

Univariate Analysis for the VQI FBVAR Dataset

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p-value

We use Welch's Two Sample t-test for continuous variables and Pearson's Chi-squared Test for categorical variables.

Descriptive statistics tables

population of interest

	Overall
	(N=3295)
PRESENTATION	
Asymptomatic	2907 (88.2%)
Symptomatic	388 (11.8%)

Patient demographic and co-morbidities

Table: A comparison of the baseline demographic and co-morbidities characteristics for symptomatic versus asymptomatic patients who undergo the F-BEVAR procedure

	Asymptomatic	Symptomatic	P-value
	(N=2907)	(N=388)	
AGE			
Mean (SD)	73.4 (7.99)	69.6 (11.1)	<0.001
Median [Min, Max]	74.0 [0, 90.0]	71.0 [33.0, 90.0]	
AGECAT			
<50	21 (0.7%)	20 (5.2%)	<0.001
>79	645 (22.2%)	64 (16.5%)	
50-59	102 (3.5%)	41 (10.6%)	
60-69	733 (25.2%)	107 (27.6%)	
70-79	1406 (48.4%)	156 (40.2%)	
GENDER			
female	675 (23.2%)	158 (40.7%)	<0.001
male	2232 (76.8%)	230 (59.3%)	
ETHNICITY			
Hispanic or Latino	111 (3.8%)	14 (3.6%)	0.947
None Hispanic or Latino	2792 (96.0%)	374 (96.4%)	
Missing	4 (0.1%)	0 (0%)	
RACE			
American Indian or Alaskan Native	6 (0.2%)	1 (0.3%)	<0.001
Asian	58 (2.0%)	7 (1.8%)	
Black or African American	196 (6.7%)	72 (18.6%)	
More than 1 race	3 (0.1%)	1 (0.3%)	

	Asymptomatic	Symptomatic	P-value
Native Hawaiian or other Pacific Islander	1 (0.0%)	1 (0.3%)	
Unknown/Other	192 (6.6%)	31 (8.0%)	
White	2451 (84.3%)	275 (70.9%)	
TRANSFER			
Hospital	36 (1.2%)	171 (44.1%)	<0.001
No	2869 (98.7%)	216 (55.7%)	
Rehab Unit	2 (0.1%)	1 (0.3%)	
PRIMARYINSURER			
Commercial	800 (27.5%)	123 (31.7%)	<0.001
Medicaid	59 (2.0%)	28 (7.2%)	
Medicare	1622 (55.8%)	186 (47.9%)	
Military/VA	92 (3.2%)	11 (2.8%)	
Non US Insurance	198 (6.8%)	10 (2.6%)	
Self Pay	12 (0.4%)	11 (2.8%)	
Missing	124 (4.3%)	19 (4.9%)	
LIVINGSTATUS			
Home	2884 (99.2%)	381 (98.2%)	0.122
Homeless	2 (0.1%)	1 (0.3%)	
Nursing home	21 (0.7%)	6 (1.5%)	
PREOP_FUNCSTATUS			
Assisted care	49 (1.7%)	18 (4.6%)	<0.001
Bed bound	4 (0.1%)	1 (0.3%)	
Full	1947 (67.0%)	226 (58.2%)	
Light work	622 (21.4%)	97 (25.0%)	
Self care	284 (9.8%)	45 (11.6%)	
Missing	1 (0.0%)	1 (0.3%)	
PRIOR_CVD			
No	2615 (90.0%)	339 (87.4%)	0.139
Yes	292 (10.0%)	49 (12.6%)	
PRIOR_CAD			
No	2089 (71.9%)	268 (69.1%)	0.279
Yes	818 (28.1%)	120 (30.9%)	
PRIOR_CHF			
No	2533 (87.1%)	322 (83.0%)	0.03
Yes	374 (12.9%)	66 (17.0%)	
COPD			
No	1802 (62.0%)	224 (57.7%)	0.118
Yes	1105 (38.0%)	164 (42.3%)	
DIABETES			
No	2380 (81.9%)	318 (82.0%)	1
Yes	527 (18.1%)	70 (18.0%)	
PREOP_DIALYSIS			
No	2862 (98.5%)	361 (93.0%)	<0.001
Yes	45 (1.5%)	27 (7.0%)	
HTN			
No	332 (11.4%)	32 (8.2%)	0.077
Yes	2568 (88.3%)	354 (91.2%)	
Missing	7 (0.2%)	2 (0.5%)	
PREOP_SMOKING			
No	347 (11.9%)	66 (17.0%)	0.006
Yes	2560 (88.1%)	322 (83.0%)	
PRIOR_CABG			

	Asymptomatic	Symptomatic	P-value
No	2409 (82.9%)	331 (85.3%)	0.262
Yes	497 (17.1%)	57 (14.7%)	
Missing	1 (0.0%)	0 (0%)	
PRIOR_PCI			
No	2214 (76.2%)	320 (82.5%)	0.007
Yes	691 (23.8%)	68 (17.5%)	
Missing	2 (0.1%)	0 (0%)	
PRIOR_ANEURREP			
No	2281 (78.5%)	268 (69.1%)	<0.001
Yes	626 (21.5%)	120 (30.9%)	
Missing			
STRESS			
No	1430 (49.2%)	296 (76.3%)	<0.001
Yes	1475 (50.7%)	92 (23.7%)	
Missing	2 (0.1%)	0 (0%)	
PREOP_CREAT			
Mean (SD)	1.18 (0.631)	1.19 (0.798)	0.756
Median [Min, Max]	1.08 [0, 14.4]	1.00 [0.400, 7.50]	
Missing	59 (2.0%)	19 (4.9%)	
DC_ASA			
No	410 (14.1%)	58 (14.9%)	0.576
Yes	2431 (83.6%)	312 (80.4%)	
Missing	66 (2.3%)	18 (4.6%)	
DC_P2Y			
No	1259 (43.3%)	205 (52.8%)	<0.001
Yes	1581 (54.4%)	165 (42.5%)	
Missing	67 (2.3%)	18 (4.6%)	
DC_STATIN			
No	505 (17.4%)	74 (19.1%)	0.33
Yes	2336 (80.4%)	296 (76.3%)	
Missing	66 (2.3%)	18 (4.6%)	

Operative Variables

Table: A comparison of the operative characteristics for symptomatic versus asymptomatic patients who undergo the F-BEVAR procedure

	Asymptomatic (N=2907)	Symptomatic (N=388)	P-value
PRIOR_AORSURG			
Both	72 (2.5%)	11 (2.8%)	<0.001
Endo	282 (9.7%)	67 (17.3%)	
None	2292 (78.8%)	267 (68.8%)	
Open	261 (9.0%)	43 (11.1%)	
PATHOLOGY			
Aneurysm	2777 (95.5%)	305 (78.6%)	<0.001
Aneurysm from dissection	83 (2.9%)	28 (7.2%)	
Dissection	28 (1.0%)	41 (10.6%)	
PAU/IMH	19 (0.7%)	14 (3.6%)	
PREOP_MAXAAADIA			
Mean (SD)	61.1 (10.4)	65.2 (17.4)	<0.001
Median [Min, Max]	60.0 [5.00, 130]	62.0 [5.50, 126]	
Missing	12 (0.4%)	5 (1.3%)	

	Asymptomatic	Symptomatic	P-value
URGENCY			
Elective	2875 (98.9%)	210 (54.1%)	<0.001
Emergent	2 (0.1%)	29 (7.5%)	
Urgent	30 (1.0%)	149 (38.4%)	
PATHOLOGY_ANEURYSM_TYPE			
Anastomotic	38 (1.3%)	6 (1.5%)	<0.001
Degenerative, fusiform	2418 (83.2%)	260 (67.0%)	
Degenerative, saccular	258 (8.9%)	31 (8.0%)	
Intercostal or visceral patch	16 (0.6%)	1 (0.3%)	
Prior trauma	0 (0%)	2 (0.5%)	
Missing	177 (6.1%)	88 (22.7%)	
PATHOLOGY_DISSECT_TYPE			
Acute, <= 30 days	7 (0.2%)	31 (8.0%)	<0.001
Chronic, >30 days	104 (3.6%)	38 (9.8%)	
Missing	2796 (96.2%)	319 (82.2%)	
PROXZONE_DISEASE			
Mean (SD)	6.76 (1.65)	5.52 (1.99)	<0.001
Median [Min, Max]	7.00 [2.00, 9.00]	5.00 [2.00, 9.00]	
GENHIST			
Ehlers-Danlos	1 (0.0%)	2 (0.5%)	0.016
Marfans	9 (0.3%)	2 (0.5%)	
Non-specific	80 (2.8%)	7 (1.8%)	
None	2817 (96.9%)	377 (97.2%)	
DISTZONE_DISEASE			
10B	594 (20.4%)	60 (15.5%)	<0.001
10L	128 (4.4%)	21 (5.4%)	
10R	177 (6.1%)	23 (5.9%)	
11B	53 (1.8%)	8 (2.1%)	
11L	30 (1.0%)	3 (0.8%)	
11R	33 (1.1%)	6 (1.5%)	
5	17 (0.6%)	3 (0.8%)	
6	20 (0.7%)	9 (2.3%)	
7	15 (0.5%)	22 (5.7%)	
8	142 (4.9%)	26 (6.7%)	
9	1698 (58.4%)	207 (53.4%)	
extent			
Juxtarenal AAA	1205 (41.5%)	83 (21.4%)	
Type 1 TAAA	6 (0.2%)	2 (0.5%)	
Type 2 TAAA	131 (4.5%)	61 (15.7%)	
Type 3 TAAA	477 (16.4%)	95 (24.5%)	
Type 4 TAAA	871 (30.0%)	104 (26.8%)	
Type 5 TAAA	41 (1.4%)	13 (3.4%)	
Missing	176 (6.1%)	30 (7.7%)	
ANESTHESIA			
General	2872 (98.8%)	378 (97.4%)	0.029
Local	21 (0.7%)	8 (2.1%)	
Regional	14 (0.5%)	2 (0.5%)	
CONTRAST			
Mean (SD)	123 (71.1)	118 (75.7)	0.248
Median [Min, Max]	110 [0, 677]	100 [0, 501]	
Missing	52 (1.8%)	9 (2.3%)	
EBL			

	Asymptomatic	Symptomatic	P-value
Mean (SD)	444 (729)	431 (472)	0.661
Median [Min, Max]	250 [0, 25000]	300 [0, 3000]	
Missing	25 (0.9%)	5 (1.3%)	
FLUOROTIME			
Mean (SD)	73.9 (38.8)	68.1 (44.4)	0.017
Median [Min, Max]	66.0 [1.00, 320]	59.8 [6.80, 285]	
Missing	142 (4.9%)	12 (3.1%)	
INTRAOP_PRBC			
Mean (SD)	0.675 (4.19)	1.12 (1.99)	<0.001
Median [Min, Max]	0 [0, 200]	0 [0, 14.0]	
Missing	2 (0.1%)	2 (0.5%)	
TOTALPROCTIME			
Mean (SD)	256 (113)	269 (139)	0.062
Median [Min, Max]	233 [25.0, 911]	237 [52.0, 852]	
Missing	2 (0.1%)	1 (0.3%)	
IVUSTEE			
Both	19 (0.7%)	4 (1.0%)	<0.001
IVUS	460 (15.8%)	127 (32.7%)	
No	2394 (82.4%)	250 (64.4%)	
TEE	24 (0.8%)	7 (1.8%)	
Missing	10 (0.3%)	0 (0%)	
ACCESS			
Open	1059 (36.4%)	150 (38.7%)	0.147
Percutaneous	1582 (54.4%)	188 (48.5%)	
Missing	266 (9.2%)	50 (12.9%)	
ARMNECK_ACCESS			
No	2144 (73.8%)	234 (60.3%)	<0.001
Yes	763 (26.2%)	154 (39.7%)	
AORDEV_NUM			
Mean (SD)	2.27 (0.914)	2.53 (1.26)	<0.001
Median [Min, Max]	2.00 [1.00, 6.00]	2.00 [1.00, 6.00]	
AORDEV_CMOT			
No	716 (24.6%)	109 (28.1%)	0.157
Yes	2191 (75.4%)	279 (71.9%)	
DEV_GTYPE			
Custom	1565 (53.8%)	89 (22.9%)	<0.001
Physician modified	554 (19.1%)	164 (42.3%)	
Standard	788 (27.1%)	135 (34.8%)	
ILIACDEV_END_R			
Common	1553 (53.4%)	133 (34.3%)	0.086
External, Unintended	18 (0.6%)	3 (0.8%)	
External,Intended	200 (6.9%)	28 (7.2%)	
None	24 (0.8%)	1 (0.3%)	
Missing	1112 (38.3%)	223 (57.5%)	
ILIACDEV_END_L			
Common	1595 (54.9%)	130 (33.5%)	0.231
External, Unintended	9 (0.3%)	2 (0.5%)	
External,Intended	157 (5.4%)	19 (4.9%)	
None	21 (0.7%)	1 (0.3%)	
Missing	1125 (38.7%)	236 (60.8%)	
BRANCH_STAGED			
No	2745 (94.4%)	353 (91.0%)	0.006

	Asymptomatic	Symptomatic	P-value
Yes	157 (5.4%)	35 (9.0%)	
Missing	5 (0.2%)	0 (0%)	
BRANCH_LSUB			
No	2851 (98.1%)	354 (91.2%)	<0.001
Yes	56 (1.9%)	34 (8.8%)	
BRANCH_CELIAC			
No	1318 (45.3%)	71 (18.3%)	<0.001
Yes	1589 (54.7%)	317 (81.7%)	
BRANCH_SMA			
No	403 (13.9%)	28 (7.2%)	<0.001
Yes	2504 (86.1%)	360 (92.8%)	
BRANCH_RRENAL			
No	21 (0.7%)	24 (6.2%)	<0.001
Yes	2886 (99.3%)	364 (93.8%)	
BRANCH_LRENAL			
No	21 (0.7%)	24 (6.2%)	<0.001
Yes	2886 (99.3%)	364 (93.8%)	
ANESTHESIA_GEN_TIMEEXT			
<12 hrs	168 (5.8%)	25 (6.4%)	<0.001
>24 hrs	62 (2.1%)	32 (8.2%)	
12-24 hrs	95 (3.3%)	16 (4.1%)	
In OR	2540 (87.4%)	304 (78.4%)	
Missing	42 (1.4%)	11 (2.8%)	
POSTOP_SPINALDRAIN			
No	2325 (80.0%)	248 (63.9%)	<0.001
Yes	582 (20.0%)	140 (36.1%)	
lrenal			
None	288 (9.9%)	38 (9.8%)	<0.001
Occluded/Covered	76 (2.6%)	25 (6.4%)	
Scallop/Fen/Branch/Chimney	2515 (86.5%)	300 (77.3%)	
Missing	28 (1.0%)	25 (6.4%)	
rrenal			
None	322 (11.1%)	56 (14.4%)	<0.001
Occluded/Covered	72 (2.5%)	22 (5.7%)	
Scallop/Fen/Branch/Chimney	2406 (82.8%)	274 (70.6%)	
Missing	107 (3.7%)	36 (9.3%)	
sma			
None	232 (8.0%)	35 (9.0%)	0.78
Occluded/Covered	3 (0.1%)	0 (0%)	
Scallop/Fen/Branch/Chimney	2261 (77.8%)	325 (83.8%)	
Missing	411 (14.1%)	28 (7.2%)	
celiac			
None	344 (11.8%)	53 (13.7%)	0.002
Occluded/Covered	68 (2.3%)	27 (7.0%)	
Scallop/Fen/Branch/Chimney	1172 (40.3%)	237 (61.1%)	
Missing	1323 (45.5%)	71 (18.3%)	
lsb			
None	15 (0.5%)	10 (2.6%)	0.009
Occluded/Covered	3 (0.1%)	10 (2.6%)	
Scallop/Fen/Branch/Chimney	12 (0.4%)	3 (0.8%)	
Missing	2877 (99.0%)	365 (94.1%)	
factor(NUM_TREATED_BRANCHES)			

	Asymptomatic	Symptomatic	P-value
1	337 (11.6%)	65 (16.8%)	<0.001
2	671 (23.1%)	74 (19.1%)	
3	921 (31.7%)	73 (18.8%)	
4	978 (33.6%)	176 (45.4%)	
factor(NUM_TREATED_RENALS)			
0	392 (13.5%)	88 (22.7%)	<0.001
1	109 (3.7%)	26 (6.7%)	
2	2406 (82.8%)	274 (70.6%)	
OCCLUDED_RENAL			
Yes	76 (2.6%)	25 (6.4%)	<0.001
No	2831 (97.4%)	363 (93.6%)	
OCCLUDED_SMA			
Yes	3 (0.1%)	0 (0%)	1
No	2904 (99.9%)	388 (100%)	
OCCLUDED_CELIAC			
Yes	68 (2.3%)	27 (7.0%)	<0.001
No	2839 (97.7%)	361 (93.0%)	

Outcomes

Table 3: A comparison of the long term follow-up outcomes for symptomatic versus asymptomatic patients who undergo the F-BEVAR procedure

	Asymptomatic (N=2907)	Symptomatic (N=388)	P-value
DEAD			
Yes	361 (12.4%)	80 (20.6%)	<0.001
No	2546 (87.6%)	308 (79.4%)	
PROC_SURVIVALDAYS			
Mean (SD)	791 (774)	690 (790)	0.018
Median [Min, Max]	485 [0, 3390]	376 [0, 3290]	
LTF_NUM_REINT			
Mean (SD)	1.10 (0.303)	1.16 (0.374)	0.464
Median [Min, Max]	1.00 [1.00, 2.00]	1.00 [1.00, 2.00]	
Missing	2740 (94.3%)	363 (93.6%)	

Table 3: A comparison of the procedure outcomes for symptomatic versus asymptomatic patients who undergo the F-BEVAR procedure

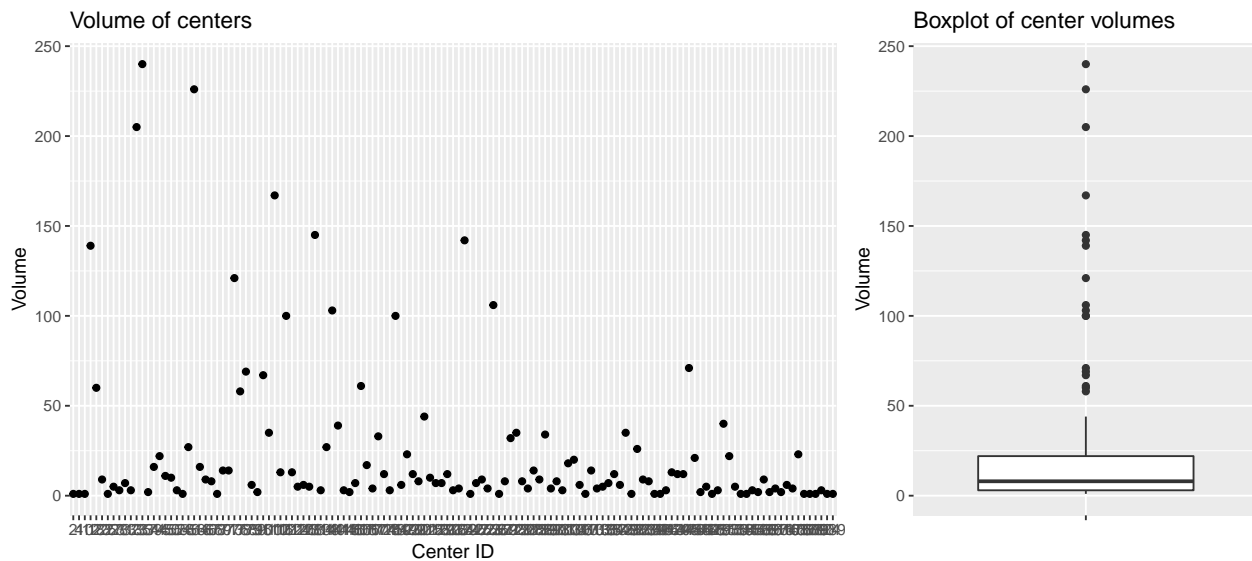
	Asymptomatic (N=2907)	Symptomatic (N=388)	P-value
TOTAL_LOS			
Mean (SD)	6.41 (21.6)	12.3 (27.8)	<0.001
Median [Min, Max]	3.00 [0, 372]	7.00 [1.00, 376]	
POSTOP_LOS			
<= 7	2499 (86.0%)	259 (66.8%)	<0.001
> 7	408 (14.0%)	129 (33.2%)	
AORDEV_TECHSUCC			
No	77 (2.6%)	16 (4.1%)	0.088
Yes	2554 (87.9%)	315 (81.2%)	

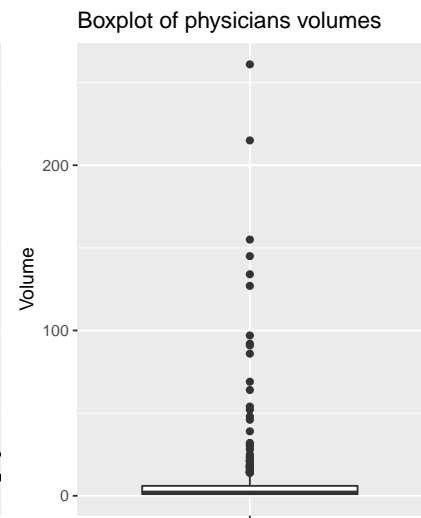
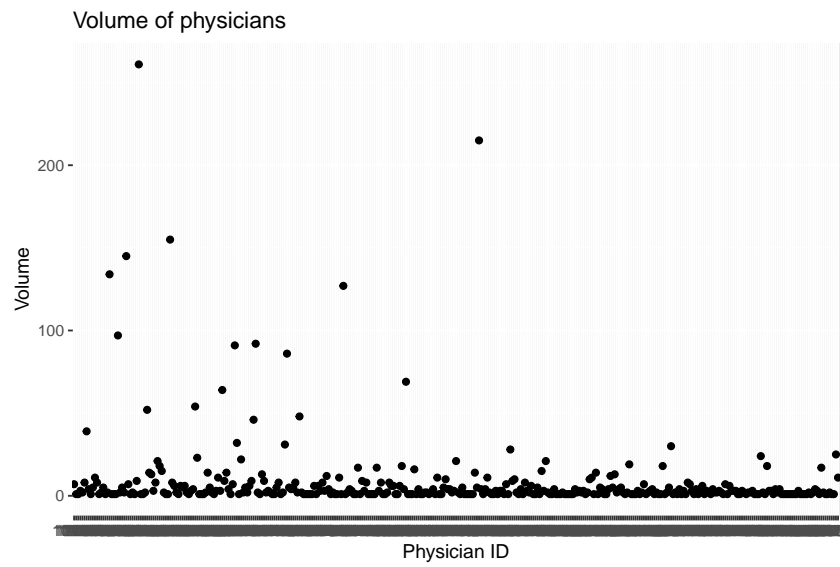
	Asymptomatic	Symptomatic	P-value
Missing	276 (9.5%)	57 (14.7%)	
CONVTOOPEN			
No	2897 (99.7%)	387 (99.7%)	1
Yes	10 (0.3%)	1 (0.3%)	
LEAKATCOMP_NONE			
No	975 (33.5%)	103 (26.5%)	0.256
Yes	1825 (62.8%)	224 (57.7%)	
Missing	107 (3.7%)	61 (15.7%)	
ICUSTAY			
Mean (SD)	2.09 (4.37)	4.61 (6.65)	<0.001
Median [Min, Max]	1.00 [0, 85.0]	3.00 [0, 49.0]	
Missing	3 (0.1%)	1 (0.3%)	
POSTOP_PRBC			
Mean (SD)	1.22 (4.12)	2.09 (4.18)	<0.001
Median [Min, Max]	0 [0, 77.0]	0 [0, 38.0]	
Missing	2 (0.1%)	0 (0%)	
POSTOP_VASO			
No	2399 (82.5%)	263 (67.8%)	<0.001
Yes	506 (17.4%)	125 (32.2%)	
Missing	2 (0.1%)	0 (0%)	
POSTOP_HIGHCREAT			
Mean (SD)	1.46 (1.10)	1.92 (1.96)	<0.001
Median [Min, Max]	1.19 [0.0100, 15.4]	1.20 [0.450, 11.8]	
Missing	16 (0.6%)	4 (1.0%)	
POSTOP_COMPLICATIONS			
No	2322 (79.9%)	273 (70.4%)	<0.001
Yes	584 (20.1%)	115 (29.6%)	
Missing	1 (0.0%)	0 (0%)	
ACCESS_COMPLICATION			
No	448 (15.4%)	62 (16.0%)	0.311
Yes	29 (1.0%)	7 (1.8%)	
Missing	2430 (83.6%)	319 (82.2%)	
POSTOP_AH			
No	2618 (90.1%)	346 (89.2%)	0.65
Yes	289 (9.9%)	42 (10.8%)	
POSTOP_CEREBROX			
No	2868 (98.7%)	378 (97.4%)	0.083
Yes	38 (1.3%)	10 (2.6%)	
Missing	1 (0.0%)	0 (0%)	
POSTOP_RESPIRATORY			
No	2784 (95.8%)	352 (90.7%)	<0.001
Yes	123 (4.2%)	36 (9.3%)	
POSTOP_DIALYSIS			
No	2820 (97.0%)	352 (90.7%)	<0.001
Yes	49 (1.7%)	18 (4.6%)	
Missing	38 (1.3%)	18 (4.6%)	
POSTOP_ARMEMBO			
No	2894 (99.6%)	386 (99.5%)	1
Yes	13 (0.4%)	2 (0.5%)	
POSTOP_LEGEMBO			
No	2846 (97.9%)	368 (94.8%)	<0.001
Yes	61 (2.1%)	20 (5.2%)	

	Asymptomatic	Symptomatic	P-value
POSTOP_LEGCOMPART			
No	2880 (99.1%)	384 (99.0%)	1
Yes	27 (0.9%)	4 (1.0%)	
POSTOP_INTISCH			
Mean (SD)	0.0372 (0.334)	0.0593 (0.442)	0.342
Median [Min, Max]	0 [0, 4.00]	0 [0, 4.00]	
POSTOP_RENALISCH			
No	2821 (97.0%)	375 (96.6%)	0.79
Yes	86 (3.0%)	13 (3.4%)	
POSTOP_SPINAL_ISCHEMIA			
No	2823 (97.1%)	363 (93.6%)	<0.001
Yes	84 (2.9%)	25 (6.4%)	
RETX_R_RTOR			
No	2733 (94.0%)	351 (90.5%)	0.009
Yes	173 (6.0%)	37 (9.5%)	
Missing	1 (0.0%)	0 (0%)	
DC_STATUS			
Dead	65 (2.2%)	17 (4.4%)	<0.001
Home	2465 (84.8%)	274 (70.6%)	
Homeless	1 (0.0%)	1 (0.3%)	
Nursing Home	104 (3.6%)	32 (8.2%)	
Other Hospital	23 (0.8%)	16 (4.1%)	
Rehab Unit	249 (8.6%)	48 (12.4%)	
BRANCH_POST			
No	2498 (85.9%)	278 (71.6%)	<0.001
Yes	406 (14.0%)	109 (28.1%)	
Missing	3 (0.1%)	1 (0.3%)	

Volume Variables

Volume Variables: REGIONID, CENTERID, PHYSICIANID





19 regions, 133 centers, 367 physicians.

Quantiles of centers' volume: 1, 3, 8, 22, 240

Quantiles of physicians' volume: 1, 1, 2, 6, 261

Code Appendix

```
knitr::opts_chunk$set(echo = FALSE,message = FALSE,warning = FALSE,fig.width = 10)
library(tidyverse)
library(table1)
library(survival)
library(Hmisc)
library(ggplot2)
library(ggpubr)

## ----- 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/jennifer-ci/Desktop/Comparative-analysis-of-treatments-of-CAA'
#path_jenn = c(
#  "/Users/jennifer-ci/Desktop/Comparative-analysis-of-treatments-of-CAA/TEVAR_International_20210712/TE
#  "/Users/jennifer-ci/Desktop/Comparative-analysis-of-treatments-of-CAA/TEVAR_International_20210712/TE
#  "/Users/jennifer-ci/Desktop/Comparative-analysis-of-treatments-of-CAA/TEVAR_International_20210901/TE
#  "/Users/jennifer-ci/Desktop/Comparative-analysis-of-treatments-of-CAA/TEVAR_International_20210901/TE

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

#setwd(wd_jenn)
#TEVAR_LTF_07 = read.csv(path_jenn[1])
#TEVAR_PROC_07 = read.csv(path_jenn[2])
#TEVAR_LTF_09 = read.csv(path_jenn[3])
#TEVAR_PROC_09 = read.csv(path_jenn[4])
pvalue <- function(x, ...) {
  y <- unlist(x)
  g <- factor(rep(1:length(x), times=apply(x, length)))
  if (is.numeric(y)) {
    # For numeric variables, Welch's Two Sample t-test
    p <- t.test(y ~ g)$p.value
  } else {
    # For categorical variables, Pearson's Chi-squared Test
    p <- chisq.test(table(y, g))$p.value
  }
  c("", sub("<", "&lt;", format.pval(p, digits=3, eps=0.001)))
}

## ----- population of interest -----
table1_POI = table1(~ PRESENTATION, data = FBVAR)
knitr::kable(table1_POI)
## ----- table: Patient demographic and co-morbidities-----

table1_CMB = table1(~ AGE+AGECAT+GENDER+ETHNICITY+ RACE+ TRANSFER+ PRIMARYINSURER+ LIVINGSTATUS+ PREO
  | PRESENTATION, data = FBVAR,overall=F, extra.col=list(`P-value`=pvalue))
knitr::kable(table1_CMB)
```

```

## ----- table: Operative Variables-----
table1_OPR = table1(~ PRIOR_AORSURG+ PATHOLOGY+ PREOP_MAXAAADIA+ URGENCY+ PATHOLOGY_ANEURYSM_TYPE+ PATHO
  | PRESENTATION, data = FBVAR,overall=F, extra.col=list(`P-value`=pvalue))

knitr::kable(table1_OPR)

## ----- table: primary outcomes-----
table1_POC = table1(~ DEAD+PROC_SURVIVALDAYS+LTF_NUM_REINT | PRESENTATION, data = FBVAR,overall=F, extra.col=list(`P-value`=pvalue))

knitr::kable(table1_POC)

## ----- table: secondary outcomes-----
table1_SOC = table1(~ TOTAL_LOS+ POSTOP_LOS+ AORDEV_TECHSUCC+ CONVTOOPEN+ LEAKATCOMP_NONE+ ICUSTAY+ POS
  | PRESENTATION, data = FBVAR,overall=F, extra.col=list(`P-value`=pvalue))

knitr::kable(table1_SOC)

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

#FBVAR %>% select(REGIONID) %>% table()
#FBVAR %>% select(CENTERID) %>% table()
#FBVAR %>% select(PHYSICIANID) %>% table()

## ----- plots of volume-----
center_vol = as.data.frame(FBVAR %>% select(CENTERID) %>% table())
phys_vol = as.data.frame(FBVAR %>% select(PHYSICIANID) %>% table())

p1 = ggplot(data = center_vol, aes(x=CENTERID, y=Freq)) +
  geom_point() +
  labs(title = 'Volume of centers',x='Center ID',y='Volume')

p2 = ggplot(data = center_vol, aes(x='', y=Freq)) +
  geom_boxplot() +
  labs(title = 'Boxplot of center volumes',x='',y='Volume')

print(ggarrange(p1, p2, widths = c(20,10),ncol = 2, nrow = 1, align = "h"))

p3 = ggplot(data = phys_vol, aes(x=PHYSICIANID, y=Freq)) +
  geom_point() +
  labs(title = 'Volume of physicians',x='Physician ID',y='Volume')

p4 = ggplot(data = phys_vol, aes(x='', y=Freq)) +
  geom_boxplot() +
  labs(title = 'Boxplot of physicians volumes',x='',y='Volume')

print(ggarrange(p3, p4, widths = c(20,10),ncol = 2, nrow = 1, align = "h"))

```