Final

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library(table1)

## Warning: package 'table1' was built under R version 4.1.2

##   
## Attaching package: 'table1'

## The following objects are masked from 'package:base':  
##   
## units, units<-

library(tidyverse)

## Warning: replacing previous import 'lifecycle::last\_warnings' by  
## 'rlang::last\_warnings' when loading 'pillar'

## Warning: replacing previous import 'lifecycle::last\_warnings' by  
## 'rlang::last\_warnings' when loading 'tibble'

## Warning: replacing previous import 'lifecycle::last\_warnings' by  
## 'rlang::last\_warnings' when loading 'hms'

## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --

## v ggplot2 3.3.5 v purrr 0.3.4  
## v tibble 3.1.4 v dplyr 1.0.7  
## v tidyr 1.1.3 v stringr 1.4.0  
## v readr 2.0.1 v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse\_conflicts() --  
## x dplyr::filter() masks stats::filter()  
## x dplyr::lag() masks stats::lag()

library(olsrr) #for stepwise regression

## Warning: package 'olsrr' was built under R version 4.1.2

##   
## Attaching package: 'olsrr'

## The following object is masked from 'package:datasets':  
##   
## rivers

library(pander) #for cleaning up the outputs  
library(broom)

dat1 <- read.csv("Data/dig.csv")

# Cleaning

#first check variables of interest for NA values  
sum(is.na(dat1$TRTMT))

## [1] 0

sum(is.na(dat1$WHF))

## [1] 0

sum(is.na(dat1$AGE))

## [1] 0

sum(is.na(dat1$KLEVEL)) #This is an issue, there are 801 observations here that are NA

## [1] 801

table(dat1$KLEVEL)

##   
## 0 1 1.1 1.2 1.3 1.5 1.9 2.4 2.6 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9   
## 12 12 2 3 1 1 1 1 1 4 6 12 11 17 57 90 112 152 223 321   
## 4 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 5 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 6.3   
## 434 496 592 550 506 521 478 385 281 213 175 114 93 53 34 26 3 2 2 1   
## 434   
## 1

summary(dat1$KLEVEL) #also has a very large outlier. Would appear that it should be 4.3, but I will likely just remove it because it is just one observation

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 0.000 4.100 4.300 4.397 4.600 434.000 801

table(dat1$RACE)

##   
## 1 2   
## 5809 991

sum(is.na(dat1$race))

## [1] 0

summary(dat1$SEX)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 1.000 1.000 1.223 1.000 2.000

summary(dat1$CREAT)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 0.100 1.045 1.200 1.286 1.443 3.761

summary(dat1$SYSBP) # 3 NA values

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 74.0 110.0 123.0 125.8 140.0 220.0 3

summary(dat1$DIABP) # 5 NA values

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 25.0 70.0 75.0 74.9 80.0 184.0 5

summary(dat1$FUNCTCLS) #6 NA

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 1.000 2.000 2.000 2.215 3.000 4.000 6

summary(dat1$CHFETIOL) #18 NA

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 1.000 1.000 1.000 1.742 2.000 6.000 18

summary(dat1$PREVMI) #1 NA

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 0.0000 0.0000 1.0000 0.6499 1.0000 1.0000 1

summary(dat1$DIABETES)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 0.0000 0.0000 0.0000 0.2843 1.0000 1.0000

summary(dat1$HYPERTEN) #1 NA

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 0.0000 0.0000 0.0000 0.4536 1.0000 1.0000 1

table(dat1$DIURETK)

##   
## 0 1   
## 6283 517

summary(dat1$DIURETK)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 0.00000 0.00000 0.00000 0.07603 0.00000 1.00000

table(dat1$KSUPP)

##   
## 0 1   
## 4208 1930

summary(dat1$KSUPP) #662

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 0.0000 0.0000 0.0000 0.3144 1.0000 1.0000 662

summary(dat1$AGE)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 21.00 57.00 65.00 63.48 71.00 94.00

summary(dat1$BMI) #has 1 NA

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 14.45 23.68 26.50 27.11 29.80 62.66 1

summary(dat1$NSYM)

## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 0.000 4.000 4.000 3.659 4.000 4.000

# Table 1 for Aim 1

table\_dat <- dat1 %>%   
 transmute(Sex =  
 case\_when(SEX == 1 ~ "Male",  
 TRUE ~ "Female"),  
 Race =   
 case\_when(RACE == 1 ~ "White",  
 TRUE ~ "Non-White"),  
 Treatment =  
 case\_when(TRTMT == 0 ~ "Placebo",  
 TRUE ~ "Digoxin",),  
 `Serum Creatinine` = CREAT,  
 `Serum Potassium` = KLEVEL,  
 SystolicBP = SYSBP,  
 DiastolicBP = DIABP,  
 `NYHA Class` =   
 case\_when(FUNCTCLS == 1 ~ "Class I",  
 FUNCTCLS == 2 ~ "Class II",  
 FUNCTCLS == 3 ~ "Class III",  
 FUNCTCLS == 4 ~ "Class IV"),  
 `CHF Etiology` =  
 case\_when(CHFETIOL == 1 ~ "Ischemic",  
 CHFETIOL == 2 ~ "Hypertensive",  
 CHFETIOL == 3 ~ "Valvular",  
 CHFETIOL == 4 ~ "Idiopathic",  
 CHFETIOL == 5 ~ "Alcohol Related",  
 CHFETIOL == 6 ~ "Other"),  
 `Previous Myocardial Infarction` =  
 case\_when(PREVMI == 0 ~ "No",  
 TRUE ~ "Yes"),  
 `History of Diabetes` =  
 case\_when(DIABETES == 0 ~ "No",  
 TRUE ~ "Yes"),  
 `History of Hypertension` =  
 case\_when(HYPERTEN == 0 ~ "No",  
 TRUE ~ "Yes"),  
 `Potassium-Sparing Diuretics` =  
 case\_when(DIURETK == 0 ~ "No",  
 TRUE ~ "Yes"),  
 `Potassium Supplement` =  
 case\_when(KSUPP == 0 ~ "No",  
 TRUE ~ "Yes"),  
 `Age of Patient` = AGE,  
 `BMI of Patient` = BMI,  
 `Number of CHF Symptoms` = NSYM,  
 `Worsened Heart Failure` =  
 case\_when(WHF == 0 ~ "No",  
 TRUE ~ "Yes")  
 )  
  
table1( ~ . | `Treatment`, data = table\_dat)

|  | Digoxin (N=3397) | Placebo (N=3403) | Overall (N=6800) |
| --- | --- | --- | --- |
| **Sex** |  |  |  |
| Female | 755 (22.2%) | 764 (22.5%) | 1519 (22.3%) |
| Male | 2642 (77.8%) | 2639 (77.5%) | 5281 (77.7%) |
| **Race** |  |  |  |
| Non-White | 487 (14.3%) | 504 (14.8%) | 991 (14.6%) |
| White | 2910 (85.7%) | 2899 (85.2%) | 5809 (85.4%) |
| **Serum Creatinine** |  |  |  |
| Mean (SD) | 1.28 (0.366) | 1.29 (0.372) | 1.29 (0.369) |
| Median [Min, Max] | 1.20 [0.500, 3.76] | 1.21 [0.100, 3.05] | 1.20 [0.100, 3.76] |
| **Serum Potassium** |  |  |  |
| Mean (SD) | 4.33 (0.511) | 4.46 (7.87) | 4.40 (5.57) |
| Median [Min, Max] | 4.30 [0, 6.30] | 4.30 [0, 434] | 4.30 [0, 434] |
| Missing | 391 (11.5%) | 410 (12.0%) | 801 (11.8%) |
| **SystolicBP** |  |  |  |
| Mean (SD) | 126 (19.9) | 126 (19.9) | 126 (19.9) |
| Median [Min, Max] | 122 [78.0, 220] | 124 [74.0, 202] | 123 [74.0, 220] |
| Missing | 1 (0.0%) | 2 (0.1%) | 3 (0.0%) |
| **DiastolicBP** |  |  |  |
| Mean (SD) | 74.9 (11.5) | 74.9 (11.1) | 74.9 (11.3) |
| Median [Min, Max] | 75.0 [25.0, 184] | 75.0 [38.0, 140] | 75.0 [25.0, 184] |
| Missing | 2 (0.1%) | 3 (0.1%) | 5 (0.1%) |
| **NYHA Class** |  |  |  |
| Class I | 465 (13.7%) | 442 (13.0%) | 907 (13.3%) |
| Class II | 1810 (53.3%) | 1854 (54.5%) | 3664 (53.9%) |
| Class III | 1042 (30.7%) | 1039 (30.5%) | 2081 (30.6%) |
| Class IV | 76 (2.2%) | 66 (1.9%) | 142 (2.1%) |
| Missing | 4 (0.1%) | 2 (0.1%) | 6 (0.1%) |
| **CHF Etiology** |  |  |  |
| Alcohol Related | 92 (2.7%) | 130 (3.8%) | 222 (3.3%) |
| Hypertensive | 272 (8.0%) | 311 (9.1%) | 583 (8.6%) |
| Idiopathic | 525 (15.5%) | 482 (14.2%) | 1007 (14.8%) |
| Ischemic | 2405 (70.8%) | 2398 (70.5%) | 4803 (70.6%) |
| Other | 46 (1.4%) | 22 (0.6%) | 68 (1.0%) |
| Valvular | 48 (1.4%) | 51 (1.5%) | 99 (1.5%) |
| Missing | 9 (0.3%) | 9 (0.3%) | 18 (0.3%) |
| **Previous Myocardial Infarction** |  |  |  |
| No | 1198 (35.3%) | 1182 (34.7%) | 2380 (35.0%) |
| Yes | 2199 (64.7%) | 2221 (65.3%) | 4420 (65.0%) |
| **History of Diabetes** |  |  |  |
| No | 2436 (71.7%) | 2431 (71.4%) | 4867 (71.6%) |
| Yes | 961 (28.3%) | 972 (28.6%) | 1933 (28.4%) |
| **History of Hypertension** |  |  |  |
| No | 1869 (55.0%) | 1846 (54.2%) | 3715 (54.6%) |
| Yes | 1528 (45.0%) | 1557 (45.8%) | 3085 (45.4%) |
| **Potassium-Sparing Diuretics** |  |  |  |
| No | 3159 (93.0%) | 3124 (91.8%) | 6283 (92.4%) |
| Yes | 238 (7.0%) | 279 (8.2%) | 517 (7.6%) |
| **Potassium Supplement** |  |  |  |
| No | 2121 (62.4%) | 2087 (61.3%) | 4208 (61.9%) |
| Yes | 1276 (37.6%) | 1316 (38.7%) | 2592 (38.1%) |
| **Age of Patient** |  |  |  |
| Mean (SD) | 63.4 (11.0) | 63.5 (10.8) | 63.5 (10.9) |
| Median [Min, Max] | 64.0 [21.0, 94.0] | 65.0 [22.0, 92.0] | 65.0 [21.0, 94.0] |
| **BMI of Patient** |  |  |  |
| Mean (SD) | 27.0 (5.19) | 27.2 (5.19) | 27.1 (5.19) |
| Median [Min, Max] | 26.4 [15.2, 58.3] | 26.6 [14.4, 62.7] | 26.5 [14.4, 62.7] |
| Missing | 0 (0%) | 1 (0.0%) | 1 (0.0%) |
| **Number of CHF Symptoms** |  |  |  |
| Mean (SD) | 3.65 (0.805) | 3.67 (0.783) | 3.66 (0.794) |
| Median [Min, Max] | 4.00 [0, 4.00] | 4.00 [0, 4.00] | 4.00 [0, 4.00] |
| **Worsened Heart Failure** |  |  |  |
| No | 2487 (73.2%) | 2223 (65.3%) | 4710 (69.3%) |
| Yes | 910 (26.8%) | 1180 (34.7%) | 2090 (30.7%) |

# Aim 1

aim1\_dat <- dat1 %>%   
 select(KLEVEL, SEX, RACE, TRTMT, CREAT, SYSBP, DIABP, FUNCTCLS, CHFETIOL, PREVMI, DIABETES, HYPERTEN, DIURETK, KSUPP, AGE, BMI, NSYM) %>%   
 filter(KLEVEL < 6.4, #remove outlier of 434 (-1)  
 is.na(KLEVEL) == 0, #remove all NA values, there are 801 (-801)  
 is.na(SYSBP) == 0, #remove all NA values (-3)  
 is.na(DIABP) == 0, #remove all NA values (-5)  
 is.na(BMI) == 0, #remove all NA values (-1)  
 is.na(KSUPP) == 0, #  
 is.na(FUNCTCLS) == 0, #  
 is.na(CHFETIOL) == 0, #  
 is.na(PREVMI) == 0, #  
 is.na(HYPERTEN) == 0 #  
  
 )  
  
sum(is.na(aim1\_dat))

## [1] 0

### P

fit1 <- lm(KLEVEL ~ ., data = aim1\_dat)  
summary(fit1)

##   
## Call:  
## lm(formula = KLEVEL ~ ., data = aim1\_dat)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.3402 -0.2674 0.0005 0.2962 1.9694   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 4.357e+00 1.018e-01 42.816 <2e-16 \*\*\*  
## SEX 2.739e-02 1.700e-02 1.611 0.1072   
## RACE 1.297e-02 2.100e-02 0.617 0.5370   
## TRTMT 1.207e-02 1.395e-02 0.865 0.3871   
## CREAT 3.638e-02 1.901e-02 1.914 0.0557 .   
## SYSBP -1.294e-05 3.524e-04 -0.037 0.9707   
## DIABP -3.612e-04 6.183e-04 -0.584 0.5592   
## FUNCTCLS 5.086e-03 1.027e-02 0.495 0.6204   
## CHFETIOL 2.115e-03 5.472e-03 0.387 0.6991   
## PREVMI -2.490e-02 1.470e-02 -1.694 0.0904 .   
## DIABETES 3.199e-02 1.549e-02 2.065 0.0390 \*   
## HYPERTEN -1.861e-02 1.402e-02 -1.327 0.1845   
## DIURETK -1.514e-02 2.621e-02 -0.578 0.5635   
## KSUPP -8.169e-03 1.518e-02 -0.538 0.5905   
## AGE -7.447e-04 6.417e-04 -1.161 0.2459   
## BMI -9.934e-04 1.349e-03 -0.736 0.4616   
## NSYM -6.704e-03 8.931e-03 -0.751 0.4529   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5115 on 5368 degrees of freedom  
## Multiple R-squared: 0.003845, Adjusted R-squared: 0.0008762   
## F-statistic: 1.295 on 16 and 5368 DF, p-value: 0.19

ols\_step\_both\_p(fit1, pent = .05, prem = .05) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_both\_p", reverting  
## to default.

* **orders**: *DIABETES* and *CREAT*
* **method**: *addition* and *addition*
* **steps**: *2*
* **predictors**: *DIABETES* and *CREAT*
* **rsquare**: *0.0007998* and *0.001538*
* **aic**: *8067* and *8065*
* **sbc**: *8086* and *8091*
* **sbic**: *-7215* and *-7217*
* **adjr**: *0.0006142* and *0.001167*
* **rmse**: *0.5115* and *0.5114*
* **mallows\_cp**: *3.412* and *1.432*
* **indvar**: *SEX*, *RACE*, *TRTMT*, *CREAT*, *SYSBP*, *DIABP*, *FUNCTCLS*, *CHFETIOL*, *PREVMI*, *DIABETES*, *HYPERTEN*, *DIURETK*, *KSUPP*, *AGE*, *BMI* and *NSYM*
* **betas**:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * (Intercept) | * DIABETES | * (Intercept) | * DIABETES | * CREAT |
| * 4.317 | * 0.03211 | * 4.269 | * 0.03158 | * 0.03787 |

* **lbetas**: *2* and *3*
* **pvalues**:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * (Intercept) | * DIABETES | * (Intercept) | * DIABETES | * CREAT |
| * 0 | * 0.03796 | * 0 | * 0.04121 | * 0.04608 |

* **beta\_pval**:

|  |  |  |  |
| --- | --- | --- | --- |
| * model | * predictor | * beta | * pval |
| * 1 | * (Intercept) | * 4.317 | * 0 |
| * 1 | * DIABETES | * 0.03211 | * 0.03796 |
| * 2 | * (Intercept) | * 4.269 | * 0 |
| * 2 | * DIABETES | * 0.03158 | * 0.04121 |
| * 2 | * CREAT | * 0.03787 | * 0.04608 |

* **model**:
* Fitting linear model: paste(response, “~”, paste(preds, collapse = " + "))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | * Estimate | * Std. Error | * t value | * Pr(>|t|) |
| * **(Intercept)** | * 4.269 | * 0.02571 | * 166 | * 0 |
| * **DIABETES** | * 0.03158 | * 0.01547 | * 2.042 | * 0.04121 |
| * **CREAT** | * 0.03787 | * 0.01898 | * 1.995 | * 0.04608 |

ols\_step\_forward\_p(fit1, penter = .05) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_forward\_p",  
## reverting to default.

* **predictors**: *DIABETES* and *CREAT*
* **mallows\_cp**: *3.412* and *1.432*
* **indvar**: *SEX*, *RACE*, *TRTMT*, *CREAT*, *SYSBP*, *DIABP*, *FUNCTCLS*, *CHFETIOL*, *PREVMI*, *DIABETES*, *HYPERTEN*, *DIURETK*, *KSUPP*, *AGE*, *BMI* and *NSYM*
* **rsquare**: *0.0007998* and *0.001538*
* **steps**: *2*
* **sbic**: *-7215* and *-7217*
* **adjr**: *0.0006142* and *0.001167*
* **rmse**: *0.5115* and *0.5114*
* **aic**: *8067* and *8065*
* **sbc**: *8086* and *8091*
* **model**:
* Fitting linear model: paste(response, “~”, paste(preds, collapse = " + "))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | * Estimate | * Std. Error | * t value | * Pr(>|t|) |
| * **(Intercept)** | * 4.269 | * 0.02571 | * 166 | * 0 |
| * **DIABETES** | * 0.03158 | * 0.01547 | * 2.042 | * 0.04121 |
| * **CREAT** | * 0.03787 | * 0.01898 | * 1.995 | * 0.04608 |

ols\_step\_backward\_p(fit1, prem = .05) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_backward\_p",  
## reverting to default.

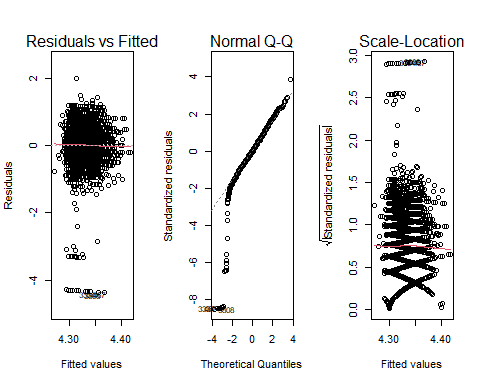
* **mallows\_cp**: *15*, *13.15*, *11.39*, *9.626*, *7.943*, *6.321*, *4.782*, *3.342*, *1.923*, *0.7073*, *0.1013*, *-0.04122*, *0.602* and *1.432*
* **removed**: *SYSBP*, *CHFETIOL*, *FUNCTCLS*, *KSUPP*, *DIURETK*, *DIABP*, *RACE*, *NSYM*, *BMI*, *TRTMT*, *AGE*, *HYPERTEN*, *SEX* and *PREVMI*
* **rsquare**: *0.003845*, *0.003817*, *0.003773*, *0.003729*, *0.00367*, *0.0036*, *0.003515*, *0.003411*, *0.003303*, *0.003157*, *0.002899*, *0.002554*, *0.002064* and *0.001538*
* **indvar**: *SEX*, *RACE*, *TRTMT*, *CREAT*, *SYSBP*, *DIABP*, *FUNCTCLS*, *CHFETIOL*, *PREVMI*, *DIABETES*, *HYPERTEN*, *DIURETK*, *KSUPP*, *AGE*, *BMI* and *NSYM*
* **steps**: *14*
* **sbic**: *-7204*, *-7206*, *-7207*, *-7209*, *-7211*, *-7212*, *-7214*, *-7215*, *-7217*, *-7218*, *-7219*, *-7219*, *-7218* and *-7217*
* **adjr**: *0.001062*, *0.00122*, *0.001362*, *0.001504*, *0.001631*, *0.001746*, *0.001846*, *0.001928*, *0.002005*, *0.002045*, *0.001972*, *0.001812*, *0.001507* and *0.001167*
* **rmse**: *0.5114*, *0.5114*, *0.5114*, *0.5113*, *0.5113*, *0.5113*, *0.5112*, *0.5112*, *0.5112*, *0.5112*, *0.5112*, *0.5112*, *0.5113* and *0.5114*
* **aic**: *8078*, *8076*, *8075*, *8073*, *8071*, *8069*, *8068*, *8067*, *8065*, *8064*, *8063*, *8063*, *8064* and *8065*
* **sbc**: *8190*, *8182*, *8173*, *8165*, *8157*, *8149*, *8140*, *8132*, *8124*, *8117*, *8109*, *8103*, *8097* and *8091*
* **model**:
* Fitting linear model: paste(response, “~”, paste(preds, collapse = " + "))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | * Estimate | * Std. Error | * t value | * Pr(>|t|) |
| * **(Intercept)** | * 4.269 | * 0.02571 | * 166 | * 0 |
| * **CREAT** | * 0.03787 | * 0.01898 | * 1.995 | * 0.04608 |
| * **DIABETES** | * 0.03158 | * 0.01547 | * 2.042 | * 0.04121 |

p\_fit <- lm(KLEVEL ~ DIABETES + CREAT, data = aim1\_dat)  
summary(p\_fit)

##   
## Call:  
## lm(formula = KLEVEL ~ DIABETES + CREAT, data = aim1\_dat)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -4.3670 -0.2607 -0.0085 0.2898 1.9863   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 4.26851 0.02571 166.037 <2e-16 \*\*\*  
## DIABETES 0.03158 0.01547 2.042 0.0412 \*   
## CREAT 0.03787 0.01898 1.995 0.0461 \*   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 0.5114 on 5382 degrees of freedom  
## Multiple R-squared: 0.001538, Adjusted R-squared: 0.001167   
## F-statistic: 4.146 on 2 and 5382 DF, p-value: 0.01588

par(mfrow = c(1,3))  
plot(p\_fit, which = 1:3)



### AIC

ols\_step\_both\_aic(fit1) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_both\_aic",  
## reverting to default.

* **predictors**: *DIABETES*, *CREAT*, *PREVMI* and *SEX*
* **method**: *addition*, *addition*, *addition* and *addition*
* **steps**: *4*
* **arsq**: *0.0006142*, *0.001167*, *0.001507* and *0.001812*
* **aic**: *8067*, *8065*, *8064* and *8063*
* **ess**: *1409*, *1408*, *1407* and *1406*
* **rss**: *1.128*, *2.169*, *2.909* and *3.601*
* **rsq**: *0.0007998*, *0.001538*, *0.002064* and *0.002554*

ols\_step\_forward\_aic(fit1) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_forward\_aic",  
## reverting to default.

* **predictors**: *DIABETES*, *CREAT*, *PREVMI* and *SEX*
* **steps**: *4*
* **arsq**: *0.0006142*, *0.001167*, *0.001507* and *0.001812*
* **aics**: *8067*, *8065*, *8064* and *8063*
* **ess**: *1409*, *1408*, *1407* and *1406*
* **rss**: *1.128*, *2.169*, *2.909* and *3.601*
* **rsq**: *0.0007998*, *0.001538*, *0.002064* and *0.002554*
* **model**:
* Fitting linear model: paste(response, “~”, paste(preds, collapse = " + "))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | * Estimate | * Std. Error | * t value | * Pr(>|t|) |
| * **(Intercept)** | * 4.252 | * 0.0344 | * 123.6 | * 0 |
| * **DIABETES** | * 0.03166 | * 0.01546 | * 2.047 | * 0.04068 |
| * **CREAT** | * 0.03744 | * 0.01897 | * 1.973 | * 0.04854 |
| * **PREVMI** | * -0.02419 | * 0.01468 | * -1.648 | * 0.09944 |
| * **SEX** | * 0.02733 | * 0.0168 | * 1.627 | * 0.1039 |

ols\_step\_backward\_aic(fit1) %>% pander()

## Warning in pander.default(.): No pander.method for "ols\_step\_backward\_aic",  
## reverting to default.

* **predictors**: *SYSBP*, *CHFETIOL*, *FUNCTCLS*, *KSUPP*, *DIURETK*, *DIABP*, *RACE*, *NSYM*, *BMI*, *TRTMT*, *AGE* and *HYPERTEN*
* **steps**: *12*
* **arsq**: *0.0008762*, *0.001062*, *0.00122*, *0.001362*, *0.001504*, *0.001631*, *0.001746*, *0.001846*, *0.001928*, *0.002005*, *0.002045*, *0.001972* and *0.001812*
* **aics**: *8080*, *8078*, *8076*, *8075*, *8073*, *8071*, *8069*, *8068*, *8067*, *8065*, *8064*, *8063* and *8063*
* **ess**: *1404*, *1404*, *1404*, *1404*, *1404*, *1405*, *1405*, *1405*, *1405*, *1405*, *1405*, *1406* and *1406*
* **rss**: *5.421*, *5.421*, *5.381*, *5.319*, *5.257*, *5.174*, *5.075*, *4.955*, *4.808*, *4.656*, *4.451*, *4.086* and *3.601*
* **rsq**: *0.003845*, *0.003845*, *0.003817*, *0.003773*, *0.003729*, *0.00367*, *0.0036*, *0.003515*, *0.003411*, *0.003303*, *0.003157*, *0.002899* and *0.002554*
* **model**:
* Fitting linear model: paste(response, “~”, paste(preds, collapse = " + "))

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | * Estimate | * Std. Error | * t value | * Pr(>|t|) |
| * **(Intercept)** | * 4.252 | * 0.0344 | * 123.6 | * 0 |
| * **SEX** | * 0.02733 | * 0.0168 | * 1.627 | * 0.1039 |
| * **CREAT** | * 0.03744 | * 0.01897 | * 1.973 | * 0.04854 |
| * **PREVMI** | * -0.02419 | * 0.01468 | * -1.648 | * 0.09944 |
| * **DIABETES** | * 0.03166 | * 0.01546 | * 2.047 | * 0.04068 |

# Aim 2

aim2\_dat <- dat1 %>%   
 filter(KLEVEL < 6.4,  
 is.na(KLEVEL) == 0) %>%   
 select(WHF, KLEVEL)  
   
sum(is.na(aim2\_dat))

## [1] 0

fit2 <- glm(formula = (WHF == 1) ~ KLEVEL, data = aim2\_dat, family = "binomial")  
summary(fit2) %>% pander()

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Std. Error | z value | Pr(>|z|) |
| **(Intercept)** | -0.7008 | 0.2392 | -2.93 | 0.003386 |
| **KLEVEL** | -0.02429 | 0.05494 | -0.4421 | 0.6584 |

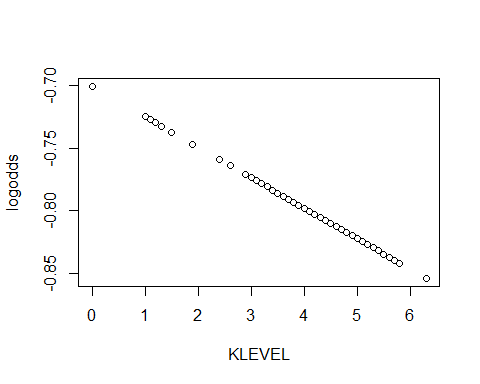
(Dispersion parameter for binomial family taken to be 1 )

|  |  |
| --- | --- |
| Null deviance: | 7415 on 5997 degrees of freedom |
| Residual deviance: | 7415 on 5996 degrees of freedom |

### Check logistic reg assumptions

#### Assumption 4

logodds <- fit2$linear.predictors  
plot(logodds ~ KLEVEL, data = aim2\_dat)



#### Assumption 5

table(aim2\_dat$WHF) %>% pander()

|  |  |
| --- | --- |
| 0 | 1 |
| 4146 | 1852 |

table(table\_dat$`Worsened Heart Failure`) %>% pander()

|  |  |
| --- | --- |
| No | Yes |
| 4710 | 2090 |

# Aim 3

library(car)

## Loading required package: carData

##   
## Attaching package: 'car'

## The following object is masked from 'package:dplyr':  
##   
## recode

## The following object is masked from 'package:purrr':  
##   
## some