ----- unadjusted -----
BRANCH_POST1 = geeglm(BRANCH_POST~ PRESENTATION,
                      data=TEVAR_PROC, family=binomial(link="logit"),
                      id = CENTERID, corstr = "independence")
# summary(POSTOP_LOS1)

t1 = BRANCH_POST1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Post-treatment Status of All Branches**")%>%as_flex_table()

## ----- adjusted -----
BRANCH_POST2 = geeglm(BRANCH_POST ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                      PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                      family=binomial(link="logit"), data=TEVAR_PROC,
                      id = CENTERID, corstr = "independence")

t2 = BRANCH_POST2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2), tab_spanner = "**Post-treatment Status of All Branches**")%>%as_flex_table()
## ----- modify dataset -----
TEVAR_PROC = TEVAR_PROC %>%
  mutate(AGECAT = factor(AGECAT, levels = c('<50', '50-59', '60-69', '70-79', '>79'),
                        labels = c('<59', '<59', '60-69', '70-79', '>79')))

## ----- Post-op Dialysis -----
# table1(~ AGECAT | factor(POSTOP_DIALYSIS), data=subset(TEVAR_PROC, !is.na(POSTOP_DIALYSIS)))

## ----- unadjusted -----
POSTOP_DIALYSIS1 = geeglm(POSTOP_DIALYSIS ~ PRESENTATION,
                        data=TEVAR_PROC, family=binomial(link="logit"),
                        id = CENTERID, corstr = "independence")

t1 = POSTOP_DIALYSIS1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1), tab_spanner = "**Post-op Dialysis**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_DIALYSIS2 = geeglm(POSTOP_DIALYSIS ~ PRESENTATION+AGECAT+GENDER+
                        PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+
                        PREOP_DIALYSIS+PATHOLOGY+extent+
                        OCCLUDED_RENAL,
                        family=binomial(link="logit"), data=TEVAR_PROC,
                        id = CENTERID, corstr = "independence")

t2 = POSTOP_DIALYSIS2 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

```

```

tbl_merge(tbls = list(t2),tab_spanner = "**Post-op Dialysis**")%>%as_flex_table()

## ----- Leg Ischemia/Emboli -----
# table1(~ AGECAT | factor(POSTOP_LEGEMBO),data=subset(TEVAR_PROC, !is.na(POSTOP_LEGEMBO)))
## ----- unadjusted -----
POSTOP_LEGEMBO1 = geeglm(POSTOP_LEGEMBO~ PRESENTATION,
                        data=TEVAR_PROC, family=binomial(link="logit"),
                        id = CENTERID, corstr = "independence")
# summary(POSTOP_LOS1)

t1 = POSTOP_LEGEMBO1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner = "**Leg Ischemia/Embol**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_LEGEMBO2 = geeglm(POSTOP_LEGEMBO ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                        PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                        family=binomial(link="logit"), data=TEVAR_PROC,
                        id = CENTERID, corstr = "independence")

t2 = POSTOP_LEGEMBO2 %>%
  tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2),tab_spanner = "**Leg Ischemia/Embol**")%>%as_flex_table()
## ----- Post-op Respiratory -----
# table1(~ AGECAT | factor(POSTOP_RESPIRATORY),data=subset(TEVAR_PROC, !is.na(POSTOP_RESPIRATORY)))

## ----- unadjusted -----
POSTOP_RESPIRATORY1 = geeglm(POSTOP_RESPIRATORY~ PRESENTATION,
                            data=TEVAR_PROC, family=binomial(link="logit"),
                            id = CENTERID, corstr = "independence")

t1 = POSTOP_RESPIRATORY1 %>%
  tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner = "**Post-op Respiratory**")%>%as_flex_table()

## ----- adjusted -----
POSTOP_RESPIRATORY2 = geeglm(POSTOP_RESPIRATORY ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+
                            PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS+PATHOLOGY+extent,
                            family=binomial(link="logit"), data=TEVAR_PROC,
                            id = CENTERID, corstr = "independence")

t2 = POSTOP_RESPIRATORY2 %>%
  tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2),tab_spanner = "**Post-op Respiratory**")%>%as_flex_table()

```