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 select columns from data: columns(mtcars, mpg, vs:carb)
```

```
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)
```

```
#refugeeswelcome
```

```
library(knitr)
library(kableExtra)
```

```

Attaching package: 'kableExtra'

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

    group_rows
```

```
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
```

```
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
```

```
# 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
```

```
# 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%)` = Up
  mutate(`exp(Coef Estimate)` = format(`exp(Coef Estimate)`, scientific = FALSE))
head(coefs_table, n=17)
```

```
                                    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
category2Other/unspecified                      2.113616       1.151310
category2Upper extremity                        3.369957       1.649216
Autoimmune                                2124187.639593      45.508540
Diabetes                                        5.442835       1.012882
Immunocompromise                                2.850516       1.393753
Tobacco                                   4632003.250577       2.934978
Vascular                              21362438360.985210       1.184239
multiple_encounters                             1.721335       1.457759
mohs                                            1.041852       1.027779
elix_vw_score                                   2.753850       2.723724
preventive_antibiotics                         29.095979       9.922451
                                      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
category2Other/unspecified              1.535283e+01
category2Upper extremity                2.153329e+01
Autoimmune                              5.405318e+19
Diabetes                                2.177091e+06
Immunocompromise                        1.321959e+01
Tobacco                                6.935864e+101
Vascular                               8.166860e+113
multiple_encounters                     2.180382e+00
mohs                                    1.062899e+00
elix_vw_score                           2.783475e+00
preventive_antibiotics                  1.353007e+02
```

```r
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

```
# apply exponentiation to all model coefficients and confidence intervals
exp_fir <- fir
exp_fir$coefficients <- exp(exp_fir$coefficients)
exp_fir$ci.upper <- exp(exp_fir$ci.upper)
exp_fir$ci.lower <- exp(exp_fir$ci.lower)

print(fir$coefficients)
```

```
                        (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                         -4.88185074                           2.74485086
                      category2Eyelid          category2Genitourinary/Anus
                           2.03410075                           2.41614000
category2Head/face/neck (unspecified)             category2Lower extremity
                           2.18357284                           1.32140228
          category2Other/unspecified             category2Upper extremity
                          -0.28983253                           0.19465432
                          Autoimmune                             Diabetes
                           2.67888909                           0.52725413
                     Immunocompromise                                Tobacco
                           0.04642027                           2.73101718
                             Vascular                  multiple_encounters
```

```
                    3.16905093                             -0.61052104
                          mohs                            elix_vw_score
                   -3.19371980                              0.01289024
         preventive_antibiotics
                    1.21508482
```

```r
cat("~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~", "\n")
```

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```r
print(exp_fir$coefficients)
```

```
                   (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
cat("%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%", "\n")
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```r
print(fir$ci.upper)
```

```
                   (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                   -4.23812659                            3.62536513
```

```
                      category2Eyelid          category2Genitourinary/Anus
                            3.57439837                           3.59910088
category2Head/face/neck (unspecified)             category2Lower extremity
                            3.00185711                           2.25230038
           category2Other/unspecified             category2Upper extremity
                            1.00479536                           1.12156059
                            Autoimmune                             Diabetes
                            3.81631606                           2.68057549
                     Immunocompromise                                Tobacco
                            0.94845689                           5.45744634
                              Vascular                multiple_encounters
                            5.56945904                           -0.24905026
                                  mohs                       elix_vw_score
                           -2.79733312                           0.02344966
                preventive_antibiotics
                            1.59076567
```

```
cat("~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~", "\n")
```

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```
print(exp_fir$ci.upper)
```

```
                      (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                        0.01443461                           37.53842693
                      category2Eyelid          category2Genitourinary/Anus
                        35.67315242                           36.56534293
category2Head/face/neck (unspecified)             category2Lower extremity
                        20.12287269                            9.50958636
           category2Other/unspecified             category2Upper extremity
                         2.73134827                            3.06964091
                         Autoimmune                             Diabetes
                        45.43651404                           14.59348935
                     Immunocompromise                                Tobacco
                         2.58172269                          234.49783056
                           Vascular                multiple_encounters
                       262.29217117                            0.77954079
                               mohs                       elix_vw_score
                         0.06097245                            1.02372677
            preventive_antibiotics
                         4.90750500
```

```r
cat("%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%", "\n")
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```r
print(fir$ci.lower)
```

```
                          (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                         -5.666001404                           1.958921285
                      category2Eyelid            category2Genitourinary/Anus
                         -0.228971976                           1.144091187
category2Head/face/neck (unspecified)               category2Lower extremity
                          1.485411067                           0.436526898
           category2Other/unspecified               category2Upper extremity
                         -1.959466115                          -0.692641681
                           Autoimmune                               Diabetes
                          1.339689193                          -4.357360949
                     Immunocompromise                                Tobacco
                         -1.102711363                           0.073907129
                             Vascular                    multiple_encounters
                         -1.777264764                          -0.975905208
                                 mohs                          elix_vw_score
                         -3.596563058                           0.002039746
                preventive_antibiotics
                          0.830640157
```

```r
cat("~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~", "\n")
```

```
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

```r
print(exp_fir$ci.lower)
```

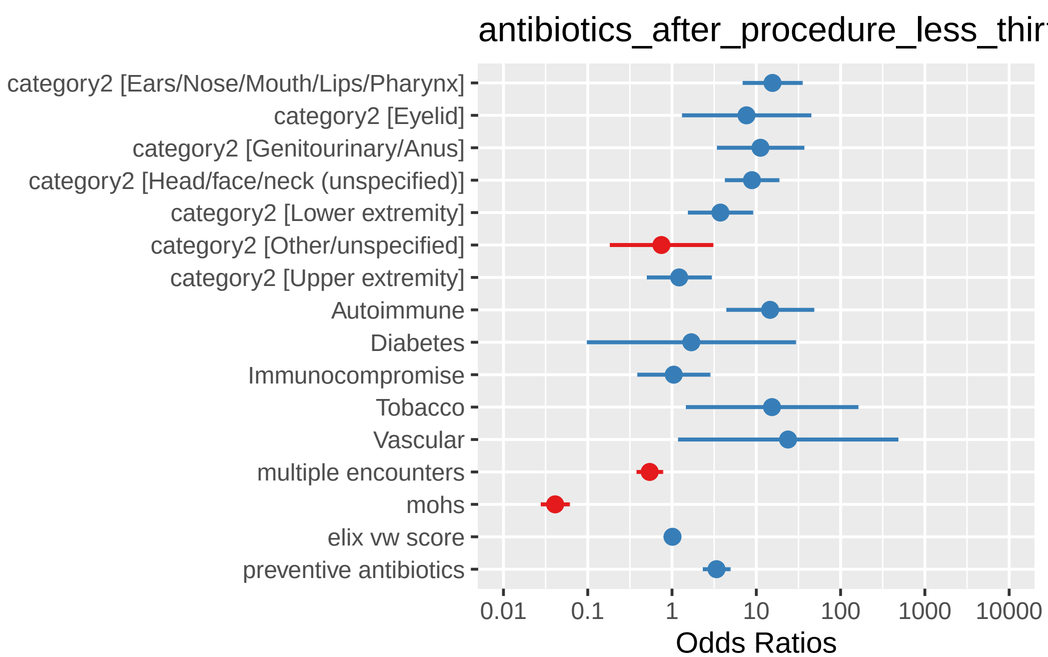
```
                          (Intercept) category2Ears/Nose/Mouth/Lips/Pharynx
                          0.003461679                           7.091673047
                      category2Eyelid            category2Genitourinary/Anus
                          0.795350822                           3.139586762
category2Head/face/neck (unspecified)               category2Lower extremity
                          4.416780632                           1.547323863
           category2Other/unspecified               category2Upper extremity
                          0.140933643                           0.500252814
```

```
            Autoimmune                Diabetes
           3.817856705             0.012812155
     Immunocompromise                 Tobacco
           0.331969772             1.076706806
              Vascular     multiple_encounters
           0.169100044             0.376851071
                  mohs            elix_vw_score
           0.027417794             1.002041827
preventive_antibiotics
           2.294787294
```

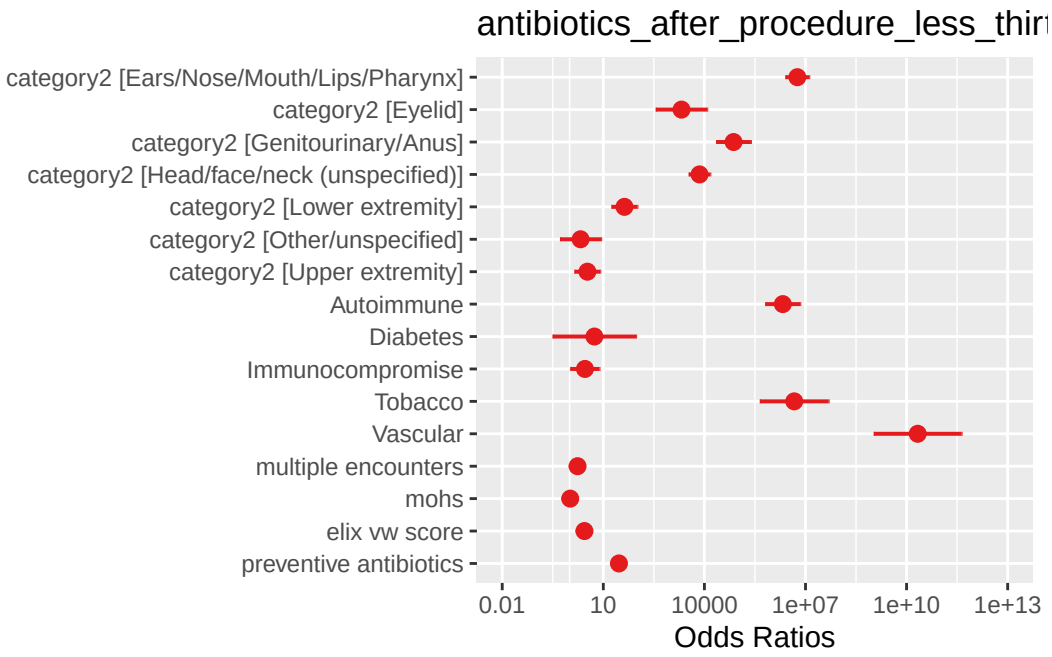
```r
cat("%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%", "\n")
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

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




```r
plot_model(exp_fir)
```



Create a contingency table for (antibiotics_after_procedure_less_thirty) and category2

```
contigency <- table(Response = main$antibiotics_after_procedure_less_thirty, Body_Part = mai
contigency_m <- as.data.frame.matrix(contigency)

kable(contigency_m) %>%
  kable_paper("striped", full_width = F) %>%
  row_spec(0, angle = -45, font_size = 10)
```

	Chest/abdomen	Ears/Nose/Mouth/Lips/Pharynx	Eyelid	Genitourinary/Anus	Head/face/neck (unspecified)	Lower extremity	Othe
0	2171	3596	487	51	11173	2689	
1	8	33	1	5	71	12	