

IBD_Analysis

David Hu

2022-11-24

IBD Analysis

```
#Load in data  
data = read.csv("~/Documents/nsqip_ibd_ic/data/comb5_data.csv", header = TRUE)  
data <- replace(data, data == "", NA)  
#data$ileostomy.formation <- ifelse(test = data$ileostomy.formation  
=="Ileostomy", yes = 1, no = 0)
```

Replaced all missing values with "NA" for imputing values later.

```
#convert all character variables to factor variables  
data[sapply(data, is.character)] <-  
lapply(data[sapply(data, is.character)], as.factor)  
#various methods to check for possible columns to drop  
#sapply(lapply(data, unique), length) #display number of levels  
#sapply(data[, sapply(data, class) == 'factor'], levels) #levels of each  
variables  
#mapply(table, data) #display levels and count for each level
```

Convert the character variables to factor variables to represent categorical data.

```
#colSums(data[, sapply(data, class) == 'factor'] == "")/nrow(data) old method  
#sapply(data[, sapply(data, class) == 'factor'], levels)  
#colSums(is.na(data))/nrow(data)
```

The "sapply(data[, sapply(data, class) == 'factor'], levels)" line is used to display the amount of levels for a categorical variable. We can find which what variables have one level so we can drop them because they will not be useful when building our model.

The "colSums(is.na(data))/nrow(data)" displays the proportion of missing values for each dataset. If a categorical variable has 25% or more of its values missing, then we drop the variable.

```
#drop variables that have >=25% missing values and those with only one levels  
data = subset(data, select = -  
c(malnourishment, colectomy.malignancy..pathologic.m.stage, colectomy.malignanc  
y..pathologic.n.stage, colectomy.malignancy..pathologic.t.stage,  
first.unplanned.return.cpt, postoperative.death...30.days.of.procedure,  
surgical.wound.s..closure,  
preop.transfusions..rbc.w.in.72.hrs.prior.to.surgery.start.time.,  
congestive.heart.failure.w.in.30.days.prior.to.surgery, ascites.w.in.30.days.p  
rior.to.surgery,
```

```

colectomy.primary.indication.for.surgery,
colectomy.non.emergent.indication.icd10.code,
postop.death.w.in.30.days.of.procedure,
currently.requiring.or.on.dialysis,
acute.renal.failure,
case.number
))

```

We've identified the following variables to drop based on whether $\leq 25\%$ of its values were missing and/or had only one level. While case.number didn't fit the criteria, it was dropped because it doesn't provide relevant information since it is the surgery case number.

```

#imputing the missing values
#install.packages("missForest")
library(missForest)
data.imp <- missForest(data)$ximp

```

Impute missing values using random forest nonparametric modeling.

```

#stepwise logistic regression
library(MASS)
model <- glm(ileostomy.formation~., data=data.imp, family="binomial")
step.model <- stepAIC(model, trace = FALSE, direction = "backward")

```

Use step wise AIC logistic regression with backward selection to select the variables that are the most useful to help the explain the probability of an illeostomy after logistic regression (will be referred to as original logistic model) on all the variables throws a warning.

```

library(car)

## Loading required package: carData

#vif(model)

```

Unable to check multicollinearity using vif (Variance Inflation Factor) on the original logistic model. Throws warning "Error in vif.default(model) : there are aliased coefficients in the model".

```

probabilities <- predict(model, data.imp, type = "response")

## Warning in predict.lm(object, newdata, se.fit, scale = 1, type = if (type
== :
## prediction from a rank-deficient fit may be misleading

predicted.classes <- ifelse(probabilities > 0.50, "None", "Ileostomy")
# Prediction accuracy
observed.classes <- data.imp$ileostomy.formation
mean(predicted.classes == observed.classes)

## [1] 0.881258

```

Although original logistic model throws a warning, the model does predict the correct outcome for 88% of the observations.

```
summary(step.model)

##
## Call:
## glm(formula = ileostomy.formation ~ age.at.time.of.surgery +
##      race + elective.surgery + height + weight + bmi +
functional.heath.status +
##      steroid.immunosuppressant.use.for.chronic.condition + wbc +
##      platelet.count + emergency.case + wound.classification +
##      asa.classification + X..of.other.procedures +
X..of.concurrent.procedures +
##      duration.of.surgical.procedure..in.minutes. +
X..of.postop.wound.disruption +
##      X..of.postop.pulmonary.embolism +
X..of.postop.on.ventilator...48.hours +
##      X..of.postop.progressive.renal.insufficiency +
X..of.postop.acute.renal.failure +
##      X..of.postop.vein.thrombosis.requiring.therapy + X..of.postop.sepsis +
##      X..of.postop.septic.shock + hospital.length.of.stay +
X..of.readmissions.w.in.30.days +
##      X..of.unplanned.readmissions + first.unplanned.return.to.or +
##      colectomy.mechanical.bowel.prep + colectomy.operative.approach +
##      colectomy.postop.anastomotic.leak +
colectomy.prolonged.postoperative.npo.or.ngt.use,
##      family = "binomial", data = data.imp)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q        Max
## -2.8523   0.1589   0.2982   0.4980   3.6490
##
## Coefficients:
##
Estimate
## (Intercept)
2.867e+01
## age.at.time.of.surgery
2.817e-02
## raceBlack or African American
-1.554e+01
## raceNative Hawaiian or Other Pacific Islander
8.734e-01
## raceSome Other Race
-1.871e+01
## raceUnknown/Not Reported
-1.503e+01
## raceWhite
-1.621e+01
```

```
## elective.surgeryYes
-8.835e-01
## height
2.626e-02
## weight
-1.176e-02
## bmi
6.528e-02
## functional.heath.statusPartially Dependent
-2.199e+00
## functional.heath.statusTotally Dependent
-1.971e+01
## steroid.immunosuppressant.use.for.chronic.conditionYes
-3.549e-01
## wbc
-4.625e-02
## platelet.count
-2.046e-03
## emergency.caseYes
-1.329e+00
## wound.classificationClean/Contaminated
2.221e+00
## wound.classificationContaminated
1.390e+00
## wound.classificationDirty/Infected
1.999e+00
## asa.classificationASA 2 - Mild Disturb
6.915e-01
## asa.classificationASA 3 - Severe Disturb
1.771e-01
## asa.classificationASA 4 - Life Threat
-4.064e-01
## X..of.other.procedures
-5.212e-01
## X..of.concurrent.procedures
2.834e-01
## duration.of.surgical.procedure..in.minutes.
-3.397e-03
## X..of.postop.wound.disruption
-2.904e+00
## X..of.postop.pulmonary.embolism
-1.995e+00
## X..of.postop.on.ventilator...48.hours
3.798e+00
## X..of.postop.progressive.renal.insufficiency
-7.821e+00
## X..of.postop.acute.renal.failure
-2.736e+00
## X..of.postop.vein.thrombosis.requiring.therapy
2.073e+01
```

```
## X..of.postop.sepsis
9.850e-01
## X..of.postop.septic.shock
4.139e+00
## hospital.length.of.stay
-1.151e-01
## X..of.readmissions.w.in.30.days
2.067e+00
## X..of.unplanned.readmissions
-2.365e+00
## first.unplanned.return.to.orYes
1.486e+00
## colectomy.mechanical.bowel.prepYes
8.820e-01
## colectomy.operative.approachMIS, unplanned conversion to open
9.109e-03
## colectomy.operative.approachOpen
-5.460e-01
## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
2.938e+00
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means -1.519e+01
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
-1.416e+01
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess -1.579e+01
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
4.348e-01
##
Std. Error
## (Intercept)
4.058e+03
## age.at.time.of.surgery
6.642e-03
## raceBlack or African American
9.031e+02
## raceNative Hawaiian or Other Pacific Islander
4.058e+03
## raceSome Other Race
9.031e+02
## raceUnknown/Not Reported
9.031e+02
## raceWhite
9.031e+02
## elective.surgeryYes
2.568e-01
## height
9.153e-03
## weight
2.133e-03
```

```
## bmi
1.914e-02
## functional.heath.statusPartially Dependent
1.221e+00
## functional.heath.statusTotally Dependent
3.956e+03
## steroid.immunosuppressant.use.for.chronic.conditionYes
2.106e-01
## wbc
2.734e-02
## platelet.count
8.547e-04
## emergency.caseYes
4.901e-01
## wound.classificationClean/Contaminated
1.454e+00
## wound.classificationContaminated
1.456e+00
## wound.classificationDirty/Infected
1.460e+00
## asa.classificationASA 2 - Mild Disturb
8.582e-01
## asa.classificationASA 3 - Severe Disturb
8.616e-01
## asa.classificationASA 4 - Life Threat
1.085e+00
## X..of.other.procedures
7.489e-02
## X..of.concurrent.procedures
1.216e-01
## duration.of.surgical.procedure..in.minutes.
1.819e-03
## X..of.postop.wound.disruption
1.268e+00
## X..of.postop.pulmonary.embolism
1.145e+00
## X..of.postop.on.ventilator...48.hours
1.858e+00
## X..of.postop.progressive.renal.insufficiency
2.212e+00
## X..of.postop.acute.renal.failure
1.585e+00
## X..of.postop.vein.thrombosis.requiring.therapy
1.028e+01
## X..of.postop.sepsis
6.533e-01
## X..of.postop.septic.shock
2.088e+00
## hospital.length.of.stay
2.144e-02
```

```
## X..of.readmissions.w.in.30.days
9.548e-01
## X..of.unplanned.readmissions
7.690e-01
## first.unplanned.return.to.orYes
7.596e-01
## colectomy.mechanical.bowel.prepYes
1.897e-01
## colectomy.operative.approachMIS, unplanned conversion to open
3.142e-01
## colectomy.operative.approachOpen
2.098e-01
## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
4.024e+03
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means 3.956e+03
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
3.956e+03
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess 3.956e+03
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
2.786e-01
##
z value
## (Intercept)
0.007
## age.at.time.of.surgery
4.241
## raceBlack or African American
-0.017
## raceNative Hawaiian or Other Pacific Islander
0.000
## raceSome Other Race
-0.021
## raceUnknown/Not Reported
-0.017
## raceWhite
-0.018
## elective.surgeryYes
-3.441
## height
2.869
## weight
-5.513
## bmi
3.410
## functional.heath.statusPartially Dependent
-1.800
## functional.heath.statusTotally Dependent
-0.005
```

```
## steroid.immunosuppressant.use.for.chronic.conditionYes
-1.685
## wbc
-1.692
## platelet.count
-2.393
## emergency.caseYes
-2.712
## wound.classificationClean/Contaminated
1.527
## wound.classificationContaminated
0.955
## wound.classificationDirty/Infected
1.370
## asa.classificationASA 2 - Mild Disturb
0.806
## asa.classificationASA 3 - Severe Disturb
0.206
## asa.classificationASA 4 - Life Threat
-0.374
## X..of.other.procedures
-6.960
## X..of.concurrent.procedures
2.331
## duration.of.surgical.procedure..in.minutes.
-1.868
## X..of.postop.wound.disruption
-2.291
## X..of.postop.pulmonary.embolism
-1.743
## X..of.postop.on.ventilator...48.hours
2.044
## X..of.postop.progressive.renal.insufficiency
-3.536
## X..of.postop.acute.renal.failure
-1.726
## X..of.postop.vein.thrombosis.requiring.therapy
2.017
## X..of.postop.sepsis
1.508
## X..of.postop.septic.shock
1.982
## hospital.length.of.stay
-5.368
## X..of.readmissions.w.in.30.days
2.165
## X..of.unplanned.readmissions
-3.075
## first.unplanned.return.to.orYes
1.957
```



```
## colectomy.mechanical.bowel.prepYes
4.649
## colectomy.operative.approachMIS, unplanned conversion to open
0.029
## colectomy.operative.approachOpen
-2.603
## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
0.001
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means -0.004
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
-0.004
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess -0.004
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
1.561
##
Pr(>|z|)
## (Intercept)
0.994362
## age.at.time.of.surgery
2.22e-05
## raceBlack or African American
0.986271
## raceNative Hawaiian or Other Pacific Islander
0.999828
## raceSome Other Race
0.983473
## raceUnknown/Not Reported
0.986723
## raceWhite
0.985678
## elective.surgeryYes
0.000580
## height
0.004124
## weight
3.54e-08
## bmi
0.000649
## functional.heath.statusPartially Dependent
0.071825
## functional.heath.statusTotally Dependent
0.996026
## steroid.immunosuppressant.use.for.chronic.conditionYes
0.091995
## wbc
0.090656
## platelet.count
0.016700
```

```
## emergency.caseYes
0.006692
## wound.classificationClean/Contaminated
0.126803
## wound.classificationContaminated
0.339646
## wound.classificationDirty/Infected
0.170816
## asa.classificationASA 2 - Mild Disturb
0.420401
## asa.classificationASA 3 - Severe Disturb
0.837142
## asa.classificationASA 4 - Life Threat
0.708118
## X..of.other.procedures
3.41e-12
## X..of.concurrent.procedures
0.019749
## duration.of.surgical.procedure..in.minutes.
0.061823
## X..of.postop.wound.disruption
0.021961
## X..of.postop.pulmonary.embolism
0.081342
## X..of.postop.on.ventilator...48.hours
0.040968
## X..of.postop.progressive.renal.insufficiency
0.000406
## X..of.postop.acute.renal.failure
0.084344
## X..of.postop.vein.thrombosis.requiring.therapy
0.043712
## X..of.postop.sepsis
0.131653
## X..of.postop.septic.shock
0.047437
## hospital.length.of.stay
7.98e-08
## X..of.readmissions.w.in.30.days
0.030403
## X..of.unplanned.readmissions
0.002107
## first.unplanned.return.to.orYes
0.050405
## colectomy.mechanical.bowel.prepYes
3.34e-06
## colectomy.operative.approachMIS, unplanned conversion to open
0.976871
## colectomy.operative.approachOpen
0.009250
```

```

## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
0.999418
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means 0.996936
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
0.997144
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess 0.996816
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
0.118568
##
## (Intercept)
## age.at.time.of.surgery
***
## raceBlack or African American
## raceNative Hawaiian or Other Pacific Islander
## raceSome Other Race
## raceUnknown/Not Reported
## raceWhite
## elective.surgeryYes
***
## height
**
## weight
***
## bmi
***
## functional.heath.statusPartially Dependent
.
## functional.heath.statusTotally Dependent
## steroid.immunosuppressant.use.for.chronic.conditionYes
.
## wbc
.
## platelet.count
*
## emergency.caseYes
**
## wound.classificationClean/Contaminated
## wound.classificationContaminated
## wound.classificationDirty/Infected
## asa.classificationASA 2 - Mild Disturb
## asa.classificationASA 3 - Severe Disturb
## asa.classificationASA 4 - Life Threat
## X..of.other.procedures
***
## X..of.concurrent.procedures
*
## duration.of.surgical.procedure..in.minutes.
.

```

```

## X..of.postop.wound.disruption
*
## X..of.postop.pulmonary.embolism
.
## X..of.postop.on.ventilator...48.hours
*
## X..of.postop.progressive.renal.insufficiency
***
## X..of.postop.acute.renal.failure
.
## X..of.postop.vein.thrombosis.requiring.therapy
*
## X..of.postop.sepsis
## X..of.postop.septic.shock
*
## hospital.length.of.stay
***
## X..of.readmissions.w.in.30.days
*
## X..of.unplanned.readmissions
**
## first.unplanned.return.to.orYes
.
## colectomy.mechanical.bowel.prepYes
***
## colectomy.operative.approachMIS, unplanned conversion to open
## colectomy.operative.approachOpen
**
## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 1385.6  on 1557  degrees of freedom
## Residual deviance:  960.7  on 1512  degrees of freedom
## AIC: 1052.7
##
## Number of Fisher Scoring iterations: 16

```

Coefficients for the stepwise AIC logistic model.

```
vif(step.model)
```

##	GVIF	Df
## age.at.time.of.surgery	1.473366	1
## race	1.438361	5
## elective.surgery	2.072016	1
## height	1.244965	1
## weight	2.189579	1
## bmi	1.906571	1
## functional.heath.status	1.058003	2
## steroid.immunosuppressant.use.for.chronic.condition	1.121287	1
## wbc	1.300009	1
## platelet.count	1.332873	1
## emergency.case	1.260757	1
## wound.classification	1.728271	3
## asa.classification	1.426994	3
## X..of.other.procedures	1.663362	1
## X..of.concurrent.procedures	1.245890	1
## duration.of.surgical.procedure..in.minutes.	1.610152	1
## X..of.postop.wound.disruption	1.444443	1
## X..of.postop.pulmonary.embolism	1.079391	1
## X..of.postop.on.ventilator...48.hours	1.928757	1
## X..of.postop.progressive.renal.insufficiency	2.245315	1
## X..of.postop.acute.renal.failure	1.822349	1
## X..of.postop.vein.thrombosis.requiring.therapy	1.760363	1
## X..of.postop.sepsis	1.290895	1
## X..of.postop.septic.shock	2.622825	1
## hospital.length.of.stay	1.979738	1
## X..of.readmissions.w.in.30.days	11.078604	1
## X..of.unplanned.readmissions	10.968128	1
## first.unplanned.return.to.or	1.508127	1
## colectomy.mechanical.bowel.prep	1.225050	1
## colectomy.operative.approach	1.517751	2
## colectomy.postop.anastomotic.leak	1.604497	4
## colectomy.prolonged.postoperative.npo.or.ngt.use	1.330859	1
##	GVIF^(1/(2*Df))	
## age.at.time.of.surgery	1.213823	
## race	1.037019	
## elective.surgery	1.439450	
## height	1.115780	
## weight	1.479723	
## bmi	1.380786	
## functional.heath.status	1.014196	
## steroid.immunosuppressant.use.for.chronic.condition	1.058908	
## wbc	1.140180	
## platelet.count	1.154501	
## emergency.case	1.122834	
## wound.classification	1.095474	
## asa.classification	1.061053	
## X..of.other.procedures	1.289714	
## X..of.concurrent.procedures	1.116194	
## duration.of.surgical.procedure..in.minutes.	1.268918	

## X..of.postop.wound.disruption	1.201850
## X..of.postop.pulmonary.embolism	1.038938
## X..of.postop.on.ventilator...48.hours	1.388797
## X..of.postop.progressive.renal.insufficiency	1.498438
## X..of.postop.acute.renal.failure	1.349944
## X..of.postop.vein.thrombosis.requiring.therapy	1.326787
## X..of.postop.sepsis	1.136176
## X..of.postop.septic.shock	1.619514
## hospital.length.of.stay	1.407032
## X..of.readmissions.w.in.30.days	3.328454
## X..of.unplanned.readmissions	3.311816
## first.unplanned.return.to.or	1.228058
## colectomy.mechanical.bowel.prep	1.106820
## colectomy.operative.approach	1.109942
## colectomy.postop.anastomotic.leak	1.060883
## colectomy.prolonged.postoperative.npo.or.ngt.use	1.153628

"X..of.readmissions.w.in.30.days" & "X..of.unplanned.readmissions" has $VIF \geq 10$, which suggest multicollinearity and one will be removed from the model. I removed "X..of.unplanned.readmissions".

```
step.model2 <- glm(formula = ileostomy.formation ~ age.at.time.of.surgery +
  race + elective.surgery + height + weight + bmi + wbc + platelet.count +
  emergency.case + wound.classification + asa.classification +
  X..of.other.procedures + X..of.concurrent.procedures +
  duration.of.surgical.procedure..in.minutes. +
  X..of.postop.organ.space.ssi + X..of.postop.wound.disruption +
  X..of.postop.pulmonary.embolism + X..of.postop.on.ventilator...48.hours +
  X..of.postop.progressive.renal.insufficiency +
  X..of.postop.vein.thrombosis.requiring.therapy +
  X..of.postop.sepsis + hospital.length.of.stay +
  hospital.discharge.destination +
  first.unplanned.return.to.or + colectomy.mechanical.bowel.prep +
  colectomy.operative.approach +
  colectomy.prolonged.postoperative.npo.or.ngt.use+X..of.readmissions.w.in.30.d
ays,
```

```
  family = "binomial", data = data.imp)
vif(step.model2)
```

##	GVIF	Df
GVIF^(1/(2*Df))		
## age.at.time.of.surgery	1.535257	1
1.239055		
## race	1.365697	5
1.031657		
## elective.surgery	2.082191	1
1.442980		
## height	1.238024	1
1.112665		
## weight	2.200040	1

1.483253		
## bmi	1.881538	1
1.371692		
## wbc	1.285201	1
1.133667		
## platelet.count	1.327199	1
1.152041		
## emergency.case	1.247435	1
1.116886		
## wound.classification	1.770669	3
1.099908		
## asa.classification	1.489137	3
1.068618		
## X..of.other.procedures	1.650112	1
1.284567		
## X..of.concurrent.procedures	1.257742	1
1.121491		
## duration.of.surgical.procedure..in.minutes.	1.609511	1
1.268665		
## X..of.postop.organ.space.ssi	1.501512	1
1.225362		
## X..of.postop.wound.disruption	1.501523	1
1.225366		
## X..of.postop.pulmonary.embolism	1.165664	1
1.079659		
## X..of.postop.on.ventilator...48.hours	1.539989	1
1.240963		
## X..of.postop.progressive.renal.insufficiency	1.375110	1
1.172651		
## X..of.postop.vein.thrombosis.requiring.therapy	1.641426	1
1.281182		
## X..of.postop.sepsis	1.287831	1
1.134827		
## hospital.length.of.stay	2.020597	1
1.421477		
## hospital.discharge.destination	2.376372	7
1.063778		
## first.unplanned.return.to.or	1.358406	1
1.165507		
## colectomy.mechanical.bowel.prep	1.238257	1
1.112770		
## colectomy.operative.approach	1.483384	2
1.103604		
## colectomy.prolonged.postoperative.npo.or.ngt.use	1.328114	1
1.152438		
## X..of.readmissions.w.in.30.days	1.355370	1
1.164203		

new model and no high VIF (≥ 5) to suggest multicollinearity.

```

probabilities <- predict(step.model2, data.imp, type = "response")
predicted.classes <- ifelse(probabilities > 0.5, "None", "Ileostomy")
# Prediction accuracy
observed.classes <- data.imp$ileostomy.formation
mean(predicted.classes == observed.classes)

## [1] 0.8767651

```

The accuracy does go down by about one percent using the stepwise AIC logistic model and removing one multicollinear variables.

```

#the coefficients for each model ran in here
as.data.frame(coef(model))

##
coef(model)
## (Intercept)
108.886666678
## age.at.time.of.surgery
0.026937520
## genderMale
-0.072822979
## raceBlack or African American
-15.635488471
## raceNative Hawaiian or Other Pacific Islander
0.276194425
## raceSome Other Race
-18.987225139
## raceUnknown/Not Reported
-15.214679506
## raceWhite
-16.357597143
## hispanic.ethnicityYes
-0.333493950
## cpt.code
-0.001973276
## in.out.patient.statusOutpatient
14.571162834
## elective.surgeryYes
-1.037525642
## origin.statusFrom acute care hospital inpatient
33.009039802
## origin.statusHome/Permanent residence
-0.151547690
## origin.statusNot transferred (admitted from home)
32.908366189
## origin.statusNursing home - Chronic care - Intermediate care
-0.985203211
## origin.statusOther facility
16.882955866
## origin.statusOutside emergency department

```



```
32.222215314
## origin.statusTransfer from other
30.748421028
## height
0.033990734
## weight
-0.012790060
## bmi
0.070424253
## diabetes.mellitusNo
-2.551928307
## diabetes.mellitusNon-Insulin
-1.868811036
## current.smoker.within.1.yearYes
-0.150036604
## dyspneaNo
0.185630213
## functional.heath.statusPartially Dependent
-0.224634032
## functional.heath.statusTotally Dependent
-13.628455599
## ventilator.dependentYes
NA
## history.of.severe.copdYes
0.757379796
## hypertension.requiring.medicationYes
0.108336429
## disseminated.cancerYes
-0.135646513
## open.wound.with.or.without.infectionYes
0.079074019
## steroid.immunosuppressant.use.for.chronic.conditionYes
-0.803134295
## bleeding.disorderYes
-0.519362023
## sepsis..sirs.sepsis.septic.shock...48h.Sepsis
0.030629891
## sepsis..sirs.sepsis.septic.shock...48h.SIRS
-0.364654877
## serum.sodium
0.028215954
## bun
0.003874216
## serum.creatinine
-0.453098259
## albumin
0.132830671
## wbc
-0.048726624
## hematocrit
```

0.027263606
platelet.count
-0.001719854
emergency.caseYes
-1.577773119
wound.classificationClean/Contaminated
2.075389720
wound.classificationContaminated
1.260116919
wound.classificationDirty/Infected
1.968731378
asa.classificationASA 2 - Mild Disturb
0.623811973
asa.classificationASA 3 - Severe Disturb
0.152037284
asa.classificationASA 4 - Life Threat
-0.413001251
X..of.other.procedures
-0.538475034
X..of.concurrent.procedures
0.259803371
duration.of.surgical.procedure..in.minutes.
-0.003608562
X..of.postop.superficial.incisional.ssi
-0.059200725
X..of.postop.deep.incisional.ssi
-0.836519841
X..of.postop.organ.space.ssi
0.624911516
X..of.postop.wound.disruption
-2.835326937
X..of.postop.pneumonia
0.050536709
X..of.postop.unplanned.intubation
1.384646042
X..of.postop.pulmonary.embolism
-2.311039075
X..of.postop.on.ventilator...48.hours
1.363330660
X..of.postop.progressive.renal.insufficiency
-5.590000825
X..of.postop.acute.renal.failure
-0.829529503
X..of.postop.uti
0.004825705
X..of.postop.cva
NA
X..of.postop.cardiac.arrest.requiring.cpr
-34.446684861
X..of.postop.myocardial.infarction

36.616912741
X..of.postop.transfusion.intraop..postop..72h.of.surgery.start.time.
0.898880687
X..of.postop.vein.thrombosis.requiring.therapy
18.055169611
X..of.postop.c..diff
14.955252694
X..of.postop.sepsis
0.984162061
X..of.postop.septic.shock
2.724981378
X..of.postop.other.occurrences
0.256367084
hospital.length.of.stay
-0.127628077
hospital.discharge.destinationFacility Which was Home
1.481874459
hospital.discharge.destinationHome
-13.177347927
hospital.discharge.destinationHome/Permanent Residence
19.348336760
hospital.discharge.destinationOther Facility
19.306307875
hospital.discharge.destinationRehab
-13.017751648
hospital.discharge.destinationSeparate Acute Care
-31.474629598
hospital.discharge.destinationSkilled Care, Not Home
-16.269802305
X..of.readmissions.w.in.30.days
1.976306645
X..of.unplanned.readmissions
-2.451375628
first.unplanned.return.to.orYes
2.016144228
colectomy.steroid.immunosuppressant.for.inflammatory.bowelYes
0.550769868
colectomy.mechanical.bowel.prepYes
0.645072080
colectomy.oral.antibiotic.prepYes
0.282373745
colectomy.chemotherapy.w.in.90.daysYes
0.877781411
colectomy.operative.approachMIS, unplanned conversion to open
-0.123474319
colectomy.operative.approachOpen
-0.577686470
colectomy.number.of.nodes.evaluated
0.004215093
colectomy.postop.anastomotic.leakLeak, treated w/ interventional means

```

0.781995364
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means -15.196306871
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
-14.556358548
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess -15.630472059
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
0.583025732
## biologic.agent.60.days.prior.to.surgeryNo
0.701113442
## biologic.agent.60.days.prior.to.surgeryYes
0.668829641
## immune.modulation.60.days.prior.to.surgeryNo
-15.384174925
## immune.modulation.60.days.prior.to.surgeryYes
-15.314508942
## colonic.dysplasiaHigh Grade Dysplasia
11.181137948
## colonic.dysplasiaLow grade Dysplasia
-2.315639703
## colonic.dysplasiaNo
11.395166815
## colonic.dysplasiaNo Dysplasia
-1.876306629
## colonic.dysplasiaNot applicable
-1.848969996
## colonic.dysplasiaUnable to determine
-1.527799877

as.data.frame(coef(step.model))

##
coef(step.model)
## (Intercept)
28.673626290
## age.at.time.of.surgery
0.028169590
## raceBlack or African American
-15.540473207
## raceNative Hawaiian or Other Pacific Islander
0.873384287
## raceSome Other Race
-18.708526843
## raceUnknown/Not Reported
-15.029347751
## raceWhite
-16.211571238
## elective.surgeryYes
-0.883455589

```

```
## height
0.026255768
## weight
-0.011757636
## bmi
0.065281274
## functional.heath.statusPartially Dependent
-2.198703768
## functional.heath.statusTotally Dependent
-19.705919353
## steroid.immunosuppressant.use.for.chronic.conditionYes
-0.354903407
## wbc
-0.046254823
## platelet.count
-0.002045566
## emergency.caseYes
-1.329147287
## wound.classificationClean/Contaminated
2.220709303
## wound.classificationContaminated
1.390222357
## wound.classificationDirty/Infected
1.999168961
## asa.classificationASA 2 - Mild Disturb
0.691490873
## asa.classificationASA 3 - Severe Disturb
0.177094375
## asa.classificationASA 4 - Life Threat
-0.406381022
## X..of.other.procedures
-0.521189422
## X..of.concurrent.procedures
0.283398926
## duration.of.surgical.procedure..in.minutes.
-0.003396701
## X..of.postop.wound.disruption
-2.904216030
## X..of.postop.pulmonary.embolism
-1.995416703
## X..of.postop.on.ventilator...48.hours
3.798063576
## X..of.postop.progressive.renal.insufficiency
-7.821215365
## X..of.postop.acute.renal.failure
-2.736258133
## X..of.postop.vein.thrombosis.requiring.therapy
20.728615907
## X..of.postop.sepsis
0.984983569
```

```

## X..of.postop.septic.shock
4.138893827
## hospital.length.of.stay
-0.115057188
## X..of.readmissions.w.in.30.days
2.066903581
## X..of.unplanned.readmissions
-2.364561347
## first.unplanned.return.to.orYes
1.486135760
## colectomy.mechanical.bowel.prepYes
0.882046322
## colectomy.operative.approachMIS, unplanned conversion to open
0.009109161
## colectomy.operative.approachOpen
-0.545996810
## colectomy.postop.anastomotic.leakLeak, treated w/ interventional means
2.937613889
## colectomy.postop.anastomotic.leakLeak, treated w/ non-interventional/non-
operative means -15.192927206
## colectomy.postop.anastomotic.leakLeak, treated w/ reoperation
-14.159458811
## colectomy.postop.anastomotic.leakNo definitive diagnosis of leak/leak
related abscess -15.785358719
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
0.434816316

as.data.frame(coef(step.model2))

##
coef(step.model2)
## (Intercept)
7.875982467
## age.at.time.of.surgery
0.030986920
## raceBlack or African American -
14.357486479
## raceNative Hawaiian or Other Pacific Islander
1.126297570
## raceSome Other Race -
17.377293319
## raceUnknown/Not Reported -
14.121542639
## raceWhite -
15.110973638
## elective.surgeryYes -
0.844947579
## height
0.027364479
## weight -

```

0.011670584	
## bmi	
0.061477560	
## wbc	-
0.052756712	
## platelet.count	-
0.001774802	
## emergency.caseYes	-
1.359853664	
## wound.classificationClean/Contaminated	
2.413713593	
## wound.classificationContaminated	
1.562355616	
## wound.classificationDirty/Infected	
2.218223304	
## asa.classificationASA 2 - Mild Disturb	
0.662956339	
## asa.classificationASA 3 - Severe Disturb	
0.206536898	
## asa.classificationASA 4 - Life Threat	-
0.386941988	
## X..of.other.procedures	-
0.544852365	
## X..of.concurrent.procedures	
0.296424005	
## duration.of.surgical.procedure..in.minutes.	-
0.003830209	
## X..of.postop.organ.space.ssi	
0.807636500	
## X..of.postop.wound.disruption	-
3.353025343	
## X..of.postop.pulmonary.embolism	-
2.459500796	
## X..of.postop.on.ventilator...48.hours	
3.178283511	
## X..of.postop.progressive.renal.insufficiency	-
3.356527517	
## X..of.postop.vein.thrombosis.requiring.therapy	
18.336096818	
## X..of.postop.sepsis	
0.820344913	
## hospital.length.of.stay	-
0.123496025	
## hospital.discharge.destinationFacility Which was Home	
1.363680171	
## hospital.discharge.destinationHome	
3.454365957	
## hospital.discharge.destinationHome/Permanent Residence	
2.876244595	
## hospital.discharge.destinationOther Facility	

```

2.771164204
## hospital.discharge.destinationRehab
3.963978771
## hospital.discharge.destinationSeparate Acute Care -
14.622823242
## hospital.discharge.destinationSkilled Care, Not Home
1.292741358
## first.unplanned.return.to.orYes
2.363582515
## colectomy.mechanical.bowel.prepYes
0.846895354
## colectomy.operative.approachMIS, unplanned conversion to open -
0.113424336
## colectomy.operative.approachOpen -
0.621715303
## colectomy.prolonged.postoperative.npo.or.ngt.useYes
0.552305952
## X.of.readmissions.w.in.30.days -
0.844351852

#other stuff to experiment with it
#levels(data.imp$race) <- c("Other", "Other", "Black or African
American", "Other", "Other", "Unknown/Not Reported", "Other")
#levels(data.imp$origin.status) <- c("Other", "From acute care hospital
inpatient", "Other", "Not transferred (admitted from
home)", "Other", "Other", "Other", "Other")
#levels(data.imp$wound.classification) <-
c("Other", "Other", "Other", "Contaminated", "Other")

```

Bottom was my attempt at building a model if we wanted to some sort of modeling for future predictions but not needed for this context. Tried to combine levels to make all the variables in model significant.