Data Analysis

Juste Simanauskaite & Patricia Rivera

Some test words here

```
knitr::opts_chunk$set(message=FALSE, warning=FALSE, fig.height=3, fig.width=5, fig.align="center")
library(tidyverse)
library(broom)
library(plyr)
library(survival)
library(survminer)
aids <- read.csv( "http://pages.pomona.edu/~jsh04747/courses/math150/AIDSdata.csv")
dim(aids)
```

```
## [1] 851  16
```

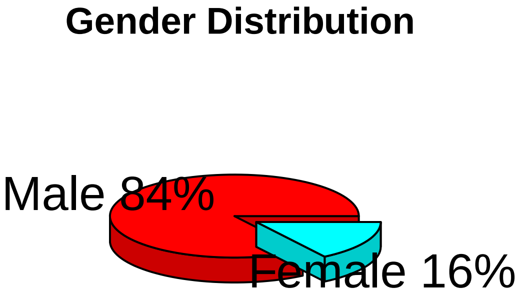
```
summary(aids)
```

```
##        id              time           censor            time_d     
##  Min.   :   1.0   Min.   :  1.0   Min.   :0.00000   Min.   :  1.0  
##  1st Qu.: 287.5   1st Qu.:179.5   1st Qu.:0.00000   1st Qu.:199.5  
##  Median : 581.0   Median :257.0   Median :0.00000   Median :266.0  
##  Mean   : 579.5   Mean   :231.8   Mean   :0.08108   Mean   :243.4  
##  3rd Qu.: 873.0   3rd Qu.:300.0   3rd Qu.:0.00000   3rd Qu.:306.0  
##  Max.   :1156.0   Max.   :362.0   Max.   :1.00000   Max.   :362.0  
##     censor_d            tx             txgrp           strat2      
##  Min.   :0.0000   Min.   :0.0000   Min.   :1.000   Min.   :0.0000  
##  1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:1.000   1st Qu.:0.0000  
##  Median :0.0000   Median :1.0000   Median :2.000   Median :1.0000  
##  Mean   :0.0235   Mean   :0.5041   Mean   :1.504   Mean   :0.6157  
##  3rd Qu.:0.0000   3rd Qu.:1.0000   3rd Qu.:2.000   3rd Qu.:1.0000  
##  Max.   :1.0000   Max.   :1.0000   Max.   :2.000   Max.   :1.0000  
##       sex            raceth          ivdrug         hemophil      
##  Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :0.00000  
##  1st Qu.:1.000   1st Qu.:1.000   1st Qu.:1.000   1st Qu.:0.00000  
##  Median :1.000   Median :1.000   Median :1.000   Median :0.00000  
##  Mean   :1.157   Mean   :1.706   Mean   :1.317   Mean   :0.03408  
##  3rd Qu.:1.000   3rd Qu.:2.000   3rd Qu.:1.000   3rd Qu.:0.00000  
##  Max.   :2.000   Max.   :5.000   Max.   :3.000   Max.   :1.00000  
##      karnof            cd4            priorzdv           age       
##  Min.   : 70.00   Min.   :  0.00   Min.   :  3.00   Min.   :15.00  
##  1st Qu.: 90.00   1st Qu.: 22.25   1st Qu.: 11.00   1st Qu.:33.00  
##  Median : 90.00   Median : 75.00   Median : 21.00   Median :38.00  
##  Mean   : 91.34   Mean   : 86.45   Mean   : 30.63   Mean   :38.81  
##  3rd Qu.:100.00   3rd Qu.:135.75   3rd Qu.: 44.00   3rd Qu.:44.00  
##  Max.   :100.00   Max.   :348.00   Max.   :288.00   Max.   :73.00  
```

The data set contains a sample size equal to 851 participants and 16 different variables.

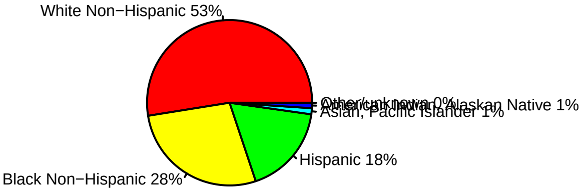
```
library(plotrix)
male<-sum(aids$sex==1)
female<-sum(aids$sex==2)
slices <- c(male, female)
lbls <- c("Male", "Female")
```

```r
pct <- round(slices/sum(slices)*100)
lbls <- paste(lbls, pct)
lbls <- paste(lbls,"%",sep="")
pie3D(slices,labels=lbls,explode=0.1,
   main="Gender Distribution ", cex.lab=0.1)
```

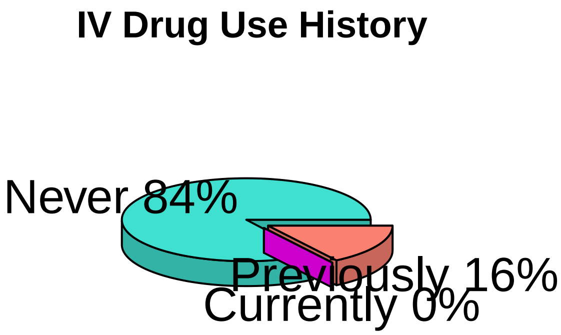


The Pie Chart represents the gender distribution in the sample, with 84% male and 16% female.

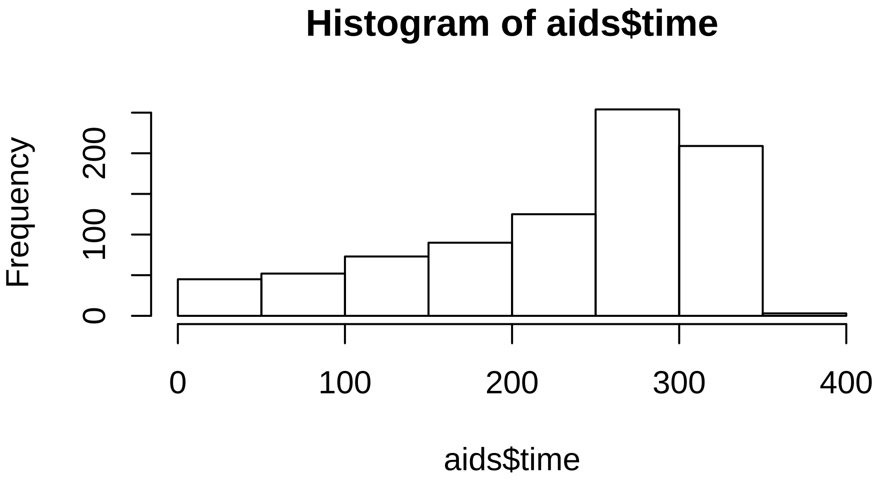
```r
wnh<-sum(aids$raceth==1)
bnh<-sum(aids$raceth==2)
h<-sum(aids$raceth==3)
api<-sum(aids$raceth==4)
aian<-sum(aids$raceth==5)
oth<-sum(aids$raceth==6)
slices <- c(wnh,bnh,h,api,aian,oth)
lbls <- c("White Non-Hispanic", "Black Non-Hispanic", "Hispanic","Asian, Pacific Islander", "American I
pct <- round(slices/sum(slices)*100)
lbls <- paste(lbls, pct)
lbls <- paste(lbls,"%",sep="")
pie(slices,lbls,col = rainbow(length(lbls)), cex=0.5 )
```

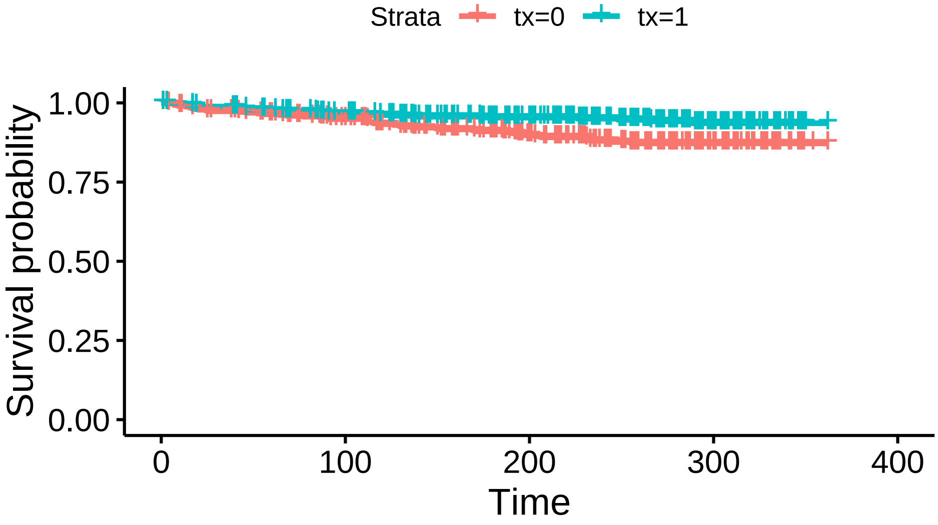


```r
never<-sum(aids$ivdrug==1)
cur<-sum(aids$ivdrug==2)
prev<-sum(aids$ivdrug==3)
slices <- c(never,cur,prev)
lbls <- c("Never", "Currently", "Previously")
pct <- round(slices/sum(slices)*100)
lbls <- paste(lbls, pct)
lbls <- paste(lbls,"%",sep="")
pie3D(slices,labels=lbls,explode=0.1,col=c("turquoise","magenta","salmon"),cex.sub=0.5,
   main="IV Drug Use History ")
```

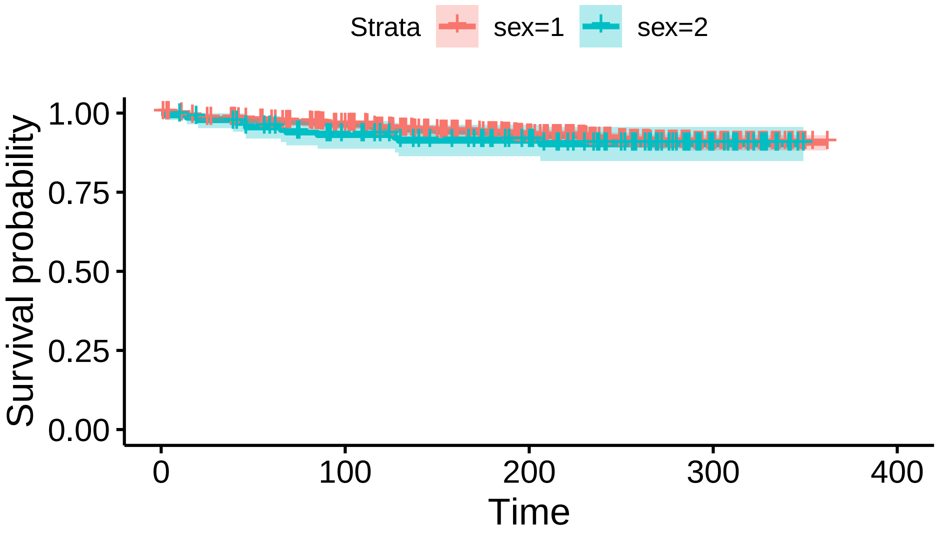


```
hist(aids$time)

###Data Plots

fit <- survfit(Surv(time,censor)~tx, data = aids)
ggsurvplot(fit,data = aids,conf.int = FALSE)
```

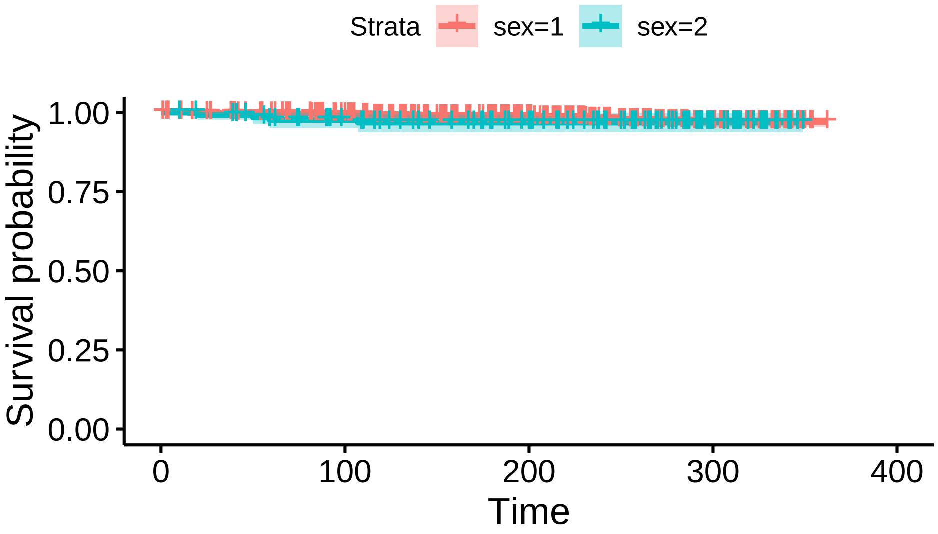




```
aids_fit_time <- survfit(Surv(time, censor) ~ sex, data=aids)
ggsurvplot(aids_fit_time, data=aids,  conf.int = TRUE)
```



```
aids_fit_time.d <- survfit(Surv(time_d, censor_d) ~ sex, data=aids)
ggsurvplot(aids_fit_time.d, data=aids,  conf.int = TRUE)
```



Survival Analysis

```
#mutation of age
aids <- read.csv( "http://pages.pomona.edu/~jsh04747/courses/math150/AIDSdata.csv")
aids <- aids %>%
  mutate(age = ifelse(age <= 20, "under20",
                             ifelse(age <=30, "20-30",
                                    ifelse(age <= 40, "30-40",
                                           ifelse(age <=50, "40-50",
                                                 ifelse(age <=60, "50-60",
                                                        ifelse(age <=70, "60-70", "over70"))))))) %>%
  mutate(age = factor(age,
                       levels = c("under20", "20-30", "30-40","40-50", "50-60","60-70","over70")),  sex
```

```r
library(survival)
library (survminer)
library(ggplot2)
library(broom)

coxph(Surv(time_d,censor_d) ~ sex , data=aids)  %>% tidy()
```

```
## # A tibble: 1 x 7
##   term    estimate std.error statistic p.value conf.low conf.high
##   <chr>      <dbl>     <dbl>     <dbl>   <dbl>    <dbl>     <dbl>
## 1 sexmale    0.390     0.559     0.697   0.486   -0.706      1.49
```

```r
coxph(Surv(time,censor) ~ sex, data=aids) %>% tidy()
```

```
## # A tibble: 1 x 7
##   term    estimate std.error statistic p.value conf.low conf.high
##   <chr>      <dbl>     <dbl>     <dbl>   <dbl>    <dbl>     <dbl>
## 1 sexmale    0.199     0.318     0.625   0.532   -0.424     0.821
```

```r
coxph(Surv(time,censor) ~ age+ txgrp+ karnof, data=aids) %>% tidy()
```

```
## # A tibble: 8 x 7
##   term      estimate std.error statistic       p.value conf.low conf.high
##   <chr>        <dbl>     <dbl>     <dbl>         <dbl>    <dbl>     <dbl>
## 1 age20-30   -0.438      1.07    -0.409   0.682             -2.53      1.66
## 2 age30-40   -0.442      1.02    -0.434   0.665             -2.44      1.55
## 3 age40-50   -0.361      1.03    -0.352   0.725             -2.37      1.65
## 4 age50-60    0.460      1.04     0.442   0.659             -1.58      2.50
## 5 age60-70   -0.780      1.42    -0.551   0.582             -3.55      2.00
## 6 ageover70 -14.1    2688.       -0.00525 0.996         -Inf      Inf
## 7 txgrp      -0.844      0.257   -3.28    0.00103           -1.35    -0.340
## 8 karnof     -0.0814     0.0138  -5.89    0.00000000385   -0.109   -0.0543
```

```r
cox.zph(coxph(Surv(time,censor) ~ age + txgrp+karnof, data=aids))
```

```
##                 rho    chisq     p
## age20-30   0.09054 5.70e-01 0.450
## age30-40   0.19294 2.53e+00 0.112
## age40-50   0.14871 1.50e+00 0.220
## age50-60   0.19861 2.69e+00 0.101
## age60-70   0.16251 1.81e+00 0.179
## ageover70  0.16355 2.57e-07 1.000
## txgrp     -0.10779 8.34e-01 0.361
## karnof     0.00121 1.03e-04 0.992
## GLOBAL          NA 7.98e+00 0.435
```

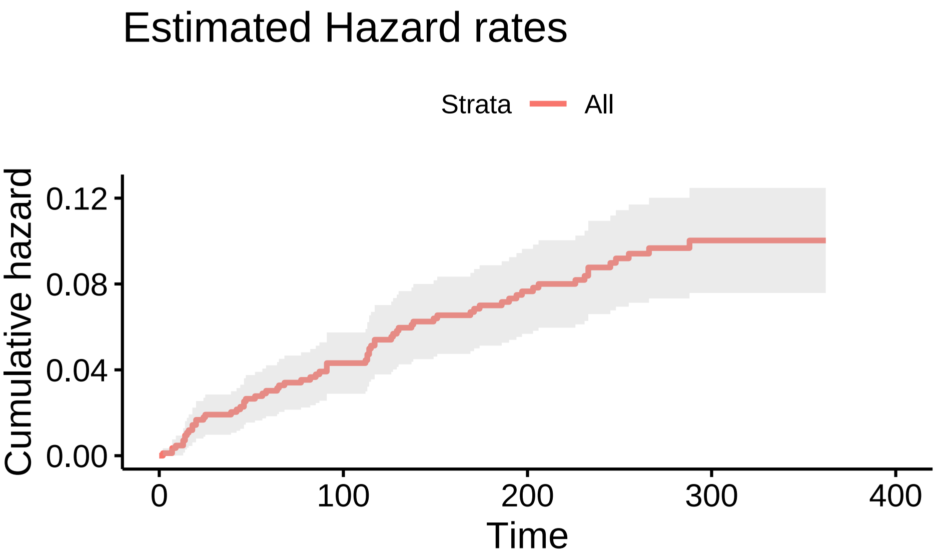
```r
coxph(Surv(time,censor) ~ age *txgrp*karnof, data=aids) %>% tidy()
```

```
## # A tibble: 27 x 7
##    term           estimate std.error  statistic p.value conf.low conf.high
##    <chr>             <dbl>     <dbl>      <dbl>   <dbl>    <dbl>     <dbl>
##  1 age20-30         307.     138277.  0.00222     0.998     -Inf       Inf
##  2 age30-40         319.     138277.  0.00231     0.998     -Inf       Inf
##  3 age40-50         327.     138277.  0.00237     0.998     -Inf       Inf
##  4 age50-60         343.     138277.  0.00248     0.998     -Inf       Inf
##  5 age60-70         287.     176491.  0.00163     0.999     -Inf       Inf
##  6 ageover70         -1.66    29414. -0.0000565   1.000     -Inf       Inf
##  7 txgrp            150.      92392.  0.00163     0.999     -Inf       Inf
##  8 karnof             3.36     1424.  0.00236     0.998     -Inf       Inf
##  9 age20-30:txgrp  -144.      92392. -0.00156     0.999     -Inf       Inf
## 10 age30-40:txgrp  -146.      92392. -0.00158     0.999     -Inf       Inf
## # ... with 17 more rows
```

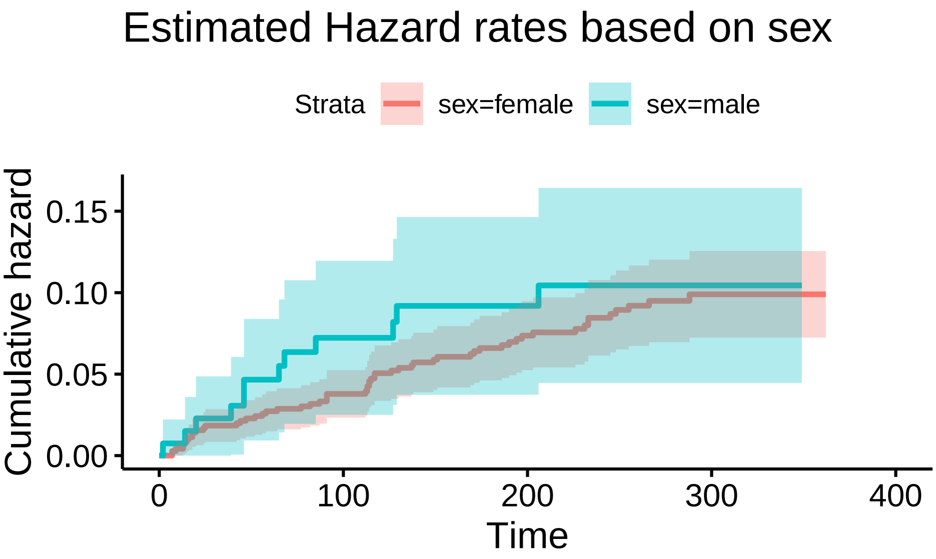
```
cox.zph(coxph(Surv(time,censor) ~ age *txgrp*karnof, data=aids))
```

```
##                              rho    chisq     p
## age20-30                 -0.1008 4.31e-08 1.000
## age30-40                 -0.1583 3.15e-08 1.000
## age40-50                 -0.0965 1.25e-08 1.000
## age50-60                 -0.2071 6.53e-08 1.000
## age60-70                 -0.2062 3.04e-08 1.000
## ageover70                -0.2493 7.81e-11 1.000
## txgrp                    -0.2032 2.68e-08 1.000
## karnof                   -0.1974 5.24e-08 1.000
## age20-30:txgrp            0.0921 2.14e-08 1.000
## age30-40:txgrp            0.1142 1.08e-08 1.000
## age40-50:txgrp            0.0826 5.64e-09 1.000
## age50-60:txgrp            0.1851 3.47e-08 1.000
## age60-70:txgrp            0.2102 2.15e-08 1.000
## ageover70:txgrp           0.1967 3.96e-11 1.000
## age20-30:karnof           0.0984 4.53e-08 1.000
## age30-40:karnof           0.1524 3.44e-08 1.000
## age40-50:karnof           0.0938 1.40e-08 1.000
## age50-60:karnof           0.2053 7.78e-08 1.000
## age60-70:karnof           0.1978 3.00e-08 1.000
## ageover70:karnof              NA      NaN   NaN
## txgrp:karnof              0.1996 2.81e-08 1.000
## age20-30:txgrp:karnof    -0.0910 2.15e-08 1.000
## age30-40:txgrp:karnof    -0.1020 9.71e-09 1.000
## age40-50:txgrp:karnof    -0.0823 6.23e-09 1.000
## age50-60:txgrp:karnof    -0.1796 3.72e-08 1.000
## age60-70:txgrp:karnof    -0.1981 1.98e-08 1.000
## ageover70:txgrp:karnof        NA      NaN   NaN
## GLOBAL                        NA 1.84e+01 0.891
```

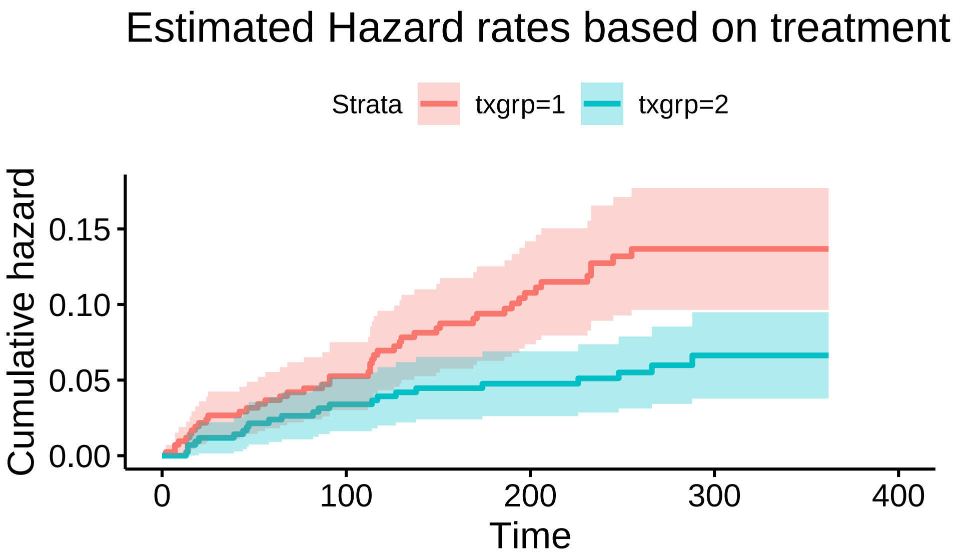
```
ggsurvplot(survfit(Surv(time,censor) ~ 1, data=aids),
           censor=F, conf.int=T, fun="cumhaz") + ggtitle("Estimated Hazard rates")
```



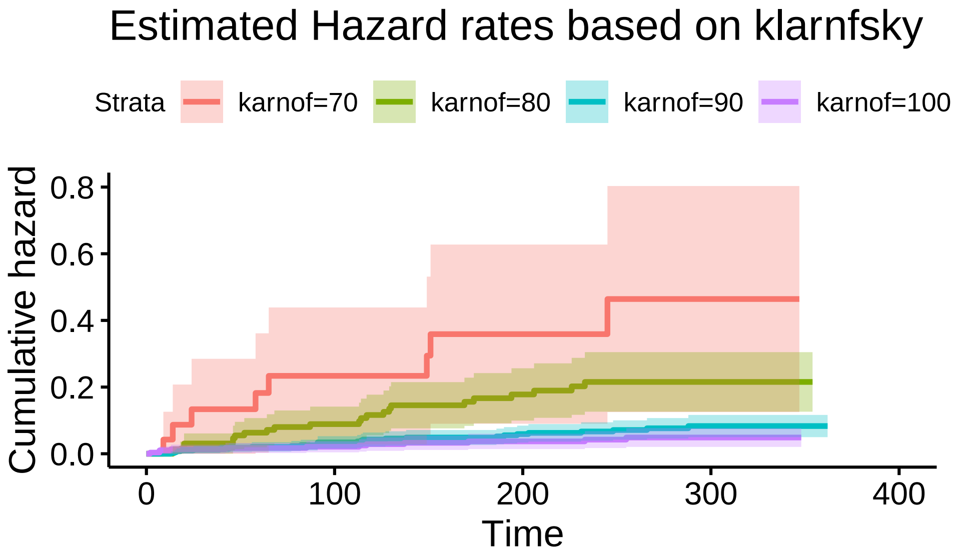
```r
ggsurvplot(survfit(Surv(time,censor) ~ sex, data=aids),
           censor=F, conf.int=T, fun="cumhaz") + ggtitle("Estimated Hazard rates based on sex")
```



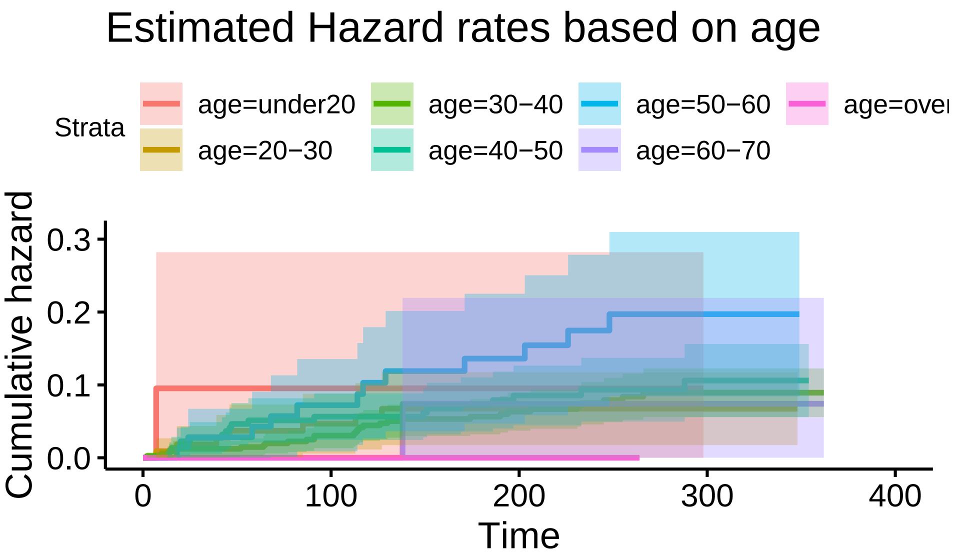
```r
ggsurvplot(survfit(Surv(time,censor) ~ txgrp, data=aids),
           censor=F, conf.int=T, fun="cumhaz") + ggtitle("Estimated Hazard rates based on treatment grou
```



```r
ggsurvplot(survfit(Surv(time,censor) ~ karnof, data=aids),
           censor=F, conf.int=T, fun="cumhaz") + ggtitle("Estimated Hazard rates based on klarnfsky")
```



```r
ggsurvplot(survfit(Surv(time,censor) ~ age, data=aids),
           censor=F, conf.int=T, fun="cumhaz") + ggtitle("Estimated Hazard rates based on age")
```



Juste's "Something New"