preprocessing

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merge the datasets

data cleaning based on inclusion, exclusion criteria

Exclusion criteria:

- exclude rupture groups.
- exclude pathology groups

population of interest: the asymptomatic and symptomatics groups.

`PRESENTATION`: 0 = Asymptomatic,1 = Symptomatic,2 = Rupture

	Overall
	(N=19564)
PRESENTATION	
Asymptomatic	9272 (47.4%)
Symptomatic	6624 (33.9%)
Rupture	1168 (6.0%)
Missing	2500 (12.8%)

Demographic history

GENDER, BMI(USING HEIGHT AND WEIGHT)?, R_PREOP_AMBUL(Preop ambulatory status), AGE (Patient age at procedure), AGECAT, PATHOLOGY (exclude 4, 8-11)

`AGECAT`: 1 = <40,2 = 40-49,3 = 50-59,4 = 60-69,5 = 70-79,6 = 80-89,7 = >89

`GENDER`: 1 = Male,2 = Female

	Asymptomatic	Symptomatic	Rupture	Overall
	(N=9272)	(N=6624)	(N=1168)	(N=19564)
GENDER				
male	6356 (68.6%)	3988 (60.2%)	736 (63.0%)	12667 (64.7%)
female	2916 (31.4%)	2636 (39.8%)	432 (37.0%)	6897 (35.3%)
AGE				
Mean (SD)	70.3 (11.5)	62.3 (16.1)	64.7 (19.5)	66.8 (14.6)
Median [Min, Max]	72.0 [0, 90.0]	65.0 [0, 90.0]	71.0 [0, 90.0]	70.0 [0, 90.0]
AGECAT				
<40	221 (2.4%)	662 (10.0%)	170 (14.6%)	1198 (6.1%)
40-49	252 (2.7%)	698 (10.5%)	71 (6.1%)	1185 (6.1%)
50-59	809 (8.7%)	1181 (17.8%)	123 (10.5%)	2411 (12.3%)
60-69	2423 (26.1%)	1633 (24.7%)	197 (16.9%)	4826 (24.7%)

	Asymptomatic	Symptomatic	Rupture	Overall
70-79	3795 (40.9%)	1552 (23.4%)	323 (27.7%)	6543 (33.4%)
80-89	1663 (17.9%)	814 (12.3%)	241 (20.6%)	3138 (16.0%)
>89	109 (1.2%)	84 (1.3%)	43 (3.7%)	263 (1.3%)

patient condition variables:

`PATHOLOGY`: 1 = Aneurysm,2 = Dissection,3 = Aneurysm from dissection,4 = Trauma,5 = Penetrating Ulcer (PAU),6 = Intramural Hematoma (IMH),7 = PAU with IMH,8 = Aortic Thrombus,9 = Other (Retired) (retired since 09/30/2014),10 = Aorto-esophageal Fistula (Retired) (retired since 09/30/2014),11 = Aorto-bronchial Fistula (Retired) (retired since 09/30/2014)

Old variable, used to be called Indication, now mapped to Pathology. Mapping detail: 1 = TAA->1 = Aneurysm; 2 = TAAA->1 = Aneurysm; 4 = Dissection->2 = Dissection; 3=Aneurysm from dissection; 3 = Trauma->4=Trauma; 5 = Penetrating Ulcer->5 = Penetrating Ulcer (PAU); 6 = Aortic Intramural Hematoma->6 = Intramural Hematoma (IMH); 7=PAU with IMH; 8=Aortic Thrombus

`PRIOR_CVD`: 0 = None,1 = hx stroke, asymptomatic,2 = hx stroke, minor deficit,3 = hx stroke, major deficit

`PRIOR_CAD`: 0 = None,1 = hx MI but no sx,2 = Stable angina,3 = Unstable angina or MI < 6 mos (retired since 09/12/2012),4 = MI < 6 mos,5 = Unstable angina

`PRIOR_CHF`: 0 = None,1 = Asymp, hx CHF,2 = Mild,3 = Moderate,4 = Severe

`COPD`: 0 = No,1 = Not Treated,2 = On Meds,3 = On Home Oxygen

`DIABETES`: 0 = None,1 = Diet,2 = Non-insulin Meds,3 = Insulin

`HTN`: History of hypertension; 0 = No, 1 = Yes (>=140/90 or history) (retired since 11/15/2016), 2 = Yes, controlled [added on 04/13/2020] , 3 = Yes, uncontrolled [added on 04/13/2020]

`PREOP_SMOKING`: 0 = Never,1 = Prior,2 = Current

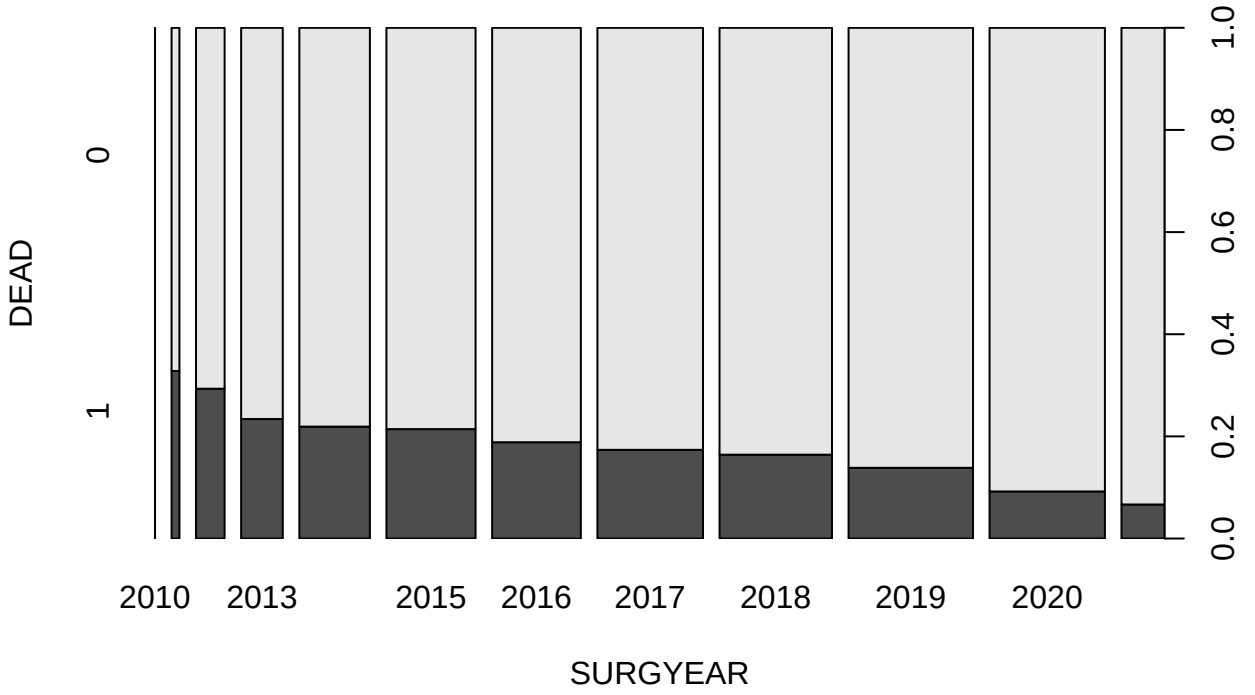
`PRIOR_AORSURG`: Any aortic procedures performed on a separate date prior to the index procedure; 0 = None,1 = Open,2 = Endo,3 = Both,4 = Other (retired since 09/30/2014)

	Asymptomatic	Symptomatic	Rupture	Overall
	(N=9272)	(N=6624)	(N=1168)	(N=19564)
factor(PATHOLOGY)				
1	7011 (75.6%)	1651 (24.9%)	471 (40.3%)	10351 (52.9%)
2	867 (9.4%)	2687 (40.6%)	210 (18.0%)	4194 (21.4%)
3	625 (6.7%)	369 (5.6%)	52 (4.5%)	1048 (5.4%)
4	267 (2.9%)	796 (12.0%)	282 (24.1%)	1528 (7.8%)
5	335 (3.6%)	468 (7.1%)	83 (7.1%)	1051 (5.4%)
6	54 (0.6%)	281 (4.2%)	30 (2.6%)	397 (2.0%)
7	59 (0.6%)	272 (4.1%)	32 (2.7%)	363 (1.9%)
8	44 (0.5%)	86 (1.3%)	2 (0.2%)	133 (0.7%)
9	1 (0.0%)	0 (0%)	1 (0.1%)	375 (1.9%)
10	0 (0%)	0 (0%)	0 (0%)	3 (0.0%)
11	0 (0%)	0 (0%)	0 (0%)	1 (0.0%)
Missing	9 (0.1%)	14 (0.2%)	5 (0.4%)	120 (0.6%)
factor(R_PREOP_AMBUL)				
1	91 (1.0%)	59 (0.9%)	19 (1.6%)	1884 (9.6%)
2	5 (0.1%)	2 (0.0%)	0 (0%)	142 (0.7%)
3	0 (0%)	0 (0%)	0 (0%)	26 (0.1%)
4	0 (0%)	2 (0.0%)	1 (0.1%)	23 (0.1%)
Missing	9176 (99.0%)	6561 (99.0%)	1148 (98.3%)	17489 (89.4%)

	Asymptomatic	Symptomatic	Rupture	Overall
factor(PREOP_SMOKING)				
0	1795 (19.4%)	2266 (34.2%)	458 (39.2%)	5132 (26.2%)
1	4818 (52.0%)	1975 (29.8%)	330 (28.3%)	8148 (41.6%)
2	2653 (28.6%)	2350 (35.5%)	340 (29.1%)	6145 (31.4%)
Missing	6 (0.1%)	33 (0.5%)	40 (3.4%)	139 (0.7%)
factor(PRIOR_CVD)				
0	8196 (88.4%)	5949 (89.8%)	1044 (89.4%)	15348 (78.5%)
1	661 (7.1%)	401 (6.1%)	65 (5.6%)	1135 (5.8%)
2	329 (3.5%)	197 (3.0%)	24 (2.1%)	551 (2.8%)
3	76 (0.8%)	55 (0.8%)	18 (1.5%)	150 (0.8%)
Missing	10 (0.1%)	22 (0.3%)	17 (1.5%)	2380 (12.2%)
factor(PRIOR_CAD)				
0	7072 (76.3%)	5571 (84.1%)	991 (84.8%)	15560 (79.5%)
1	1627 (17.5%)	677 (10.2%)	111 (9.5%)	2777 (14.2%)
2	454 (4.9%)	213 (3.2%)	30 (2.6%)	798 (4.1%)
3	0 (0%)	0 (0%)	0 (0%)	7 (0.0%)
4	66 (0.7%)	68 (1.0%)	14 (1.2%)	168 (0.9%)
5	44 (0.5%)	73 (1.1%)	10 (0.9%)	153 (0.8%)
Missing	9 (0.1%)	22 (0.3%)	12 (1.0%)	101 (0.5%)
factor(PRIOR_CHF)				
0	7982 (86.1%)	5885 (88.8%)	1009 (86.4%)	17044 (87.1%)
1	786 (8.5%)	414 (6.3%)	78 (6.7%)	1432 (7.3%)
2	297 (3.2%)	166 (2.5%)	37 (3.2%)	574 (2.9%)
3	172 (1.9%)	103 (1.6%)	23 (2.0%)	329 (1.7%)
4	30 (0.3%)	36 (0.5%)	6 (0.5%)	90 (0.5%)
Missing	5 (0.1%)	20 (0.3%)	15 (1.3%)	95 (0.5%)
factor(COPD)				
0	6128 (66.1%)	5141 (77.6%)	898 (76.9%)	13976 (71.4%)
1	797 (8.6%)	432 (6.5%)	75 (6.4%)	1487 (7.6%)
2	1867 (20.1%)	837 (12.6%)	143 (12.2%)	3211 (16.4%)
3	474 (5.1%)	195 (2.9%)	41 (3.5%)	801 (4.1%)
Missing	6 (0.1%)	19 (0.3%)	11 (0.9%)	89 (0.5%)
factor(DIABETES)				
0	7698 (83.0%)	5614 (84.8%)	978 (83.7%)	16316 (83.4%)
1	371 (4.0%)	267 (4.0%)	53 (4.5%)	790 (4.0%)
2	921 (9.9%)	491 (7.4%)	75 (6.4%)	1698 (8.7%)
3	277 (3.0%)	233 (3.5%)	49 (4.2%)	671 (3.4%)
Missing	5 (0.1%)	19 (0.3%)	13 (1.1%)	89 (0.5%)
factor(HTN)				
0	1158 (12.5%)	1177 (17.8%)	323 (27.7%)	3040 (15.5%)
1	6319 (68.2%)	4107 (62.0%)	634 (54.3%)	13118 (67.1%)
2	1274 (13.7%)	706 (10.7%)	126 (10.8%)	2114 (10.8%)
3	483 (5.2%)	571 (8.6%)	63 (5.4%)	1117 (5.7%)
Missing	38 (0.4%)	63 (1.0%)	22 (1.9%)	175 (0.9%)
factor(PRIOR_AORSURG)				
0	6753 (72.8%)	5347 (80.7%)	954 (81.7%)	14839 (75.8%)
1	1377 (14.9%)	719 (10.9%)	108 (9.2%)	2549 (13.0%)
2	917 (9.9%)	479 (7.2%)	92 (7.9%)	1654 (8.5%)
3	216 (2.3%)	63 (1.0%)	10 (0.9%)	289 (1.5%)
4	0 (0%)	0 (0%)	1 (0.1%)	131 (0.7%)
Missing	9 (0.1%)	16 (0.2%)	3 (0.3%)	102 (0.5%)

other variables

Surgery year would affect outcome, since surgeons got more familiar with the surgery.



Outcome variables

`PROC_SURVIVALDAYS`: This should be the longest known time of survival data available for the patient. Survival days are calculated as the Last Date of Contact (or Date of Death) for the patient - Procedure date for a procedure. Please refer to included Death and Survival Days Logic.pdf for additional details."

`POSTOP_LOS`: Length of Stay in days calculated by DISCHARGE_DT - SURGERY_DT

	Asymptomatic	Symptomatic	Rupture	Overall
	(N=9272)	(N=6624)	(N=1168)	(N=19564)
factor(DEAD)				
0	8103 (87.4%)	5570 (84.1%)	741 (63.4%)	16254 (83.1%)
1	1168 (12.6%)	1053 (15.9%)	427 (36.6%)	3295 (16.8%)
Missing	1 (0.0%)	1 (0.0%)	0 (0%)	15 (0.1%)
PROC_SURVIVALDAYS				
Mean (SD)	719 (725)	657 (730)	522 (709)	798 (883)
Median [Min, Max]	456 [-355, 3360]	407 [0, 3200]	215 [0, 3410]	454 [-355, 3970]
Missing	1 (0.0%)	0 (0%)	0 (0%)	1 (0.0%)
POSTOP_LOS				
Mean (SD)	6.48 (28.4)	10.0 (20.2)	16.0 (51.1)	8.57 (28.0)
Median [Min, Max]	3.00 [0, 1100]	6.00 [0, 1100]	9.00 [0, 1140]	5.00 [0, 1140]
Missing	1 (0.0%)	1 (0.0%)	0 (0%)	4 (0.0%)

Clustering variables:

19 regions, 189 centers, 1094 physicians.

Most physicians only performed 1 or 2 procedures. Several performed over 100 procedures. Since the more

surgeries a surgeon did, the more familiar he or she is. So we need to cluster on this.

Cluster on centers and physicians

Code Appendix

```
knitr::opts_chunk$set(echo = FALSE,message = FALSE,warning = FALSE)
library(tidyverse)
library(table1)

## ------------- working directories for Lily ----------
wd_lily = '/Users/hanyiwang/Desktop/Comparative-analysis-of-treatments-of-CAA'
path_lily = c(
  "../data/TEVAR_International_20210712/TEVAR_International_LTF_r12_2_14_20210701.csv",
  "../data/TEVAR_International_20210712/TEVAR_International_PROC_r12_2_14_20210701.csv",
  "../data/TEVAR_International_20210901/TEVAR_International_LTF_r12_2_14_20210901.csv",
  "../data/TEVAR_International_20210901/TEVAR_International_PROC_r12_2_14_20210901.csv")


## ------------- read data ----------
setwd(wd_lily)
TEVAR_LTF_07 = read.csv(path_lily[1])
TEVAR_PROC_07 = read.csv(path_lily[2])
#TEVAR_LTF_09 = read.csv(path_lily[3])
#TEVAR_PROC_09 = read.csv(path_lily[4])
## ------------- data cleaning----------
TEVAR_PROC_07 = TEVAR_PROC_07 %>%
  mutate(DEAD=factor(DEAD)) %>%
  mutate(PRESENTATION = factor(PRESENTATION,levels = c(0,1,2),
                               labels = c('Asymptomatic','Symptomatic','Rupture'))) %>%
  mutate(AGECAT = factor(AGECAT,levels = c(1,2,3,4,5,6,7),
                         labels = c('<40','40-49','50-59','60-69','70-79','80-89','>89'))) %>%
  mutate(GENDER=factor(GENDER,levels=c(1,2),
                       labels=c('male','female'))) %>%
  mutate(SURGYEAR=factor(SURGYEAR)) %>%
  mutate(PATHOLOGY=factor(PATHOLOGY))

## ------------- inclusion and exclusion----------

## ------------- population of interest ----------
table1(~  PRESENTATION, data = TEVAR_PROC_07)
## ------------- table1: demographic----------
table1(~ GENDER+AGE+AGECAT
         | PRESENTATION, data = TEVAR_PROC_07)
## ------------- table2: anatomy ----------
table1(~ factor(PATHOLOGY)+
         factor(R_PREOP_AMBUL)+factor(PREOP_SMOKING)+factor(PRIOR_CVD)+
         factor(PRIOR_CAD)+factor(PRIOR_CHF)+factor(COPD)+factor(DIABETES)+factor(HTN)+
         factor(PRIOR_AORSURG)
       | PRESENTATION, data = TEVAR_PROC_07)


plot(DEAD~SURGYEAR,data=TEVAR_PROC_07)
## ------------- table3: outcomes----------
table1(~ factor(DEAD) + PROC_SURVIVALDAYS+POSTOP_LOS | PRESENTATION, data = TEVAR_PROC_07)

## ------------- Survival curves----------
```

```
## ------------- clustering variables----------

#TEVAR_PROC_07 %>% select(REGIONID) %>% table()
#TEVAR_PROC_07 %>% select(CENTERID) %>% table()
#TEVAR_PROC_07 %>% select(PHYSICIANID) %>% table()
```