HW2Q2

```
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.2     v tibble    3.2.1
v lubridate 1.9.4     v tidyr     1.3.1
v purrr     1.0.4
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becor
```

```
library(logistf)
library(readxl)
library(maditr)
```

```
To aggregate all non-grouping columns: take_all(mtcars, mean, by = am)


Attaching package: 'maditr'

The following objects are masked from 'package:dplyr':

    between, coalesce, first, last

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

    transpose
```

```
The following object is masked from 'package:readr':

    cols
```

```
library(sjPlot)
library(knitr)
```

```
main <- read_csv("full_v5.csv")
```

```
Rows: 24397 Columns: 26
-- Column specification --------------------------------------------------------
Delimiter: ","
chr (14): ip_patient_id, ip_enc_id, diagnosis_date, procedure_date, icd_code...
dbl (12): X, procedure_code, age, elix_vw_score, preventive_antibiotics, ant...

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
cols <- tibble(Index = seq_along(names(main)), Name = names(main))
```

```
#kable(cols, format = "latex", booktabs = TRUE)
cols
```

```
# A tibble: 26 x 2
   Index Name
   <int> <chr>
 1     1 X
 2     2 ip_patient_id
 3     3 ip_enc_id
 4     4 diagnosis_date
 5     5 procedure_date
 6     6 icd_code
 7     7 procedure_code
 8     8 Category
 9     9 icd_description
10    10 procedure_description
# i 16 more rows
```

```r
multiple_patients <- main %>%
  count(ip_patient_id) %>%
  arrange(desc(n)) %>%
  filter(n > 1) %>%
  pull(ip_patient_id)

# make multiple encounters var

main <- main %>%
  mutate(
    multiple_encounters = if_else(ip_patient_id %in% multiple_patients, 1, 0)
  )

main %>%
  count(multiple_encounters) %>%
  arrange(desc(n))
```

```
# A tibble: 2 x 2
  multiple_encounters     n
                <dbl> <int>
1                   1 16229
2                   0  8168
```

```r
# create logist model
fir <- logistf(antibiotics_after_procedure_less_thirty ~
                 category2 + Autoimmune + Diabetes +
                 Immunocompromise + Tobacco + Vascular +
                 multiple_encounters + mohs + elix_vw_score + preventive_antibiotics,
               data = main, firth = T, pl = T)
```

```r
# view model results
summary(fir)
```

```
logistf(formula = antibiotics_after_procedure_less_thirty ~ category2 +
    Autoimmune + Diabetes + Immunocompromise + Tobacco + Vascular +
    multiple_encounters + mohs + elix_vw_score + preventive_antibiotics,
    data = main, pl = T, firth = T)

Model fitted by Penalized ML
Coefficients:
                                          coef    se(coef)   lower 0.95
```

(Intercept)	-4.88185074	0.355026646	-5.666001404
category2Ears/Nose/Mouth/Lips/Pharynx	2.74485086	0.415128266	1.958921285
category2Eyelid	2.03410075	0.897247735	-0.228971976
category2Genitourinary/Anus	2.41614000	0.605470171	1.144091187
category2Head/face/neck (unspecified)	2.18357284	0.376705900	1.485411067
category2Lower extremity	1.32140228	0.451508221	0.436526898
category2Other/unspecified	-0.28983253	0.718102632	-1.959466115
category2Upper extremity	0.19465432	0.450100421	-0.692641681
Autoimmune	2.67888909	0.609835378	1.339689193
Diabetes	0.52725413	1.454804983	-4.357360949
Immunocompromise	0.04642027	0.506677767	-1.102711363
Tobacco	2.73101718	1.199778604	0.073907129
Vascular	3.16905093	1.531667384	-1.777264764
multiple_encounters	-0.61052104	0.181676477	-0.975905208
mohs	-3.19371980	0.200274805	-3.596563058
elix_vw_score	0.01289024	0.005348483	0.002039746
preventive_antibiotics	1.21508482	0.190658707	0.830640157

	upper 0.95	Chisq	p
(Intercept)	-4.23812659	Inf	0.000000e+00
category2Ears/Nose/Mouth/Lips/Pharynx	3.62536513	53.193854887	3.022027e-13
category2Eyelid	3.57439837	3.251308557	7.136646e-02
category2Genitourinary/Anus	3.59910088	12.129516946	4.962997e-04
category2Head/face/neck (unspecified)	3.00185711	47.654520165	5.083489e-12
category2Lower extremity	2.25230038	8.491126950	3.568827e-03
category2Other/unspecified	1.00479536	0.168731706	6.812414e-01
category2Upper extremity	1.12156059	0.184103481	6.678702e-01
Autoimmune	3.81631606	12.805890246	3.455298e-04
Diabetes	2.68057549	0.109360372	7.408735e-01
Immunocompromise	0.94845689	0.008138642	9.281168e-01
Tobacco	5.45744634	4.025707468	4.481182e-02
Vascular	5.56945904	2.107763302	1.465534e-01
multiple_encounters	-0.24905026	10.963499104	9.292418e-04
mohs	-2.79733312	Inf	0.000000e+00
elix_vw_score	0.02344966	5.391117884	2.023950e-02
preventive_antibiotics	1.59076567	35.595564862	2.428398e-09

	method
(Intercept)	2
category2Ears/Nose/Mouth/Lips/Pharynx	2
category2Eyelid	2
category2Genitourinary/Anus	2
category2Head/face/neck (unspecified)	2
category2Lower extremity	2
category2Other/unspecified	2

```
category2Upper extremity                    2
Autoimmune                                  2
Diabetes                                    2
Immunocompromise                            2
Tobacco                                     2
Vascular                                    2
multiple_encounters                         2
mohs                                        2
elix_vw_score                               2
preventive_antibiotics                      2

Method: 1-Wald, 2-Profile penalized log-likelihood, 3-None

Likelihood ratio test=410.4844 on 16 df, p=0, n=24397
Wald test = 2521.122 on 16 df, p = 0
```

```r
# view coefficients
exp(coef(fir))
```

```
                          (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                            0.007582967                          15.562292867
                       category2Eyelid           category2Genitourinary/Anus
                            7.645373933                          11.202533929
category2Head/face/neck (unspecified)              category2Lower extremity
                            8.877969199                           3.748674387
            category2Other/unspecified              category2Upper extremity
                            0.748388890                           1.214890951
                             Autoimmune                              Diabetes
                           14.568899530                           1.694273668
                       Immunocompromise                                Tobacco
                            1.047514559                          15.348491276
                               Vascular                    multiple_encounters
                           23.784900216                           0.543067835
                                  mohs                          elix_vw_score
                            0.041019004                           1.012973676
                  preventive_antibiotics
                            3.370579940
```

```r
# view 95% confidence intervals
round(exp(cbind(Estimate=coef(fir), confint(fir))), 4)
```

```
                                            Estimate Lower 95% Upper 95%
```

```
(Intercept)                                0.0076    0.0035    0.0144
category2Ears/Nose/Mouth/Lips/Pharynx     15.5623    7.0917   37.5384
category2Eyelid                            7.6454    0.7954   35.6732
category2Genitourinary/Anus               11.2025    3.1396   36.5653
category2Head/face/neck (unspecified)      8.8780    4.4168   20.1229
category2Lower extremity                   3.7487    1.5473    9.5096
category2Other/unspecified                 0.7484    0.1409    2.7313
category2Upper extremity                   1.2149    0.5003    3.0696
Autoimmune                                14.5689    3.8179   45.4365
Diabetes                                   1.6943    0.0128   14.5935
Immunocompromise                           1.0475    0.3320    2.5817
Tobacco                                   15.3485    1.0767  234.4978
Vascular                                  23.7849    0.1691  262.2922
multiple_encounters                        0.5431    0.3769    0.7795
mohs                                       0.0410    0.0274    0.0610
elix_vw_score                              1.0130    1.0020    1.0237
preventive_antibiotics                     3.3706    2.2948    4.9075
```

Get the coefs table, exponentiate coefs, and then output it nicely:

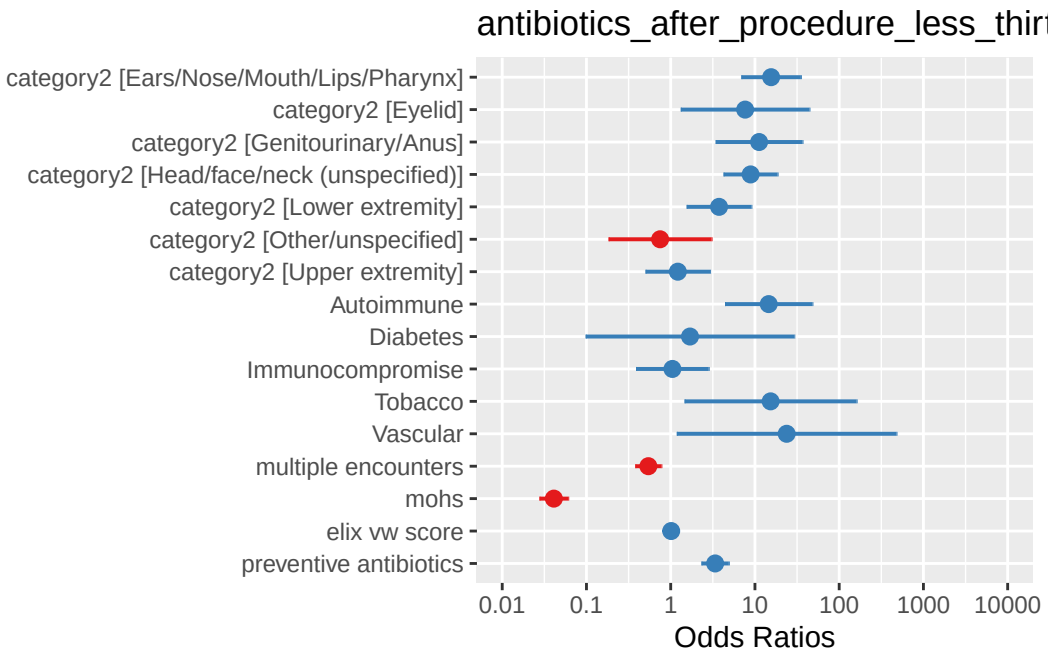
```
coefs_table <- data.frame(round(exp(cbind(Estimate=coef(fir), confint(fir))), 4))
coefs_table <- coefs_table %>%
  mutate(Estimate = exp(Estimate), Lower.95. = exp(Lower.95.), Upper.95. = exp(Upper.95.)) %
  rename(`exp(Coef Estimate)` = Estimate, `exp(Lower 95%)` = Lower.95., `exp(Upper 95%)` = U
  mutate(`exp(Coef Estimate)` = format(`exp(Coef Estimate)`, scientific = FALSE))
head(coefs_table)
```

```
                                  exp(Coef Estimate) exp(Lower 95%)
(Intercept)                                 1.007629       1.003506
category2Ears/Nose/Mouth/Lips/Pharynx    5736156.817147    1201.949379
category2Eyelid                             2091.004811       2.215327
category2Genitourinary/Anus                73313.496661      23.094627
category2Head/face/neck (unspecified)       7172.431518      82.830802
category2Lower extremity                      42.465841       4.698766
                                  exp(Upper 95%)
(Intercept)                         1.014504e+00
category2Ears/Nose/Mouth/Lips/Pharynx   2.007798e+16
category2Eyelid                         3.109381e+15
category2Genitourinary/Anus             7.587663e+15
category2Head/face/neck (unspecified)   5.486109e+08
category2Lower extremity                1.348860e+04
```

```
kable(coefs_table, format = "latex", booktabs = TRUE)
```

	exp(Coef Estimate)	exp(Lower 95%)	exp(Upper 95%)
(Intercept)	1.007629	1.003506	1.014504e+00
category2Ears/Nose/Mouth/Lips/Pharynx	5736156.817147	1201.949379	2.007798e+16
category2Eyelid	2091.004811	2.215327	3.109381e+15
category2Genitourinary/Anus	73313.496661	23.094627	7.587663e+15
category2Head/face/neck (unspecified)	7172.431518	82.830802	5.486109e+08
category2Lower extremity	42.465841	4.698766	1.348860e+04
category2Other/unspecified	2.113616	1.151309	1.535283e+01
category2Upper extremity	3.369957	1.649216	2.153329e+01
Autoimmune	2124187.639593	45.508540	5.405318e+19
Diabetes	5.442835	1.012882	2.177091e+06
Immunocompromise	2.850516	1.393753	1.321959e+01
Tobacco	4632003.250577	2.934978	6.935864e+101
Vascular	21362438360.985210	1.184239	8.166860e+113
multiple_encounters	1.721335	1.457758	2.180382e+00
mohs	1.041852	1.027779	1.062899e+00
elix_vw_score	2.753850	2.723724	2.783475e+00
preventive_antibiotics	29.095979	9.922451	1.353007e+02

```
# plot
plot_model(fir)
```


antibiotics_after_procedure_less_thir
category2 [Ears/Nose/Mouth/Lips/Pharynx]
category2 [Eyelid]
category2 [Genitourinary/Anus]
category2 [Head/face/neck (unspecified)]
category2 [Lower extremity]
category2 [Other/unspecified]
category2 [Upper extremity]
Autoimmune
Diabetes
Immunocompromise
Tobacco
Vascular
multiple encounters
mohs
elix vw score
preventive antibiotics
0.01
0.1
1
10
100
1000
10000
Odds Ratios