Survival Analysis

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## Solution:

The following code chunk displays the setup procedure:

#Installing the 'coin' & 'TH.data' package (commented out as not necessary)  
#install.packages("coin")  
#install.packages("TH.data")  
  
# Loading the data sets  
library("coin")  
library("TH.data")  
  
data("glioma")  
data("GBSG2")  
  
head(glioma)

## no. age sex histology group event time  
## 1 1 41 Female Grade3 RIT TRUE 53  
## 2 2 45 Female Grade3 RIT FALSE 28  
## 3 3 48 Male Grade3 RIT FALSE 69  
## 4 4 54 Male Grade3 RIT FALSE 58  
## 5 5 40 Female Grade3 RIT FALSE 54  
## 6 6 31 Male Grade3 RIT TRUE 25

head(GBSG2)

## horTh age menostat tsize tgrade pnodes progrec estrec time cens  
## 1 no 70 Post 21 II 3 48 66 1814 1  
## 2 yes 56 Post 12 II 7 61 77 2018 1  
## 3 yes 58 Post 35 II 9 52 271 712 1  
## 4 yes 59 Post 17 II 4 60 29 1807 1  
## 5 no 73 Post 35 II 1 26 65 772 1  
## 6 no 32 Pre 57 III 24 0 13 448 1

summary(glioma)

## no. age sex histology group   
## Min. : 1.000 Min. :19.00 Female:16 GBM :20 Control:18   
## 1st Qu.: 5.000 1st Qu.:40.00 Male :21 Grade3:17 RIT :19   
## Median :10.000 Median :47.00   
## Mean : 9.757 Mean :48.49   
## 3rd Qu.:14.000 3rd Qu.:57.00   
## Max. :19.000 Max. :83.00   
## event time   
## Mode :logical Min. : 5.00   
## FALSE:14 1st Qu.:13.00   
## TRUE :23 Median :28.00   
## NA's :0 Mean :30.84   
## 3rd Qu.:50.00   
## Max. :69.00

summary(GBSG2)

## horTh age menostat tsize tgrade   
## no :440 Min. :21.00 Pre :290 Min. : 3.00 I : 81   
## yes:246 1st Qu.:46.00 Post:396 1st Qu.: 20.00 II :444   
## Median :53.00 Median : 25.00 III:161   
## Mean :53.05 Mean : 29.33   
## 3rd Qu.:61.00 3rd Qu.: 35.00   
## Max. :80.00 Max. :120.00   
## pnodes progrec estrec time   
## Min. : 1.00 Min. : 0.0 Min. : 0.00 Min. : 8.0   
## 1st Qu.: 1.00 1st Qu.: 7.0 1st Qu.: 8.00 1st Qu.: 567.8   
## Median : 3.00 Median : 32.5 Median : 36.00 Median :1084.0   
## Mean : 5.01 Mean : 110.0 Mean : 96.25 Mean :1124.5   
## 3rd Qu.: 7.00 3rd Qu.: 131.8 3rd Qu.: 114.00 3rd Qu.:1684.8   
## Max. :51.00 Max. :2380.0 Max. :1144.00 Max. :2659.0   
## cens   
## Min. :0.0000   
## 1st Qu.:0.0000   
## Median :0.0000   
## Mean :0.4359   
## 3rd Qu.:1.0000   
## Max. :1.0000

* After loading the two data sets, execute the commands in this lecture three times:
* First, using glioma and the two groupings based on the sex column

# Checking the levels of 'sex' covariate  
levels(glioma$sex)

## [1] "Female" "Male"

# Comparing time across sexes  
table(subset(glioma, sex=="Female", select = time))

##   
## 5 8 9 14 25 28 36 43 48 50 53 54 59   
## 1 3 1 2 1 1 1 1 1 1 1 1 1

table(subset(glioma, sex=="Male", select = time))

##   
## 6 8 11 12 13 14 15 19 20 25 31 32 34 36 50 51 57 58 61 69   
## 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1

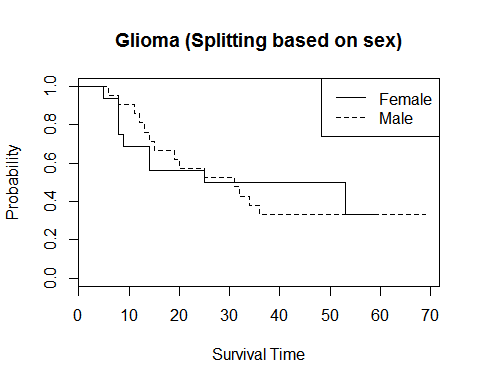
# Building the 'Surv' Object  
surv1<-Surv(time=glioma$time, event=glioma$event)  
summary(surv1)

## time status   
## Min. : 5.00 Min. :0.0000   
## 1st Qu.:13.00 1st Qu.:0.0000   
## Median :28.00 Median :1.0000   
## Mean :30.84 Mean :0.6216   
## 3rd Qu.:50.00 3rd Qu.:1.0000   
## Max. :69.00 Max. :1.0000

# Estimating the Survival Curve  
survf1<-survfit(formula = surv1~glioma$sex, data=glioma)  
summary(survf1)

## Call: survfit(formula = surv1 ~ glioma$sex, data = glioma)  
##   
## glioma$sex=Female   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 5 16 1 0.938 0.0605 0.826 1.000  
## 8 15 3 0.750 0.1083 0.565 0.995  
## 9 12 1 0.688 0.1159 0.494 0.957  
## 14 11 2 0.562 0.1240 0.365 0.867  
## 25 9 1 0.500 0.1250 0.306 0.816  
## 53 3 1 0.333 0.1596 0.130 0.852  
##   
## glioma$sex=Male   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 6 21 1 0.952 0.0465 0.866 1.000  
## 8 20 1 0.905 0.0641 0.788 1.000  
## 11 19 1 0.857 0.0764 0.720 1.000  
## 12 18 1 0.810 0.0857 0.658 0.996  
## 13 17 1 0.762 0.0929 0.600 0.968  
## 14 16 1 0.714 0.0986 0.545 0.936  
## 15 15 1 0.667 0.1029 0.493 0.902  
## 19 14 1 0.619 0.1060 0.443 0.866  
## 20 13 1 0.571 0.1080 0.395 0.828  
## 25 12 1 0.524 0.1090 0.348 0.788  
## 31 11 1 0.476 0.1090 0.304 0.746  
## 32 10 1 0.429 0.1080 0.262 0.702  
## 34 9 1 0.381 0.1060 0.221 0.657  
## 36 8 1 0.333 0.1029 0.182 0.610

# Plotting the results  
plot(survf1, lty=1:2, main="Glioma (Splitting based on sex)", ylab = "Probability", xlab="Survival Time")  
legend("topright",legend=levels(glioma$sex), lty=1:2)



The above calculations and plot shows us that as time increases, initially Males have a higher chance of survival, but later, we observe that Females have a higher chance of survival. This eventually balances out to less than 40% chance of survival after more than 50 months.

* Second, using glioma and the two groupings based on the histology column

# Checking the levels of 'histology' covariate  
levels(glioma$histology)

## [1] "GBM" "Grade3"

# Comparing time across hoistology levels  
table(subset(glioma, histology=="GBM", select = time))

##   
## 5 6 8 11 12 13 14 15 20 25 31 36 43 59   
## 1 1 4 1 1 1 3 1 1 1 1 2 1 1

table(subset(glioma, histology=="Grade3", select = time))

##   
## 9 19 25 28 32 34 48 50 51 53 54 57 58 61 69   
## 1 1 1 1 1 1 1 2 1 1 1 2 1 1 1

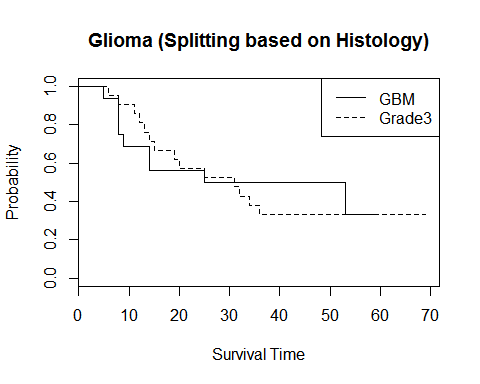
# Building the 'Surv' Object  
surv2<-Surv(time=glioma$time, event=glioma$event)  
summary(surv2)

## time status   
## Min. : 5.00 Min. :0.0000   
## 1st Qu.:13.00 1st Qu.:0.0000   
## Median :28.00 Median :1.0000   
## Mean :30.84 Mean :0.6216   
## 3rd Qu.:50.00 3rd Qu.:1.0000   
## Max. :69.00 Max. :1.0000

# Estimating the Survival Curve  
survf2<-survfit(formula = surv2~glioma$sex, data=glioma)  
summary(survf2)

## Call: survfit(formula = surv2 ~ glioma$sex, data = glioma)  
##   
## glioma$sex=Female   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 5 16 1 0.938 0.0605 0.826 1.000  
## 8 15 3 0.750 0.1083 0.565 0.995  
## 9 12 1 0.688 0.1159 0.494 0.957  
## 14 11 2 0.562 0.1240 0.365 0.867  
## 25 9 1 0.500 0.1250 0.306 0.816  
## 53 3 1 0.333 0.1596 0.130 0.852  
##   
## glioma$sex=Male   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 6 21 1 0.952 0.0465 0.866 1.000  
## 8 20 1 0.905 0.0641 0.788 1.000  
## 11 19 1 0.857 0.0764 0.720 1.000  
## 12 18 1 0.810 0.0857 0.658 0.996  
## 13 17 1 0.762 0.0929 0.600 0.968  
## 14 16 1 0.714 0.0986 0.545 0.936  
## 15 15 1 0.667 0.1029 0.493 0.902  
## 19 14 1 0.619 0.1060 0.443 0.866  
## 20 13 1 0.571 0.1080 0.395 0.828  
## 25 12 1 0.524 0.1090 0.348 0.788  
## 31 11 1 0.476 0.1090 0.304 0.746  
## 32 10 1 0.429 0.1080 0.262 0.702  
## 34 9 1 0.381 0.1060 0.221 0.657  
## 36 8 1 0.333 0.1029 0.182 0.610

# Plotting the results  
plot(survf2, lty=1:2, main="Glioma (Splitting based on Histology)", ylab = "Probability", xlab="Survival Time")  
legend("topright",legend=levels(glioma$histology), lty=1:2)



As seen with the case of splitting based on sex, splitting based on histology leads to similar results with the GBM and Grade3 histologies as seen by the plot above.

* Third, using the GBSG2 data frame from the TH.data package, using the column horTH to split the data frame into two groups

# Checking the levels of 'horTH' covariate  
levels(GBSG2$horTh)

## [1] "no" "yes"

# Comparing time across horTH  
table(subset(GBSG2, GBSG2$horTH=="no", select = time))

## < table of extent 0 >

table(subset(GBSG2, GBSG2$horTH=="yes", select = time))

## < table of extent 0 >

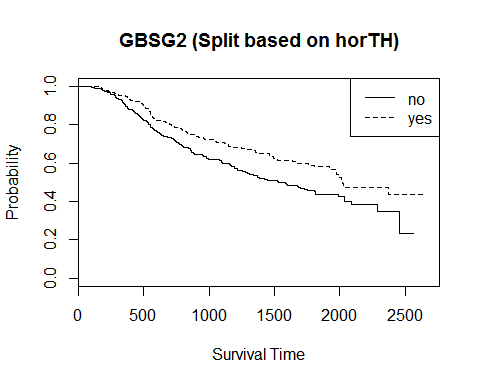
# Building the 'Surv' Object  
surv3<-Surv(time=GBSG2$time, event=GBSG2$cens)  
summary(surv3)

## time status   
## Min. : 8.0 Min. :0.0000   
## 1st Qu.: 567.8 1st Qu.:0.0000   
## Median :1084.0 Median :0.0000   
## Mean :1124.5 Mean :0.4359   
## 3rd Qu.:1684.8 3rd Qu.:1.0000   
## Max. :2659.0 Max. :1.0000

# Estimating the Survival Curve  
survf3<-survfit(formula = surv3~GBSG2$horTh, data=GBSG2)  
summary(survf3)

## Call: survfit(formula = surv3 ~ GBSG2$horTh, data = GBSG2)  
##   
## GBSG2$horTh=no   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 72 430 1 0.998 0.00232 0.9931 1.000  
## 98 429 1 0.995 0.00328 0.9889 1.000  
## 113 428 1 0.993 0.00401 0.9852 1.000  
## 120 427 1 0.991 0.00463 0.9817 1.000  
## 160 425 1 0.988 0.00517 0.9783 0.999  
## 171 424 1 0.986 0.00566 0.9750 0.997  
## 173 423 1 0.984 0.00611 0.9718 0.996  
## 175 422 1 0.981 0.00652 0.9687 0.994  
## 181 420 1 0.979 0.00691 0.9656 0.993  
## 191 419 1 0.977 0.00728 0.9625 0.991  
## 195 418 1 0.974 0.00763 0.9595 0.989  
## 205 416 1 0.972 0.00796 0.9565 0.988  
## 223 415 1 0.970 0.00828 0.9536 0.986  
## 233 414 1 0.967 0.00859 0.9507 0.984  
## 241 413 1 0.965 0.00888 0.9477 0.983  
## 242 412 1 0.963 0.00916 0.9449 0.981  
## 247 411 1 0.960 0.00943 0.9420 0.979  
## 249 410 1 0.958 0.00970 0.9391 0.977  
## 251 409 1 0.956 0.00995 0.9363 0.975  
## 272 408 1 0.953 0.01020 0.9335 0.973  
## 281 405 2 0.949 0.01068 0.9279 0.970  
## 285 403 2 0.944 0.01113 0.9223 0.966  
## 288 401 1 0.942 0.01135 0.9195 0.964  
## 293 400 1 0.939 0.01156 0.9168 0.962  
## 305 399 1 0.937 0.01177 0.9140 0.960  
## 307 398 1 0.934 0.01198 0.9113 0.958  
## 308 397 1 0.932 0.01217 0.9085 0.956  
## 316 395 1 0.930 0.01237 0.9058 0.954  
## 329 393 1 0.927 0.01256 0.9031 0.952  
## 336 392 1 0.925 0.01275 0.9004 0.950  
## 338 391 3 0.918 0.01330 0.8922 0.944  
## 343 388 1 0.916 0.01347 0.8895 0.942  
## 344 387 1 0.913 0.01364 0.8868 0.940  
## 348 386 1 0.911 0.01381 0.8841 0.938  
## 350 385 1 0.908 0.01398 0.8815 0.936  
## 353 384 1 0.906 0.01414 0.8788 0.934  
## 358 383 1 0.904 0.01430 0.8761 0.932  
## 359 382 2 0.899 0.01461 0.8708 0.928  
## 360 380 1 0.897 0.01476 0.8682 0.926  
## 370 379 2 0.892 0.01506 0.8629 0.922  
## 371 377 1 0.890 0.01520 0.8602 0.920  
## 372 376 1 0.887 0.01534 0.8576 0.918  
## 375 375 1 0.885 0.01548 0.8550 0.916  
## 379 374 1 0.882 0.01562 0.8523 0.914  
## 385 373 1 0.880 0.01576 0.8497 0.911  
## 403 372 1 0.878 0.01589 0.8471 0.909  
## 415 371 1 0.875 0.01603 0.8445 0.907  
## 417 370 1 0.873 0.01616 0.8419 0.905  
## 420 369 2 0.868 0.01641 0.8367 0.901  
## 426 366 1 0.866 0.01654 0.8340 0.899  
## 436 365 1 0.863 0.01666 0.8314 0.897  
## 438 364 1 0.861 0.01678 0.8288 0.895  
## 446 363 1 0.859 0.01690 0.8262 0.893  
## 448 362 1 0.856 0.01702 0.8236 0.890  
## 449 361 1 0.854 0.01714 0.8211 0.888  
## 455 360 1 0.852 0.01726 0.8185 0.886  
## 456 359 1 0.849 0.01737 0.8159 0.884  
## 460 358 1 0.847 0.01748 0.8133 0.882  
## 465 356 1 0.845 0.01759 0.8107 0.880  
## 471 355 1 0.842 0.01771 0.8081 0.878  
## 476 354 2 0.837 0.01792 0.8030 0.873  
## 481 352 1 0.835 0.01803 0.8004 0.871  
## 486 351 1 0.833 0.01813 0.7978 0.869  
## 490 349 1 0.830 0.01824 0.7952 0.867  
## 491 348 2 0.825 0.01844 0.7901 0.862  
## 495 346 1 0.823 0.01854 0.7875 0.860  
## 503 345 1 0.821 0.01864 0.7849 0.858  
## 518 344 1 0.818 0.01874 0.7824 0.856  
## 525 343 1 0.816 0.01884 0.7798 0.854  
## 529 341 1 0.814 0.01893 0.7772 0.851  
## 530 339 1 0.811 0.01903 0.7747 0.849  
## 535 338 1 0.809 0.01912 0.7721 0.847  
## 536 337 1 0.806 0.01922 0.7695 0.845  
## 537 336 1 0.804 0.01931 0.7670 0.843  
## 544 334 1 0.802 0.01940 0.7644 0.840  
## 545 333 1 0.799 0.01949 0.7618 0.838  
## 547 331 1 0.797 0.01958 0.7592 0.836  
## 548 330 1 0.794 0.01967 0.7566 0.834  
## 550 329 2 0.789 0.01984 0.7515 0.829  
## 552 327 1 0.787 0.01993 0.7489 0.827  
## 554 325 1 0.785 0.02001 0.7463 0.825  
## 563 324 1 0.782 0.02010 0.7438 0.823  
## 571 321 1 0.780 0.02018 0.7412 0.820  
## 575 320 1 0.777 0.02027 0.7386 0.818  
## 578 319 1 0.775 0.02035 0.7360 0.816  
## 579 318 1 0.772 0.02043 0.7334 0.814  
## 586 317 1 0.770 0.02051 0.7308 0.811  
## 594 316 2 0.765 0.02067 0.7257 0.807  
## 595 314 1 0.763 0.02075 0.7231 0.804  
## 600 312 1 0.760 0.02082 0.7205 0.802  
## 612 311 1 0.758 0.02090 0.7179 0.800  
## 622 309 1 0.755 0.02097 0.7153 0.798  
## 624 306 2 0.750 0.02113 0.7101 0.793  
## 629 303 1 0.748 0.02120 0.7075 0.791  
## 637 300 1 0.745 0.02128 0.7049 0.788  
## 646 298 1 0.743 0.02135 0.7023 0.786  
## 650 297 1 0.740 0.02143 0.6996 0.784  
## 670 291 1 0.738 0.02150 0.6969 0.781  
## 679 289 1 0.735 0.02158 0.6942 0.779  
## 687 288 1 0.733 0.02165 0.6916 0.776  
## 707 286 1 0.730 0.02173 0.6889 0.774  
## 714 285 1 0.728 0.02180 0.6862 0.772  
## 727 282 1 0.725 0.02188 0.6834 0.769  
## 731 281 1 0.723 0.02195 0.6807 0.767  
## 732 280 1 0.720 0.02203 0.6780 0.764  
## 742 274 1 0.717 0.02210 0.6753 0.762  
## 745 273 1 0.715 0.02218 0.6725 0.759  
## 747 272 1 0.712 0.02225 0.6697 0.757  
## 748 271 1 0.709 0.02232 0.6670 0.755  
## 754 270 1 0.707 0.02239 0.6642 0.752  
## 762 267 1 0.704 0.02247 0.6615 0.750  
## 769 264 1 0.701 0.02254 0.6587 0.747  
## 772 263 1 0.699 0.02261 0.6559 0.745  
## 776 261 1 0.696 0.02268 0.6531 0.742  
## 790 259 1 0.693 0.02275 0.6503 0.740  
## 795 257 1 0.691 0.02282 0.6474 0.737  
## 797 256 1 0.688 0.02289 0.6446 0.734  
## 801 254 1 0.685 0.02296 0.6418 0.732  
## 805 253 1 0.683 0.02303 0.6389 0.729  
## 819 252 1 0.680 0.02310 0.6361 0.727  
## 838 251 1 0.677 0.02316 0.6333 0.724  
## 842 249 1 0.674 0.02323 0.6305 0.722  
## 855 246 1 0.672 0.02330 0.6276 0.719  
## 857 245 1 0.669 0.02336 0.6247 0.716  
## 859 243 1 0.666 0.02343 0.6219 0.714  
## 861 241 1 0.663 0.02349 0.6190 0.711  
## 865 240 1 0.661 0.02356 0.6161 0.709  
## 866 239 1 0.658 0.02362 0.6133 0.706  
## 867 238 1 0.655 0.02368 0.6104 0.703  
## 876 236 1 0.652 0.02375 0.6075 0.701  
## 883 234 1 0.650 0.02381 0.6046 0.698  
## 889 233 1 0.647 0.02387 0.6017 0.695  
## 891 232 1 0.644 0.02393 0.5988 0.693  
## 945 225 1 0.641 0.02399 0.5959 0.690  
## 956 224 1 0.638 0.02405 0.5929 0.687  
## 959 223 1 0.635 0.02412 0.5899 0.685  
## 960 222 1 0.633 0.02418 0.5870 0.682  
## 981 216 1 0.630 0.02424 0.5839 0.679  
## 982 215 1 0.627 0.02430 0.5809 0.676  
## 983 214 1 0.624 0.02437 0.5778 0.673  
## 991 212 1 0.621 0.02443 0.5748 0.671  
## 1002 210 1 0.618 0.02449 0.5717 0.668  
## 1080 207 1 0.615 0.02455 0.5686 0.665  
## 1090 203 1 0.612 0.02462 0.5655 0.662  
## 1093 201 1 0.609 0.02468 0.5624 0.659  
## 1094 199 1 0.606 0.02475 0.5592 0.656  
## 1105 195 2 0.600 0.02488 0.5528 0.650  
## 1108 193 1 0.596 0.02495 0.5495 0.647  
## 1157 188 1 0.593 0.02501 0.5463 0.644  
## 1162 187 1 0.590 0.02508 0.5430 0.641  
## 1164 186 1 0.587 0.02515 0.5397 0.638  
## 1170 184 1 0.584 0.02521 0.5364 0.635  
## 1174 182 1 0.581 0.02528 0.5331 0.632  
## 1192 178 1 0.577 0.02534 0.5297 0.629  
## 1193 176 1 0.574 0.02541 0.5263 0.626  
## 1207 173 1 0.571 0.02548 0.5229 0.623  
## 1218 170 1 0.567 0.02555 0.5194 0.620  
## 1219 169 1 0.564 0.02562 0.5160 0.617  
## 1225 167 1 0.561 0.02569 0.5125 0.613  
## 1253 159 1 0.557 0.02577 0.5088 0.610  
## 1279 157 1 0.554 0.02585 0.5051 0.607  
## 1280 156 1 0.550 0.02592 0.5015 0.603  
## 1296 155 1 0.546 0.02600 0.4978 0.600  
## 1306 153 1 0.543 0.02607 0.4941 0.596  
## 1329 151 1 0.539 0.02614 0.4904 0.593  
## 1337 149 1 0.536 0.02622 0.4867 0.590  
## 1366 139 1 0.532 0.02631 0.4827 0.586  
## 1371 138 1 0.528 0.02640 0.4787 0.582  
## 1387 137 1 0.524 0.02649 0.4747 0.579  
## 1388 136 1 0.520 0.02657 0.4707 0.575  
## 1420 134 1 0.516 0.02666 0.4667 0.571  
## 1449 127 1 0.512 0.02675 0.4625 0.568  
## 1460 125 1 0.508 0.02685 0.4582 0.564  
## 1525 116 1 0.504 0.02698 0.4536 0.560  
## 1528 114 1 0.499 0.02710 0.4490 0.555  
## 1587 109 1 0.495 0.02724 0.4442 0.551  
## 1589 108 1 0.490 0.02737 0.4394 0.547  
## 1601 106 1 0.486 0.02750 0.4346 0.543  
## 1675 94 1 0.480 0.02768 0.4291 0.538  
## 1684 91 1 0.475 0.02788 0.4235 0.533  
## 1701 89 1 0.470 0.02807 0.4179 0.528  
## 1730 77 1 0.464 0.02836 0.4113 0.523  
## 1753 72 1 0.457 0.02869 0.4044 0.517  
## 1806 67 1 0.450 0.02906 0.3969 0.511  
## 1814 66 2 0.437 0.02974 0.3822 0.499  
## 1990 39 1 0.426 0.03102 0.3690 0.491  
## 2034 36 1 0.414 0.03233 0.3550 0.482  
## 2039 35 1 0.402 0.03350 0.3414 0.473  
## 2093 27 1 0.387 0.03541 0.3235 0.463  
## 2286 10 1 0.348 0.04862 0.2650 0.458  
## 2456 3 1 0.232 0.10020 0.0997 0.541  
##   
## GBSG2$horTh=yes   
## time n.risk n.event survival std.err lower 95% CI upper 95% CI  
## 169 240 1 0.996 0.00416 0.988 1.000  
## 177 239 2 0.988 0.00717 0.974 1.000  
## 180 237 1 0.983 0.00826 0.967 1.000  
## 184 236 1 0.979 0.00922 0.961 0.997  
## 227 233 1 0.975 0.01009 0.955 0.995  
## 238 231 1 0.971 0.01090 0.950 0.992  
## 272 230 1 0.967 0.01164 0.944 0.990  
## 275 229 1 0.962 0.01233 0.938 0.987  
## 286 228 1 0.958 0.01298 0.933 0.984  
## 308 226 1 0.954 0.01359 0.928 0.981  
## 357 224 1 0.950 0.01418 0.922 0.978  
## 369 222 1 0.945 0.01475 0.917 0.975  
## 374 221 1 0.941 0.01529 0.912 0.971  
## 377 220 1 0.937 0.01581 0.906 0.968  
## 392 219 1 0.932 0.01631 0.901 0.965  
## 394 218 1 0.928 0.01678 0.896 0.962  
## 410 217 1 0.924 0.01724 0.891 0.958  
## 426 216 1 0.920 0.01768 0.886 0.955  
## 473 212 1 0.915 0.01813 0.880 0.952  
## 475 211 1 0.911 0.01855 0.875 0.948  
## 491 210 1 0.907 0.01896 0.870 0.945  
## 498 209 1 0.902 0.01936 0.865 0.941  
## 500 208 1 0.898 0.01975 0.860 0.938  
## 502 207 1 0.894 0.02012 0.855 0.934  
## 504 206 1 0.889 0.02049 0.850 0.930  
## 515 205 1 0.885 0.02084 0.845 0.927  
## 533 204 1 0.881 0.02119 0.840 0.923  
## 540 203 1 0.876 0.02152 0.835 0.919  
## 542 202 1 0.872 0.02185 0.830 0.916  
## 544 201 1 0.868 0.02217 0.825 0.912  
## 548 200 2 0.859 0.02278 0.815 0.905  
## 552 198 1 0.855 0.02307 0.811 0.901  
## 554 197 1 0.850 0.02336 0.806 0.897  
## 557 196 1 0.846 0.02364 0.801 0.894  
## 559 195 1 0.842 0.02391 0.796 0.890  
## 564 194 1 0.837 0.02418 0.791 0.886  
## 573 192 1 0.833 0.02444 0.786 0.882  
## 577 191 1 0.829 0.02470 0.781 0.878  
## 598 190 1 0.824 0.02495 0.777 0.875  
## 632 189 1 0.820 0.02520 0.772 0.871  
## 648 188 1 0.815 0.02544 0.767 0.867  
## 662 187 1 0.811 0.02568 0.762 0.863  
## 675 186 1 0.807 0.02591 0.757 0.859  
## 698 184 1 0.802 0.02613 0.753 0.855  
## 712 183 1 0.798 0.02636 0.748 0.851  
## 722 181 1 0.794 0.02658 0.743 0.847  
## 729 179 1 0.789 0.02679 0.738 0.843  
## 730 178 1 0.785 0.02701 0.733 0.839  
## 755 172 1 0.780 0.02723 0.729 0.835  
## 784 169 1 0.775 0.02746 0.723 0.831  
## 797 168 1 0.771 0.02768 0.718 0.827  
## 799 167 1 0.766 0.02790 0.713 0.823  
## 827 164 1 0.762 0.02812 0.708 0.819  
## 836 162 1 0.757 0.02833 0.703 0.814  
## 855 161 1 0.752 0.02855 0.698 0.810  
## 859 158 1 0.747 0.02876 0.693 0.806  
## 890 155 1 0.743 0.02897 0.688 0.802  
## 893 154 1 0.738 0.02919 0.683 0.797  
## 918 152 1 0.733 0.02939 0.678 0.793  
## 956 148 1 0.728 0.02961 0.672 0.788  
## 964 147 1 0.723 0.02982 0.667 0.784  
## 1036 142 1 0.718 0.03004 0.661 0.779  
## 1043 141 1 0.713 0.03026 0.656 0.775  
## 1059 140 1 0.708 0.03047 0.650 0.770  
## 1120 132 1 0.702 0.03070 0.645 0.765  
## 1140 131 1 0.697 0.03093 0.639 0.760  
## 1146 130 1 0.692 0.03116 0.633 0.755  
## 1150 129 1 0.686 0.03137 0.627 0.751  
## 1183 125 1 0.681 0.03160 0.622 0.746  
## 1246 122 1 0.675 0.03183 0.616 0.741  
## 1280 120 1 0.670 0.03206 0.610 0.735  
## 1343 113 1 0.664 0.03232 0.603 0.730  
## 1352 111 1 0.658 0.03257 0.597 0.725  
## 1363 108 1 0.652 0.03284 0.590 0.719  
## 1459 105 1 0.645 0.03310 0.584 0.714  
## 1463 104 1 0.639 0.03336 0.577 0.708  
## 1481 103 1 0.633 0.03361 0.570 0.702  
## 1493 98 1 0.627 0.03388 0.564 0.697  
## 1502 96 1 0.620 0.03415 0.557 0.691  
## 1521 93 1 0.613 0.03443 0.549 0.685  
## 1641 87 1 0.606 0.03475 0.542 0.678  
## 1679 83 1 0.599 0.03509 0.534 0.672  
## 1763 69 1 0.590 0.03564 0.524 0.664  
## 1807 65 1 0.581 0.03623 0.514 0.657  
## 1918 44 1 0.568 0.03774 0.499 0.647  
## 1975 41 1 0.554 0.03928 0.482 0.637  
## 1977 40 1 0.540 0.04066 0.466 0.626  
## 1989 38 1 0.526 0.04201 0.450 0.615  
## 2015 32 1 0.510 0.04379 0.431 0.603  
## 2018 30 1 0.493 0.04551 0.411 0.590  
## 2030 27 1 0.474 0.04734 0.390 0.577  
## 2372 13 1 0.438 0.05603 0.341 0.563

# Plotting the results  
plot(survf3, lty=1:2, main="GBSG2 (Split based on horTH)", ylab = "Probability", xlab="Survival Time")  
legend("topright",legend=levels(GBSG2$horTh), lty=1:2)



From the above plot and calculations we can see that as time progresses, those who receive hormonal therapy have a better chance at survival, with those not recieving the therapy having a similarly steady decrease with a sudden drop in survival after roughly 2450 days.