Generalized linear models with the Generalized Estimating Equations for the VQI FBVAR Dataset

Jennifer Ci, Thu Vu, Lily Hanyi Wang

Generalized linear models with the Generalized Estimating Equations for continuous outcomes

TOTAL_LOS

Length of Stay in days calculated by DISCHARGE_DT - ADMIT_DT

Characteristic	TOTAL_LOS Length of Stay in days		
	OR[1]	95% CI[1]	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	5.10	4.08, 6.38	**<0.001**

[1]OR = Odds Ratio, CI = Confidence Interval

Characteristic	TOTAL_LOS Length of Stay in days		
	OR[1]	95% CI[1]	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	3.79	3.00, 4.81	**<0.001**
AGECAT			
<50	—	—	
>79	1.93	0.89, 4.18	0.10
50-59	1.88	0.83, 4.28	0.13
60-69	1.34	0.62, 2.87	0.5
70-79	2.20	1.03, 4.66	**0.041**
GENDER			

[1]OR = Odds Ratio, CI = Confidence Interval

Characteristic	TOTAL_LOS Length of Stay in days		
	OR[1]	95% CI[1]	p-value
female	—	—	
male	0.62	0.52, 0.75	**<0.001**
PREOP_SMOKING			
No	—	—	
Yes	1.02	0.78, 1.33	>0.9
PRIOR_AORSURG			
Both	—	—	
Endo	1.67	0.97, 2.87	0.064
None	1.13	0.67, 1.92	0.6
Open	1.52	0.86, 2.66	0.15
PRIOR_CHF			
No	—	—	
Yes	1.50	1.19, 1.88	**<0.001**
PREOP_DIALYSIS			
No	—	—	
Yes	1.75	1.02, 3.00	**0.042**
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	1.89	1.19, 2.99	**0.007**
Dissection	1.89	1.09, 3.28	**0.024**
PAU/IMH	1.97	0.94, 4.11	0.072
extent			
Juxtarenal	—	—	
No	2.07	1.69, 2.53	**<0.001**

[1]OR = Odds Ratio, CI = Confidence Interval

ICUSTAY

ICU Stay

	ICU Stay		
Characteristic	**OR[1]**	**95% CI[1]**	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	3.10	2.42, 3.97	**<0.001**

[1]OR = Odds Ratio, CI = Confidence Interval

	ICU Stay		
Characteristic	**OR[1]**	**95% CI[1]**	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	2.10	1.60, 2.75	**<0.001**
AGECAT			
<50	—	—	
>79	1.32	0.50, 3.47	0.6
50-59	1.26	0.45, 3.53	0.7
60-69	1.00	0.39, 2.57	>0.9
70-79	1.30	0.51, 3.34	0.6
GENDER			
female	—	—	
male	0.61	0.49, 0.76	**<0.001**
PREOP_SMOKING			
No	—	—	
Yes	0.99	0.73, 1.34	>0.9
PRIOR_AORSURG			
Both	—	—	
Endo	1.33	0.77, 2.32	0.3
None	0.72	0.42, 1.24	0.2
Open	1.25	0.70, 2.23	0.5
PRIOR_CHF			
No	—	—	

[1]OR = Odds Ratio, CI = Confidence Interval

Characteristic	OR[1]	95% CI[1]	p-value
	ICU Stay		
Yes	1.22	0.93, 1.59	0.15
PREOP_DIALYSIS			
No	—	—	
Yes	1.96	1.12, 3.43	**0.019**
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	1.34	0.80, 2.23	0.3
Dissection	1.79	0.97, 3.30	0.062
PAU/IMH	1.26	0.51, 3.11	0.6
extent			
Juxtarenal	—	—	
No	2.18	1.72, 2.75	**<0.001**

[1]OR = Odds Ratio, CI = Confidence Interval

POSTOP_PRBC

Transfusion # Units PRBC

	Transfusion # Units PRBC		
Characteristic	**Beta**	**95% CI**[1]	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	0.96	0.52, 1.4	**<0.001**

[1]CI = Confidence Interval

	Transfusion # Units PRBC		
Characteristic	**Beta**	**95% CI**[1]	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	0.43	-0.05, 0.92	0.079
AGECAT			
<50	—	—	
>79	-0.96	-5.6, 3.7	0.7
50-59	-0.30	-5.1, 4.5	>0.9
60-69	-1.2	-5.8, 3.5	0.6
70-79	-0.89	-5.5, 3.8	0.7
GENDER			
female	—	—	
male	-0.81	-1.1, -0.49	**<0.001**
PREOP_SMOKING			
No	—	—	
Yes	-0.27	-0.73, 0.20	0.3
PRIOR_AORSURG			
Both	—	—	
Endo	-0.04	-1.0, 0.92	>0.9
None	-0.32	-1.3, 0.69	0.5
Open	0.17	-0.95, 1.3	0.8
PRIOR_CHF			
No	—	—	

[1]CI = Confidence Interval

Characteristic	Beta	95% CI[1]	p-value
	Transfusion # Units PRBC		
Yes	-0.07	-0.33, 0.19	0.6
PREOP_DIALYSIS			
No	—	—	
Yes	0.73	-0.16, 1.6	0.11
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	-0.13	-1.2, 0.97	0.8
Dissection	1.2	-0.78, 3.1	0.2
PAU/IMH	0.44	-1.1, 2.0	0.6
extent			
Juxtarenal	—	—	
No	0.72	0.36, 1.1	**<0.001**

[1]CI = Confidence Interval

POSTOP_HIGHCREAT

Highest Creatinine (has not updated yet)

	Highest Creatinine		
Characteristic	Beta	95% CI[1]	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	0.34	0.16, 0.52	**<0.001**

[1]CI = Confidence Interval

	Highest Creatinine		
Characteristic	Beta	95% CI[1]	p-value
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	0.22	0.06, 0.37	**0.006**
AGECAT			
<50	—	—	
>79	-0.34	-0.89, 0.22	0.2
50-59	-0.12	-0.74, 0.51	0.7
60-69	-0.30	-0.85, 0.26	0.3
70-79	-0.30	-0.85, 0.25	0.3
GENDER			
female	—	—	
male	0.18	0.10, 0.26	**<0.001**
PREOP_SMOKING			
No	—	—	
Yes	0.02	-0.08, 0.13	0.6
PRIOR_AORSURG			
Both	—	—	
Endo	0.28	0.03, 0.53	**0.030**
None	0.18	-0.07, 0.42	0.2
Open	0.11	-0.14, 0.36	0.4
PRIOR_CHF			
No	—	—	

[1]CI = Confidence Interval

| | Highest Creatinine | | |
Characteristic	Beta	95% CI[1]	p-value
Yes	0.16	0.07, 0.25	**<0.001**
PREOP_DIALYSIS			
No	—	—	
Yes	4.1	3.4, 4.9	**<0.001**
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	-0.16	-0.41, 0.10	0.2
Dissection	0.30	-0.10, 0.70	0.15
PAU/IMH	0.19	-0.17, 0.55	0.3
extent			
Juxtarenal	—	—	
No	0.07	-0.03, 0.16	0.2

[1]CI = Confidence Interval

POSTOP_INTISCH

Intestinal Ischemia

	Intestinal Ischemia		
Characteristic	**OR[1]**	**95% CI[1]**	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.14	0.56, 2.33	0.7

[1]OR = Odds Ratio, CI = Confidence Interval

	Intestinal Ischemia		
Characteristic	**OR[1]**	**95% CI[1]**	**p-value**
PRESENTATION			
Asymptomatic	—	—	
Symptomatic	1.08	0.50, 2.32	0.9
AGECAT			
<50	—	—	
>79	0.42	0.07, 2.43	0.3
50-59	0.49	0.06, 4.21	0.5
60-69	0.37	0.06, 2.20	0.3
70-79	0.45	0.08, 2.54	0.4
GENDER			
female	—	—	
male	0.62	0.37, 1.03	0.064
PREOP_SMOKING			
No	—	—	
Yes	0.86	0.43, 1.73	0.7
PRIOR_AORSURG			
Both	—	—	
Endo	1.89	0.22, 16.1	0.6
None	1.78	0.21, 15.1	0.6
Open	1.57	0.16, 15.4	0.7
PRIOR_CHF			
No	—	—	

[1]OR = Odds Ratio, CI = Confidence Interval

	Intestinal Ischemia		
Characteristic	**OR**[1]	**95% CI**[1]	**p-value**
Yes	1.06	0.53, 2.12	0.9
PREOP_DIALYSIS			
No	—	—	
Yes	0.70	0.09, 5.20	0.7
PATHOLOGY			
Aneurysm	—	—	
Aneurysm from dissection	0.51	0.07, 3.85	0.5
Dissection	0.73	0.14, 3.76	0.7
PAU/IMH	1.28	0.16, 10.5	0.8
extent			
Juxtarenal	—	—	
No	0.94	0.53, 1.68	0.8

[1]OR = Odds Ratio, CI = Confidence Interval

Correlation matrix
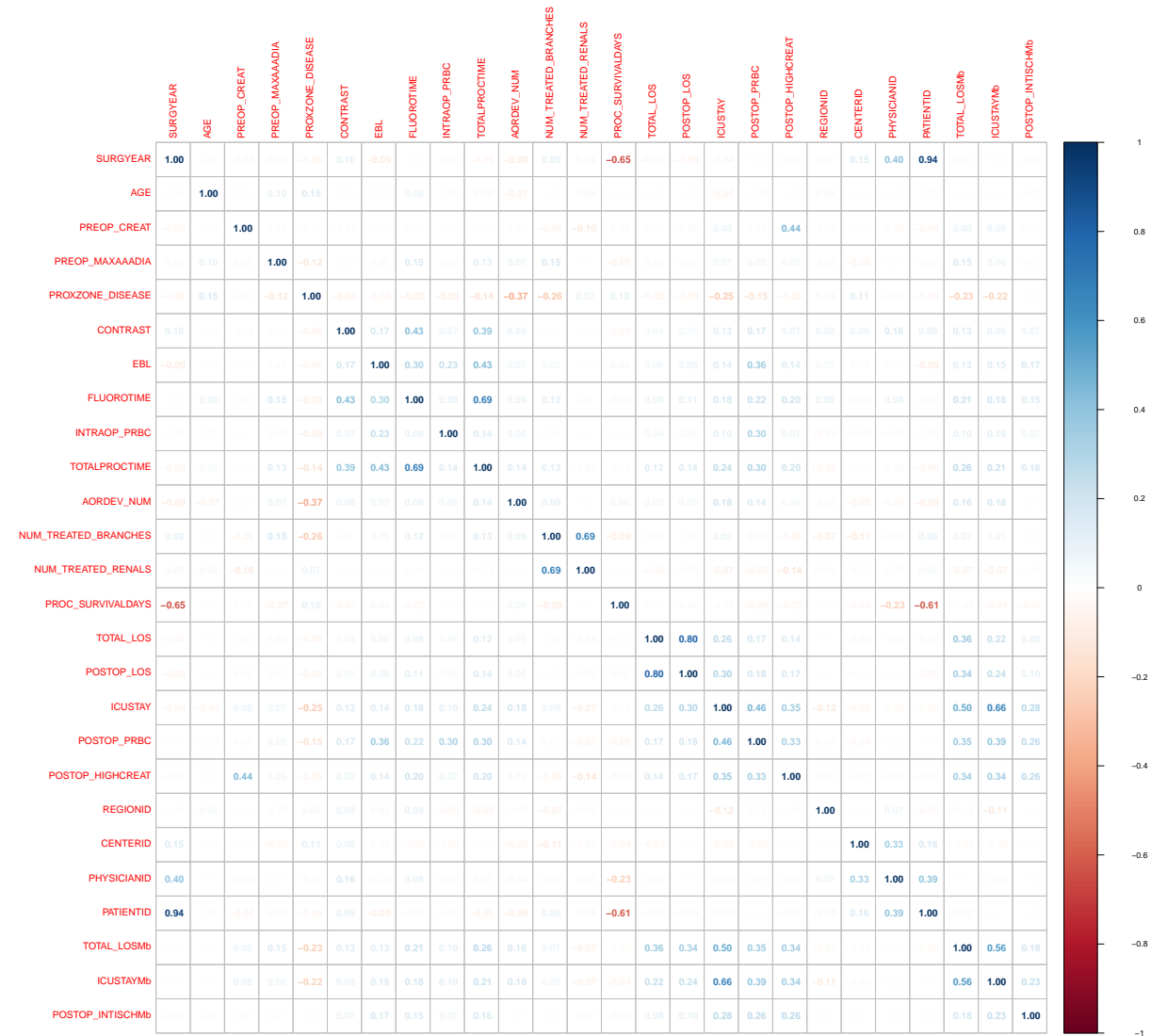
$SURGMONTH
[1] "feb" "aug" "jun" "sep" "oct" "may" "mar" "nov" "jan" "apr" "dec" "jul"
##
$PRESENTATION
[1] "Asymptomatic" "Symptomatic"
##
$AGECAT
[1] "60-69" "<50"   "70-79" ">79"   "50-59"
##
$GENDER
[1] "male"   "female"
##

```
## $ETHNICITY
## [1] "None Hispanic or Latino" "Hispanic or Latino"
## [3] NA
##
## $RACE
## [1] "Black or African American"
## [2] "White"
## [3] "Unknown/Other"
## [4] "Asian"
## [5] "American Indian or Alaskan Native"
## [6] "Native Hawaiian or other Pacific Islander"
## [7] "More than 1 race"
##
## $TRANSFER
## [1] "No"          "Hospital"    "Rehab Unit"
##
## $PRIMARYINSURER
## [1] "Medicare"        "Commercial"      NA                "Medicaid"
## [5] "Military/VA"     "Self Pay"        "Non US Insurance"
##
## $LIVINGSTATUS
## [1] "Home"          "Nursing home" "Homeless"
##
## $PREOP_FUNCSTATUS
## [1] "Full"          "Light work"    "Self care"     "Assisted care"
## [5] NA              "Bed bound"
##
## $PRIOR_CVD
## [1] "No"  "Yes"
##
## $PRIOR_CAD
## [1] "No"  "Yes" NA
##
## $PRIOR_CHF
## [1] "No"  "Yes"
##
## $COPD
## [1] "No"  "Yes"
##
## $DIABETES
## [1] "No"  "Yes"
##
## $PREOP_DIALYSIS
## [1] "No"  "Yes"
##
## $HTN
## [1] "Yes" "No"  NA
##
## $PREOP_SMOKING
## [1] "Yes" "No"  NA
##
## $PRIOR_CABG
## [1] "No"  "Yes" NA
##
```

```
## $PRIOR_PCI
## [1] "No"  "Yes" NA
##
## $PRIOR_ANEURREP
## [1] "Yes" "No"
##
## $STRESS
## [1] "Yes" "No"  NA
##
## $DC_ASA
## [1] "Yes" "No"  NA
##
## $DC_P2Y
## [1] "No"  "Yes" NA
##
## $DC_STATIN
## [1] "Yes" "No"  NA
##
## $PRIOR_AORSURG
## [1] "Open" "Endo" "None" "Both"
##
## $PATHOLOGY
## [1] "Dissection"              "Aneurysm from dissection"
## [3] "Aneurysm"                "PAU/IMH"
##
## $URGENCY
## [1] "Elective" "Urgent"   "Emergent"
##
## $PATHOLOGY_ANEURYSM_TYPE
## [1] NA                            "Degenerative, fusiform"
## [3] "Degenerative, saccular"       "Anastomotic"
## [5] "Intercostal or visceral patch" "Prior trauma"
##
## $PATHOLOGY_DISSECT_TYPE
## [1] "Chronic, >30 days" NA              "Acute, <= 30 days"
##
## $GENHIST
## [1] "None"         "Non-specific" "Marfans"      NA
## [5] "Loeys-Dietz"  "Ehlers-Danlos"
##
## $DISTZONE_DISEASE
##  [1] "9"   "10B" "10L" "11B" "10R" "8"   "7"   "11L" "6"   "5"   "11R" "4"
##
## $extent
## [1] No        <NA>      Juxtarenal
## Levels: Juxtarenal No
##
## $ANESTHESIA
## [1] "General"  "Local"    "Regional"
##
## $IVUSTEE
## [1] "No"   "IVUS" NA     "Both" "TEE"
##
## $ACCESS
```

```
## [1] "Percutaneous" NA               "Open"
##
## $ARMNECK_ACCESS
## [1] "No"  "Yes"
##
## $AORDEV_CMOD
## [1] "Yes" "No"
##
## $DEV_GTYPE
## [1] "Physician modified" "Standard"           "Custom"
##
## $ILIACDEV_END_R
## [1] "Common"             NA                      "None"
## [4] "External,Intended"  "External, Unintended"
##
## $ILIACDEV_END_L
## [1] "Common"             NA                      "External,Intended"
## [4] "External, Unintended" "None"
##
## $BRANCH_STAGED
## [1] "Yes" "No"  NA
##
## $BRANCH_LSUB
## [1] "Yes" "No"
##
## $BRANCH_CELIAC
## [1] "Yes" "No"
##
## $BRANCH_SMA
## [1] "Yes" "No"
##
## $BRANCH_RRENAL
## [1] "Yes" "No"
##
## $BRANCH_LRENAL
## [1] "Yes" "No"
##
## $ANESTHESIA_GEN_TIMEEXT
## [1] "In OR"    "<12 hrs"  "12-24 hrs" ">24 hrs"   NA
##
## $POSTOP_SPINALDRAIN
## [1] "Yes" "No"
##
## $lrenal
## [1] "Scallop/Fen/Branch/Chimney" "None"
## [3] "Occluded/Covered"           NA
##
## $rrenal
## [1] "Scallop/Fen/Branch/Chimney" "None"
## [3] "Occluded/Covered"           NA
##
## $sma
## [1] "Scallop/Fen/Branch/Chimney" NA
## [3] "None"                       "Occluded/Covered"
```

```
## 
## $celiac
## [1] "Scallop/Fen/Branch/Chimney" "None"
## [3] NA                          "Occluded/Covered"
## 
## $lsub
## [1] NA                          "Scallop/Fen/Branch/Chimney"
## [3] "Occluded/Covered"          "None"
## 
## $OCCLUDED_RENAL
## [1] FALSE  TRUE
## 
## $OCCLUDED_SMA
## [1] FALSE  TRUE
## 
## $OCCLUDED_CELIAC
## [1] FALSE  TRUE
## 
## $DEAD
## [1] FALSE  TRUE
## 
## $AORDEV_TECHSUCC
## [1] "Yes" "No"  NA
## 
## $CONVTOOPEN
## [1] "No"  "Yes"
## 
## $LEAKATCOMP_NONE
## [1] NA    "Yes" "No"
## 
## $POSTOP_VASO
## [1] "No"  "Yes" NA
## 
## $POSTOP_COMPLICATIONS
## [1] "No"  "Yes" NA
## 
## $ACCESS_COMPLICATION
## [1] "No"  "Yes" NA
## 
## $POSTOP_AH
## [1] "No"  "Yes"
## 
## $POSTOP_CEREBROSX
## [1] "No"  "Yes" NA
## 
## $POSTOP_RESPIRATORY
## [1] "No"  "Yes"
## 
## $POSTOP_DIALYSIS
## [1] "No"  NA    "Yes"
## 
## $POSTOP_ARMEMBO
## [1] "No"  "Yes"
## 
```

```
## $POSTOP_LEGEMBO
## [1] "No"  "Yes"
##
## $POSTOP_LEGCOMPART
## [1] "No"  "Yes"
##
## $POSTOP_INTISCH
## [1] "No"  "Yes"
##
## $POSTOP_RENALISCH
## [1] "No"  "Yes"
##
## $POSTOP_SPINAL_ISCHEMIA
## [1] "No"  "Yes"
##
## $RETX_R_RTOR
## [1] "No"  "Yes" NA
##
## $DC_STATUS
## [1] "Home"           "Dead"           "Rehab Unit"     "Nursing Home"
## [5] "Other Hospital" NA               "Homeless"
##
## $BRANCH_POST
## [1] "No"  "Yes" NA
##
## $TOTAL_LOSM
## [1] "<=7" ">7"
##
## $ICUSTAYM
## [1] "<=4" ">4"  NA


##                 SURGMONTH        PRESENTATION                 AGECAT
##                        12                   2                      5
##                    GENDER           ETHNICITY                   RACE
##                         2                   3                      7
##                  TRANSFER      PRIMARYINSURER           LIVINGSTATUS
##                         3                   7                      3
##          PREOP_FUNCSTATUS           PRIOR_CVD              PRIOR_CAD
##                         6                   2                      3
##                 PRIOR_CHF                COPD               DIABETES
##                         2                   2                      2
##           PREOP_DIALYSIS                 HTN          PREOP_SMOKING
##                         2                   3                      3
##               PRIOR_CABG           PRIOR_PCI         PRIOR_ANEURREP
##                         3                   3                      2
##                    STRESS              DC_ASA                 DC_P2Y
##                         3                   3                      3
##                 DC_STATIN       PRIOR_AORSURG              PATHOLOGY
##                         3                   4                      4
##                   URGENCY PATHOLOGY_ANEURYSM_TYPE PATHOLOGY_DISSECT_TYPE
##                         3                   6                      3
##                   GENHIST     DISTZONE_DISEASE                 extent
##                         6                  12                      3
##                ANESTHESIA             IVUSTEE                 ACCESS
```

16

```
##                      3                        5                      3
##         ARMNECK_ACCESS              AORDEV_CMOD              DEV_GTYPE
##                      2                        2                      3
##         ILIACDEV_END_R           ILIACDEV_END_L           BRANCH_STAGED
##                      5                        5                      3
##            BRANCH_LSUB            BRANCH_CELIAC             BRANCH_SMA
##                      2                        2                      2
##          BRANCH_RRENAL            BRANCH_LRENAL  ANESTHESIA_GEN_TIMEEXT
##                      2                        2                      5
##     POSTOP_SPINALDRAIN                    lrenal                 rrenal
##                      2                        4                      4
##                    sma                    celiac                   lsub
##                      4                        4                      4
##         OCCLUDED_RENAL             OCCLUDED_SMA         OCCLUDED_CELIAC
##                      2                        2                      2
##                   DEAD           AORDEV_TECHSUCC             CONVTOOPEN
##                      2                        3                      2
##        LEAKATCOMP_NONE              POSTOP_VASO    POSTOP_COMPLICATIONS
##                      3                        3                      3
##    ACCESS_COMPLICATION                POSTOP_AH        POSTOP_CEREBROSX
##                      3                        2                      3
##      POSTOP_RESPIRATORY          POSTOP_DIALYSIS          POSTOP_ARMEMBO
##                      2                        3                      2
##          POSTOP_LEGEMBO        POSTOP_LEGCOMPART          POSTOP_INTISCH
##                      2                        2                      2
##       POSTOP_RENALISCH   POSTOP_SPINAL_ISCHEMIA            RETX_R_RTOR
##                      2                        2                      3
##              DC_STATUS              BRANCH_POST             TOTAL_LOSM
##                      7                        3                      2
##               ICUSTAYM
##                      3
```
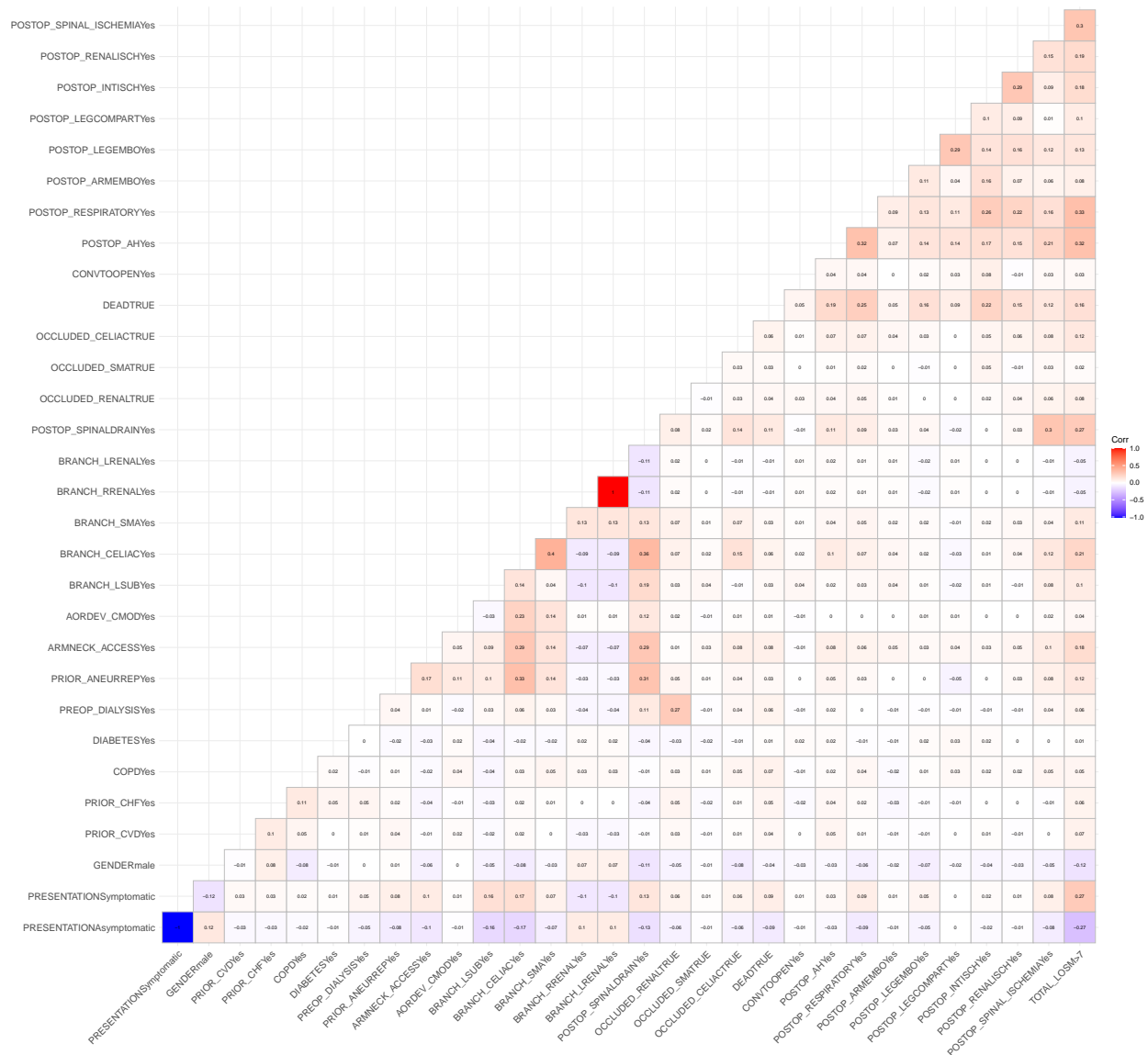
```
## 'data.frame':    3744 obs. of  30 variables:
##  $ PRESENTATION        : chr  "Asymptomatic" "Asymptomatic" "Asymptomatic" "Asymptomatic" ...
##  $ GENDER              : chr  "male" "male" "female" "male" ...
##  $ PRIOR_CVD           : chr  "No" "Yes" "No" "No" ...
##  $ PRIOR_CHF           : chr  "No" "Yes" "No" "No" ...
##  $ COPD                : chr  "No" "Yes" "No" "No" ...
##  $ DIABETES            : chr  "No" "Yes" "No" "No" ...
##  $ PREOP_DIALYSIS      : chr  "No" "No" "No" "No" ...
##  $ PRIOR_ANEURREP      : chr  "Yes" "Yes" "No" "No" ...
##  $ ARMNECK_ACCESS      : chr  "No" "No" "No" "No" ...
##  $ AORDEV_CMOD         : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ BRANCH_LSUB         : chr  "Yes" "No" "No" "No" ...
##  $ BRANCH_CELIAC       : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ BRANCH_SMA          : chr  "Yes" "Yes" "Yes" "Yes" ...
```

```
##  $ BRANCH_RRENAL         : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ BRANCH_LRENAL         : chr  "Yes" "Yes" "Yes" "Yes" ...
##  $ POSTOP_SPINALDRAIN    : chr  "Yes" "Yes" "No" "No" ...
##  $ OCCLUDED_RENAL        : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ OCCLUDED_SMA          : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ OCCLUDED_CELIAC       : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ DEAD                  : logi  FALSE FALSE FALSE FALSE FALSE FALSE ...
##  $ CONVTOOPEN            : chr  "No" "No" "No" "No" ...
##  $ POSTOP_AH             : chr  "No" "No" "No" "No" ...
##  $ POSTOP_RESPIRATORY    : chr  "No" "No" "No" "No" ...
##  $ POSTOP_ARMEMBO        : chr  "No" "No" "No" "No" ...
##  $ POSTOP_LEGEMBO        : chr  "No" "No" "No" "No" ...
##  $ POSTOP_LEGCOMPART     : chr  "No" "No" "No" "No" ...
##  $ POSTOP_INTISCH        : chr  "No" "No" "No" "No" ...
##  $ POSTOP_RENALISCH      : chr  "No" "No" "No" "No" ...
##  $ POSTOP_SPINAL_ISCHEMIA: chr  "No" "No" "No" "No" ...
##  $ TOTAL_LOSM            : chr  "<=7" "<=7" "<=7" "<=7" ...
```

Code Appendix

```r
knitr::opts_chunk$set(echo = FALSE,message = FALSE,warning = FALSE)
knitr::opts_chunk$set(fig.width=20, fig.height=20)

library(tidyverse)
library(table1)
library(survival)
library(Hmisc)
library(ggplot2)
library(ggpubr)
library(corrplot)
library(caret)
library(survminer)
library(knitr)
library(kableExtra)
library(dplyr)




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


## ------------- working directories for Jenn ----------
wd_jenn = '/Users/jenniferci/Desktop/stlp new laptop/Capstone/Comparative-analysis-of-treatments-of-CAA-
path_jenn = c("TEVAR_PROC.csv")

## ------------- working directories for Thu ----------
# wd_thu = '/Users/thuvu/Desktop/Comparative-analysis-of-treatments-of-CAA'
# path_thu = c("FBVAR.csv")

## ------------- read data ----------
#setwd(wd_lily)
#FBVAR = read.csv(path_lily)

#setwd(wd_jenn)
PROC = read.csv(path_jenn)

#find duplicate participants
#n_occur <- data.frame(table(PROC$PATIENTID))
#n_occur[n_occur$Freq > 1,]

#PROC[PROC$PATIENTID %in% n_occur$Var1[n_occur$Freq > 1],]


# setwd(wd_thu)
# FBVAR = read.csv(path_thu)

library(geepack)
library(gtsummary)
```

```r
PROC = PROC %>%
  mutate(extent = factor(extent,levels = c("Juxtarenal AAA","Type 1 TAAA","Type 2 TAAA",
                                           "Type 3 TAAA","Type 4 TAAA","Type 5 TAAA"),
                         labels = c('Juxtarenal','No','No','No','Juxtarenal','No')))
#change to bianry variables
PROC = PROC %>% mutate(
TOTAL_LOSM = (ifelse(TOTAL_LOS>7, ">7",
                     ifelse( TOTAL_LOS<=7, "<=7",NA))),
ICUSTAYM = (ifelse(ICUSTAY>4, ">4",
                   ifelse(ICUSTAY<=4,"<=4",NA))))

PROC$TOTAL_LOSMb <- as.numeric(PROC$TOTAL_LOSM != "<=7")
PROC$ICUSTAYMb <- as.numeric(PROC$ICUSTAYM != "<=4")
PROC$POSTOP_INTISCHMb<-as.numeric(PROC$POSTOP_INTISCH != "No")


#check the variables
#PROC%>% select(TOTAL_LOSM,TOTAL_LOS,TOTAL_LOSMb)
#class(PROC$TOTAL_LOSMb)
#PROC%>% select(ICUSTAYM,ICUSTAY,ICUSTAYMb)
#PROC%>% select(POSTOP_INTISCH,POSTOP_INTISCHMb)


#table(PROC$extent)


#remove missing values
PROCNM<-subset(PROC, !is.na(extent))

#PROCNM[is.na(PROCNM) | PROCNM=="Inf"] = NA
# repeated patients, need id, geeglm needs complete data, extent is not complete
#unadjusted


LOS1<-geeglm(TOTAL_LOSMb~ PRESENTATION, data=PROCNM, family=binomial(link="logit"), id = CENTERID, corst

t1<-LOS1 %>%tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner ="**TOTAL_LOS Length of Stay in days**")%>%as_flex_table()


#adjusted
LOS2<-geeglm(TOTAL_LOSMb ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYS
             , data=PROCNM, family=binomial(link="logit"),id = CENTERID, corstr = "independence")
t2<-LOS2 %>%tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2),tab_spanner ="**TOTAL_LOS Length of Stay in days**")%>%as_flex_table()


#the difference in mean number of sessions attended comparing treatment to control
```

```r
#adjust<-c('PRESENTATION','AGECAT', 'GENDER', 'PREOP_SMOKING','PRIOR_AORSURG', 'PRIOR_CHF','PATHOLOGY',
#PROC %>%
#  tbl_uvregression(
#    y = TOTAL_LOS,
#    x = PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+PATHOLOGY+NUM_TREATED_BRANCHES
#    method = geepack::geeglm,
#    method.args = list(id = X+CENTERID, corstr = "independence"),
#    include = all_of(adjust)
#  ) %>%
#  as_kable()


#unadjusted
ICU1<-geeglm(ICUSTAYMb~ PRESENTATION, data=PROCNM, family=binomial(link="logit"), id = CENTERID, corstr

#summary(LOS2)
#summary(ICU1)

#ICU1<-geeglm(ICUSTAY ~ PRESENTATION, data=PROCNM,id = CENTERID, corstr = "independence")
t1<-ICU1 %>%tbl_regression(exponentiate=TRUE, tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner ="**ICU Stay**")%>%as_flex_table()

#adjusted
ICU2<-geeglm(ICUSTAYMb ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+PREOP_DIALYSIS
            , family=binomial(link="logit"), data=PROCNM, id = CENTERID, corstr = "independence")
t2<- ICU2 %>%tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t2),tab_spanner ="**ICU Stay**")%>%as_flex_table()
#unadjusted
POSTOP_PRBC1<-geeglm(POSTOP_PRBC ~ PRESENTATION, data=PROCNM,id = CENTERID, corstr = "independence")
t1<-POSTOP_PRBC1 %>%tbl_regression(tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner ="**Transfusion # Units PRBC**")%>%as_flex_table()


#adjusted
POSTOP_PRBC2<-geeglm(POSTOP_PRBC ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_CHF+PREO
t2<- POSTOP_PRBC2 %>%tbl_regression(tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)
tbl_merge(tbls = list(t2),tab_spanner ="**Transfusion # Units PRBC**")%>%as_flex_table()


#unadjusted
POSTOP_HIGHCREAT1<-geeglm(POSTOP_HIGHCREAT ~ PRESENTATION, data=PROCNM,id = CENTERID, corstr = "independe
t1<-POSTOP_HIGHCREAT1 %>%tbl_regression(tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner ="**Highest Creatinine**")%>%as_flex_table()
```

```r
#adjusted
POSTOP_HIGHCREAT2<-geeglm(POSTOP_HIGHCREAT ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIO
                          , data=PROCNM, id = CENTERID, corstr = "independence")
t2<- POSTOP_HIGHCREAT2 %>%tbl_regression(tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)
tbl_merge(tbls = list(t2),tab_spanner ="**Highest Creatinine**")%>%as_flex_table()




#unadjusted
POSTOP_INTISCH1<-geeglm(POSTOP_INTISCHMb ~ PRESENTATION, family=binomial(link="logit"), data=PROCNM,id =

t1<-POSTOP_INTISCH1 %>%tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)

tbl_merge(tbls = list(t1),tab_spanner ="**Intestinal Ischemia**")%>%as_flex_table()


#adjusted
POSTOP_INTISCH2<-geeglm(POSTOP_INTISCHMb ~ PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_
                        , data=PROCNM,family=binomial(link="logit"), id = CENTERID, corstr = "independen
t2<- POSTOP_INTISCH2 %>%tbl_regression(exponentiate=TRUE,tidy_fun = broom.mixed::tidy)%>%
  bold_p(t = 0.05)
tbl_merge(tbls = list(t2),tab_spanner ="**Intestinal Ischemia**")%>%as_flex_table()



#model<-geeglm(as.numeric(POSTOP_DIALYSIS)~PRESENTATION+AGECAT+GENDER+PREOP_SMOKING+PRIOR_AORSURG+PRIOR_


#model<-geeglm(outcome~predictor+confounder, family=binomial(link = "logit"),
#data=na.omit(data), corstr='ar1', id=id, std.err="san.se")
#TOTAL_LOS

#ICUSTAY
#POSTOP_PRBC
#POSTOP_HIGHCREAT

#POSTOP_INTISCH



library(corrplot)
library(tidyverse)
library(caret)
library(ggcorrplot)

matrix <- PROC %>%
    select_if(is.numeric) %>% subset(., select = -1)%>%
    cor(.,use = "complete")
```

```r
corrplot(matrix, method="number")



#select dataset that column are not numeric
matrix <- PROC %>% select_if(negate(is.numeric))


# find out the variables
lapply(matrix[,], unique)
sapply(lapply(matrix, unique), length)

#select if more than one variable
y<-matrix %>%select_if(function(col) length(unique(col))==2)

# Convert all columns to factor
data3 <- as.data.frame(unclass(y),
                       stringsAsFactors = TRUE)



 model.matrix(~0 +., data=data3) %>%
  cor(use="pairwise.complete.obs") %>%
  ggcorrplot(show.diag = F, type="lower", lab=TRUE, lab_size=2)



str(y)
```