Untitled

```r
library(ISLR2)
library(survival)
library(coxed)
```

```
Loading required package: rms

Loading required package: Hmisc


Attaching package: 'Hmisc'

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

    format.pval, units

Loading required package: mgcv

Loading required package: nlme

This is mgcv 1.9-1. For overview type 'help("mgcv-package")'.
```

#labs #11.8.1 Brain Cancer Data

```r
names(BrainCancer)
```

```
[1] "sex"       "diagnosis" "loc"       "ki"        "gtv"       "stereo"
[7] "status"    "time"
```

```r
attach(BrainCancer)
table(sex)
```

```
sex
Female   Male
    45     43
```

```r
table(diagnosis)
```

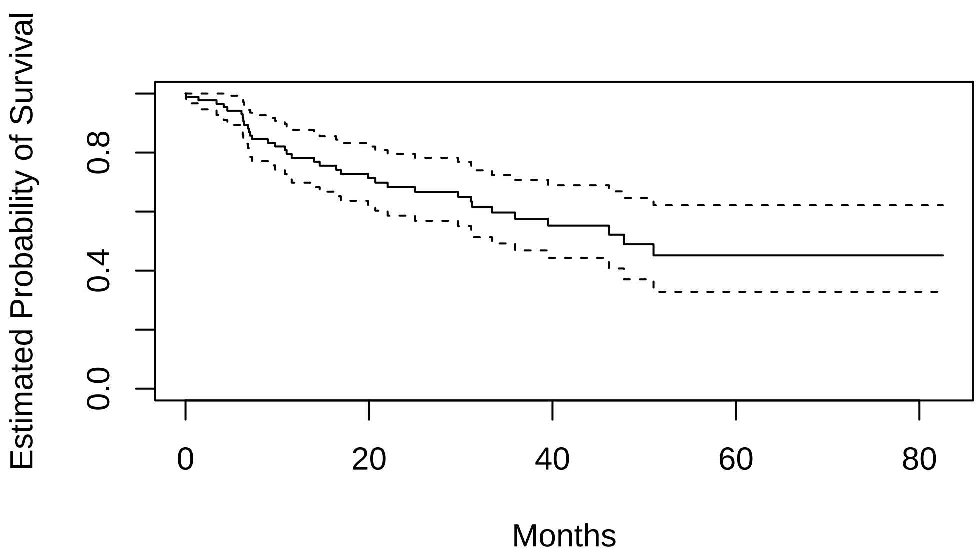
```
diagnosis
Meningioma  LG glioma  HG glioma      Other
        42          9         22         14
```

```r
table(status)
```

```
status
 0  1
53 35
```

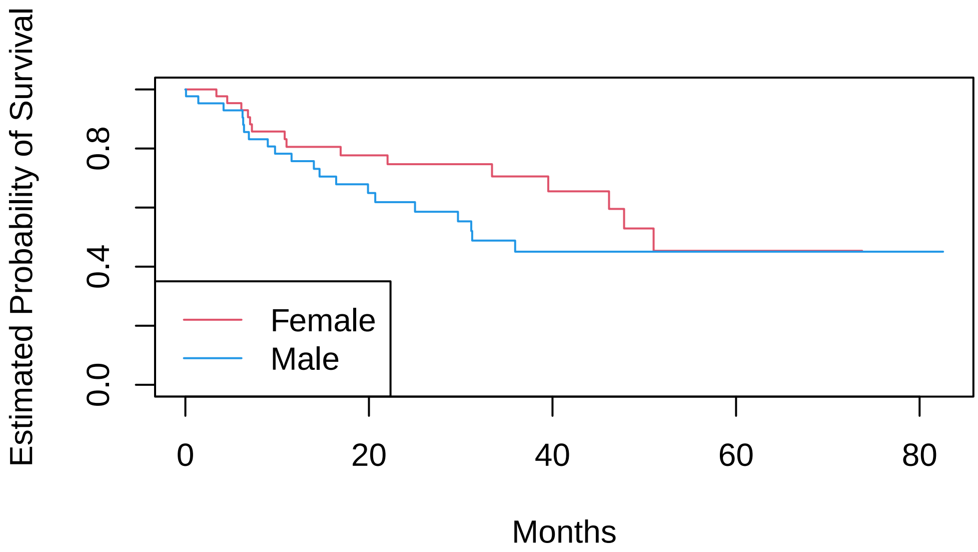
#create the Kaplan-Meier survival curve

```r
fit.surv <- survfit(Surv(time, status) ~ 1)
plot(fit.surv, xlab = "Months",
    ylab = "Estimated Probability of Survival")
```



#stratified by `sex`, Figure 11.3.

```r
fit.sex <- survfit(Surv(time, status) ~ sex)
plot(fit.sex, xlab = "Months",
    ylab = "Estimated Probability of Survival", col = c(2,4))
legend("bottomleft", levels(sex), col = c(2,4), lty = 1)
```



#a log-rank test to compare the survival of males to females

```r
logrank.test <- survdiff(Surv(time, status) ~ sex)
logrank.test
```

```
Call:
survdiff(formula = Surv(time, status) ~ sex)

            N Observed Expected (O-E)^2/E (O-E)^2/V
sex=Female 45       15     18.5     0.676      1.44
sex=Male   43       20     16.5     0.761      1.44

 Chisq= 1.4  on 1 degrees of freedom, p= 0.2
```

#fit Cox proportional hazards models

```r
fit.cox <- coxph(Surv(time, status) ~ sex)
summary(fit.cox)
```

```
Call:
coxph(formula = Surv(time, status) ~ sex)

  n= 88, number of events= 35

          coef exp(coef) se(coef)     z Pr(>|z|)
sexMale 0.4077    1.5033   0.3420 1.192    0.233

        exp(coef) exp(-coef) lower .95 upper .95
sexMale     1.503     0.6652     0.769     2.939

Concordance= 0.565  (se = 0.045 )
Likelihood ratio test= 1.44  on 1 df,   p=0.2
Wald test            = 1.42  on 1 df,   p=0.2
Score (logrank) test = 1.44  on 1 df,   p=0.2
```

```r
summary(fit.cox)$logtest[1]
```

```
    test
1.438822
```

```r
summary(fit.cox)$waldtest[1]
```

```
test
1.42
```

```r
summary(fit.cox)$sctest[1]
```

```
    test
1.440495
```

```r
logrank.test$chisq
```

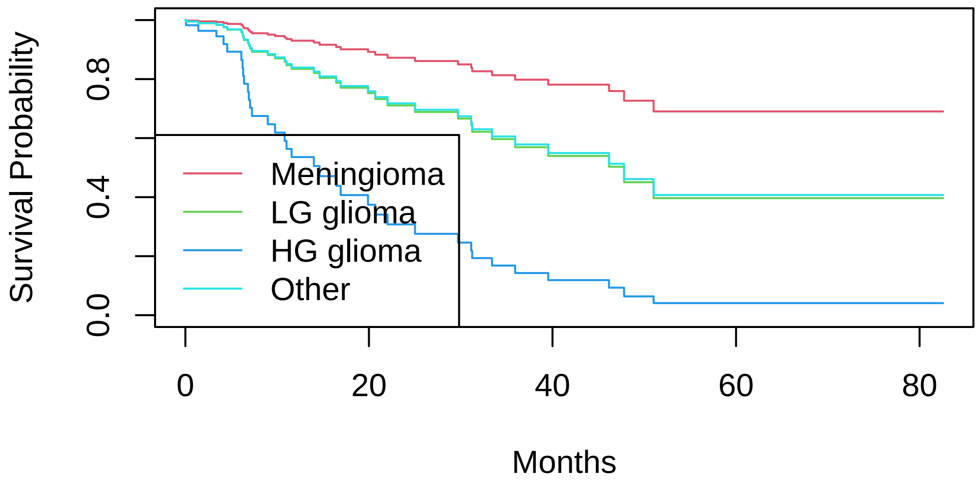
```
[1] 1.440495
```

#fit a model that makes use of additional predictors.

```r
fit.all <- coxph(
Surv(time, status) ~ sex + diagnosis + loc + ki + gtv +
  stereo)
fit.all
```

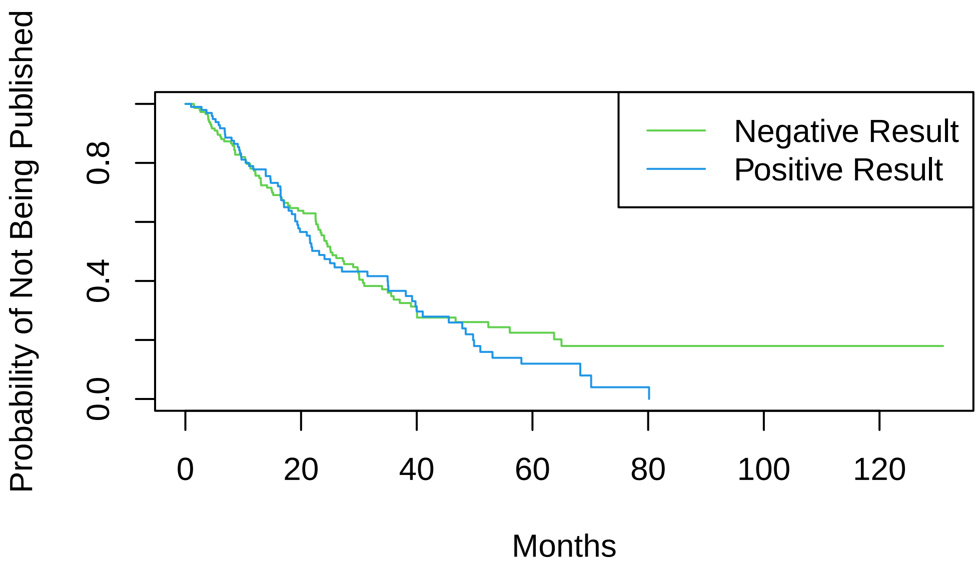
```
Call:
coxph(formula = Surv(time, status) ~ sex + diagnosis + loc +
    ki + gtv + stereo)

                        coef exp(coef) se(coef)      z        p
sexMale              0.18375   1.20171  0.36036  0.510  0.61012
diagnosisLG glioma   0.91502   2.49683  0.63816  1.434  0.15161
diagnosisHG glioma   2.15457   8.62414  0.45052  4.782 1.73e-06
diagnosisOther       0.88570   2.42467  0.65787  1.346  0.17821
locSupratentorial    0.44119   1.55456  0.70367  0.627  0.53066
ki                  -0.05496   0.94653  0.01831 -3.001  0.00269
gtv                  0.03429   1.03489  0.02233  1.536  0.12466
stereoSRT            0.17778   1.19456  0.60158  0.296  0.76760

Likelihood ratio test=41.37  on 8 df, p=1.776e-06
n= 87, number of events= 35
   (1 observation deleted due to missingness)
```

```r
modaldata <- data.frame(
     diagnosis = levels(diagnosis),
     sex = rep("Female", 4),
     loc = rep("Supratentorial", 4),
     ki = rep(mean(ki), 4),
     gtv = rep(mean(gtv), 4),
     stereo = rep("SRT", 4)
     )
survplots <- survfit(fit.all, newdata = modaldata)
plot(survplots, xlab = "Months",
    ylab = "Survival Probability", col = 2:5)
legend("bottomleft", levels(diagnosis), col = 2:5, lty = 1)
```



#11.8.2 Publication Data #plotting the Kaplan-Meier curves stratified on the `posres`

```
fit.posres <- survfit(
    Surv(time, status) ~ posres, data = Publication
  )
plot(fit.posres, xlab = "Months",
    ylab = "Probability of Not Being Published", col = 3:4)
legend("topright", c("Negative Result", "Positive Result"),
    col = 3:4, lty = 1)
```



#fitting Cox's proportional hazards model to the `posres` variable

```r
fit.pub <- coxph(Surv(time, status) ~ posres,
    data = Publication)
fit.pub
```

```
Call:
coxph(formula = Surv(time, status) ~ posres, data = Publication)

         coef exp(coef) se(coef)     z    p
posres 0.1481    1.1596   0.1616 0.916 0.36

Likelihood ratio test=0.83  on 1 df, p=0.3611
n= 244, number of events= 156
```

#log-rank test

```r
logrank.test <- survdiff(Surv(time, status) ~ posres,
    data = Publication)
logrank.test
```

```
Call:
survdiff(formula = Surv(time, status) ~ posres, data = Publication)

           N Observed Expected (O-E)^2/E (O-E)^2/V
posres=0 146       87     92.6     0.341     0.844
posres=1  98       69     63.4     0.498     0.844

 Chisq= 0.8  on 1 degrees of freedom, p= 0.4
```

#include other predictors in the model

```r
fit.pub2 <- coxph(Surv(time, status) ~ . - mech,
    data = Publication)
fit.pub2
```

```
Call:
coxph(formula = Surv(time, status) ~ . - mech, data = Publication)

               coef  exp(coef)   se(coef)      z       p
posres    5.708e-01  1.770e+00  1.760e-01  3.244 0.00118
multi    -4.086e-02  9.600e-01  2.512e-01 -0.163 0.87079
```

```
clinend   5.462e-01  1.727e+00  2.620e-01  2.085 0.03710
sampsize  4.678e-06  1.000e+00  1.472e-05  0.318 0.75070
budget    4.385e-03  1.004e+00  2.465e-03  1.779 0.07518
impact    5.832e-02  1.060e+00  6.676e-03  8.735 < 2e-16

Likelihood ratio test=149.2  on 6 df, p=< 2.2e-16
n= 244, number of events= 156
```

#11.8.3 Call Center Data

```r
set.seed(4)
N <- 2000
Operators <- sample(5:15, N, replace = T)
Center <- sample(c("A", "B", "C"), N, replace = T)
Time <- sample(c("Morn.", "After.", "Even."), N, replace = T)
X <- model.matrix( ~ Operators + Center + Time)[, -1]

#specify the coefficients and the hazard function
true.beta <- c(0.04, -0.3, 0, 0.2, -0.2)
h.fn <- function(x) return(0.00001 * x)
```

#Cox proportional hazards model

```r
queuing <- sim.survdata(N = N, T = 1000, X = X,
    beta = true.beta, hazard.fun = h.fn)
```

```
Warning in FUN(X[[i]], ...): 9 additional observations right-censored because the user-suppli
                                  is nonzero at the latest timepoint. To avoid these extra ce
```

```r
names(queuing)
```

```
[1] "data"             "xdata"            "baseline"         "xb"
[5] "exp.xb"           "betas"            "ind.survive"      "marg.effect"
[9] "marg.effect.data"
```

```r
head(queuing$data)
```

```
  Operators CenterB CenterC TimeEven. TimeMorn.   y failed
1        12       1       0         0         1 344   TRUE
2        15       0       0         0         0 241   TRUE
```

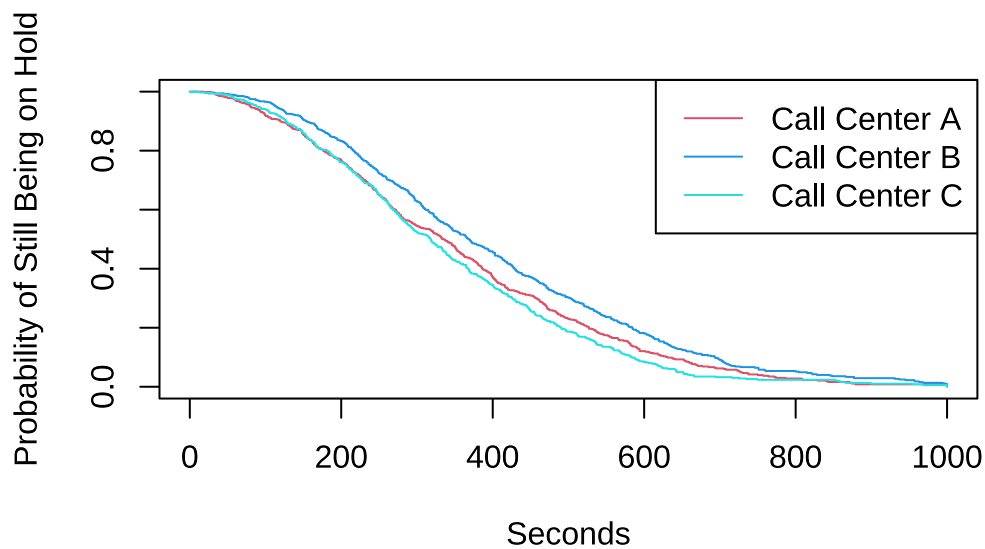
```
3           7         0       1         1         0  187    TRUE
4           7         0       0         0         0  279    TRUE
5          11         0       1         0         1  954    TRUE
6           7         1       0         0         1  455    TRUE
```

```
mean(queuing$data$failed)
```

```
[1] 0.89
```

#plot Kaplan-Meier survival curves. stratify by `Center`.

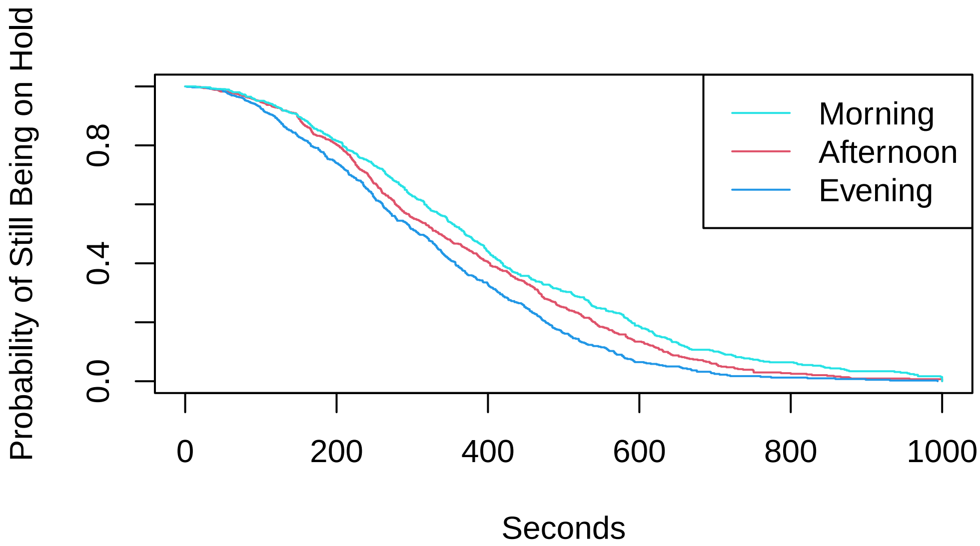
```
fit.Center <- survfit(Surv(y, failed) ~ Center,
    data = queuing$data)
plot(fit.Center, xlab = "Seconds",
    ylab = "Probability of Still Being on Hold",
    col = c(2, 4, 5))
legend("topright",
     c("Call Center A", "Call Center B", "Call Center C"),
     col = c(2, 4, 5), lty = 1)
```



#stratify by `Time`.

```
fit.Time <- survfit(Surv(y, failed) ~ Time,
   data = queuing$data)
plot(fit.Time, xlab = "Seconds",
```

```r
    ylab = "Probability of Still Being on Hold",
    col = c(2, 4, 5))
legend("topright", c("Morning", "Afternoon", "Evening"),
    col = c(5, 2, 4), lty = 1)
```




```r
survdiff(Surv(y, failed) ~ Center, data = queuing$data)
```

```
Call:
survdiff(formula = Surv(y, failed) ~ Center, data = queuing$data)

           N Observed Expected (O-E)^2/E (O-E)^2/V
Center=A 683      603      579     0.971      1.45
Center=B 667      600      701    14.641     24.64
Center=C 650      577      499    12.062     17.05

 Chisq= 28.3  on 2 degrees of freedom, p= 7e-07
```

```r
survdiff(Surv(y, failed) ~ Time, data = queuing$data)
```

```
Call:
survdiff(formula = Surv(y, failed) ~ Time, data = queuing$data)

              N Observed Expected (O-E)^2/E (O-E)^2/V
Time=After. 688      616      619    0.0135     0.021
Time=Even.  653      582      468   27.6353    38.353
```

```
Time=Morn.  659      582      693   17.7381    29.893

 Chisq= 46.8  on 2 degrees of freedom, p= 7e-11
```

#fit Cox's proportional hazards model to the data.

```r
fit.queuing <- coxph(Surv(y, failed) ~ .,
    data = queuing$data)
fit.queuing
```

```
Call:
coxph(formula = Surv(y, failed) ~ ., data = queuing$data)

              coef exp(coef) se(coef)      z        p
Operators  0.04174   1.04263  0.00759  5.500  3.8e-08
CenterB   -0.21879   0.80349  0.05793 -3.777 0.000159
CenterC    0.07930   1.08253  0.05850  1.356 0.175256
TimeEven.  0.20904   1.23249  0.05820  3.592 0.000328
TimeMorn. -0.17352   0.84070  0.05811 -2.986 0.002828

Likelihood ratio test=102.8  on 5 df, p=< 2.2e-16
n= 2000, number of events= 1780
```