SA analysis for expression data from 290 primary colorectal cancers

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November 14, 2017

Contents

Overview

This document explains a variety of survival analysis methods that performed on Expression data from 290 primary colorectal cancers

Setup

This section aims to load needed libs to perform survival analysis functionalties.

Load survival library

```
suppressMessages(library(survival))
```

Load graphics library

```
suppressMessages(library(ggfortify))
```

```
## Warning: package 'ggplot2' was built under R version 3.4.2
```

```
## Warning: namespace 'DBI' is not available and has been replaced
## by .GlobalEnv when processing object 'call.'

## Warning: namespace 'DBI' is not available and has been replaced
## by .GlobalEnv when processing object 'call.'
```

Load the dataset

```
load("D:/moh/DSTI/Courses/Survival Analysis using R -S17/CRC_226_GSE14333.RData")
```

Dataset Exploration

This section aims to explore dataset data and metadate before performing any kind of analysis.

Metadata

```
clinical_metadata
```

```
##   variable_name                                  description
## 1      location                               tumor location
## 2   dukes_stage        cancer stage (Duke's classification)
## 3      age_diag                            age at diagnosis
## 4        gender                                      gender
## 5     dfs_time Disease Free Survival (DFS) time, in months
## 6    dfs_event   DFS event: 1=event time, 0=censoring time
## 7        adjXRT                  adjuvant radiation therapy
## 8        adjCTX                       adjuvant chemotherapy
```

Structure

```
str(clinical_data)
```

```
## 'data.frame':    226 obs. of  9 variables:
##  $ sampleID   : chr  "GSM358341" "GSM358342" "GSM358343" "GSM358344" ...
##  $ location   : Factor w/ 4 levels "Rectum","Colon",..: 4 1 3 3 3 4 3 3 4 4 ...
##  $ dukes_stage: Factor w/ 3 levels "A","B","C": 1 1 1 1 1 1 1 1 1 1 ...
##  $ age_diag   : num  78 53 80 58 81 57 63 51 86 76 ...
##  $ gender     : Factor w/ 2 levels "F","M": 2 1 1 2 2 2 1 2 1 2 ...
##  $ dfs_time   : num  3.64 14.53 16.47 19.75 20.02 ...
##  $ dfs_event  : num  1 0 1 1 1 1 0 1 1 1 ...
##  $ adjXRT     : Factor w/ 2 levels "N","Y": 1 1 1 1 1 1 1 1 1 1 ...
##  $ adjCTX     : Factor w/ 2 levels "N","Y": 1 1 1 1 1 1 1 2 1 1 ...
```

Sample Data

```
head(clinical_data)
```

```
##    sampleID location dukes_stage age_diag gender dfs_time dfs_event adjXRT
## 1 GSM358341    Right           A       78      M     3.64         1      N
## 2 GSM358342   Rectum           A       53      F    14.53         0      N
## 3 GSM358343     Left           A       80      F    16.47         1      N
## 4 GSM358344     Left           A       58      M    19.75         1      N
## 5 GSM358345     Left           A       81      M    20.02         1      N
## 6 GSM358346    Right           A       57      M    23.96         1      N
##   adjCTX
## 1      N
## 2      N
## 3      N
## 4      N
## 5      N
## 6      N
```

Full statistics

```
summary(clinical_data)
```

```
##    sampleID           location   dukes_stage    age_diag     gender
##  Length:226         Rectum: 30   A:41        Min.   :26.00   F:106
##  Class :character   Colon :  2   B:94        1st Qu.:58.00   M:120
##  Mode  :character   Left  : 93   C:91        Median :67.00
##                     Right :101               Mean   :66.03
##                                              3rd Qu.:75.00
##                                              Max.   :92.00
##     dfs_time        dfs_event      adjXRT  adjCTX
##  Min.   :  0.92   Min.   :0.0000   N:204   N:139
##  1st Qu.: 22.28   1st Qu.:1.0000   Y: 22   Y: 87
##  Median : 38.46   Median :1.0000
##  Mean   : 43.52   Mean   :0.7788
##  3rd Qu.: 59.50   3rd Qu.:1.0000
##  Max.   :142.55   Max.   :1.0000
```

Basic Non-Parametric

Here we are performing basic analysis using ***Kaplan-Meier*** and ***Fleming-Harrington*** methods using different time units in **Months** which is the default and in **Years**. The rest of analysis will use the default time unitin **Months**

In months

Kaplan-Meier non-parametric

```
kmsurvival_month <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~ 1)
summary(kmsurvival_month)
```

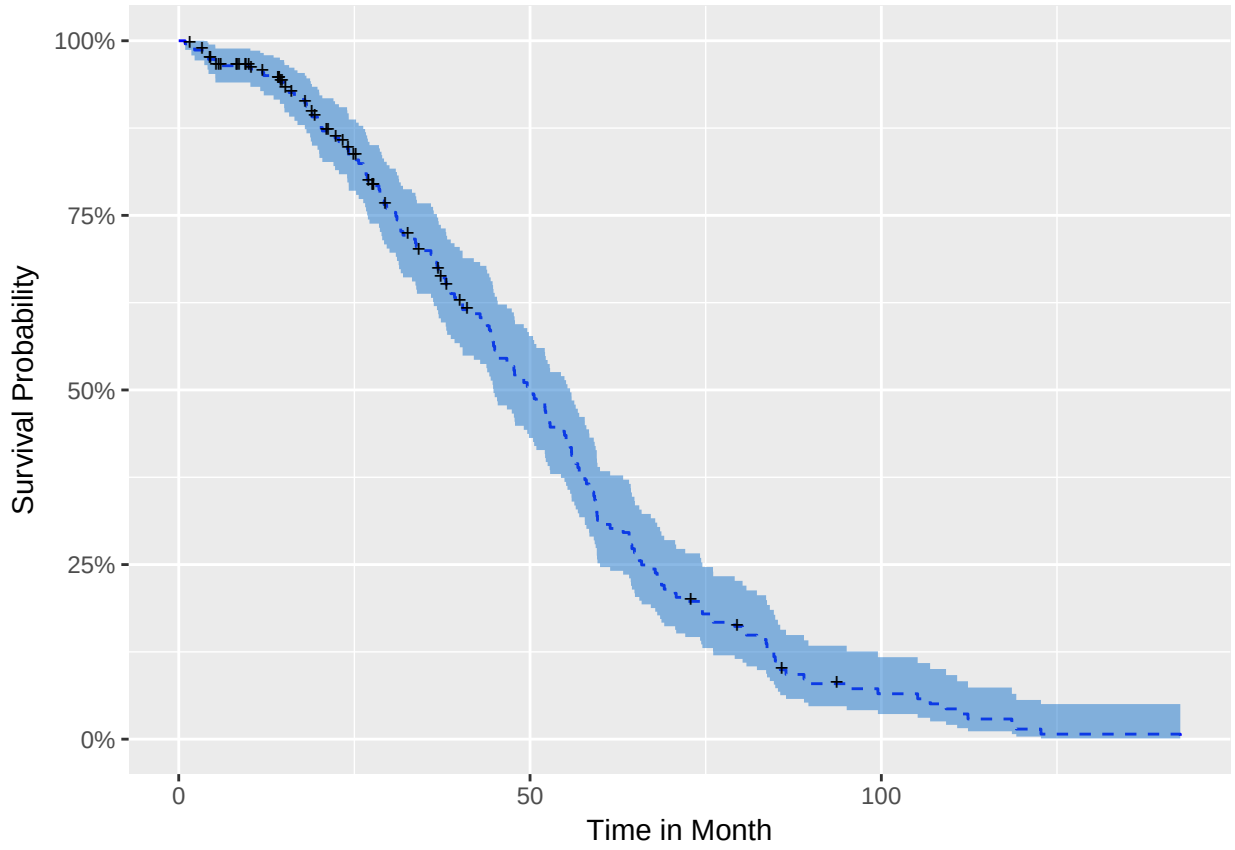
```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     1)
##
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    226       1  0.99558 0.00441      0.98696       1.0000
##    1.80    224       1  0.99113 0.00624      0.97897       1.0000
##    2.26    223       1  0.98669 0.00764      0.97183       1.0000
##    3.64    221       1  0.98222 0.00881      0.96511       0.9996
##    4.10    220       1  0.97776 0.00984      0.95867       0.9972
##    4.24    219       1  0.97329 0.01076      0.95244       0.9946
##    5.20    216       1  0.96879 0.01161      0.94629       0.9918
##    5.22    215       1  0.96428 0.01240      0.94028       0.9889
##   10.20    205       1  0.95958 0.01320      0.93404       0.9858
##   11.60    203       1  0.95485 0.01396      0.92788       0.9826
##   12.10    201       1  0.95010 0.01468      0.92177       0.9793
##   13.50    200       1  0.94535 0.01535      0.91573       0.9759
##   14.40    195       1  0.94050 0.01602      0.90962       0.9724
##   15.00    192       1  0.93560 0.01667      0.90350       0.9688
##   15.05    191       1  0.93070 0.01729      0.89743       0.9652
##   15.71    189       1  0.92578 0.01788      0.89138       0.9615
##   16.47    187       1  0.92083 0.01846      0.88535       0.9577
##   16.90    186       1  0.91588 0.01901      0.87936       0.9539
##   17.95    185       1  0.91093 0.01954      0.87342       0.9500
##   18.18    183       1  0.90595 0.02006      0.86747       0.9461
##   18.70    182       1  0.90097 0.02056      0.86156       0.9422
##   18.80    181       1  0.89599 0.02104      0.85569       0.9382
##   18.96    179       1  0.89099 0.02151      0.84981       0.9342
##   19.75    177       1  0.88595 0.02197      0.84393       0.9301
##   19.98    176       1  0.88092 0.02241      0.83807       0.9260
##   20.02    175       1  0.87589 0.02284      0.83224       0.9218
##   20.44    174       1  0.87085 0.02326      0.82644       0.9177
##   22.02    171       1  0.86576 0.02368      0.82058       0.9134
##   22.25    170       1  0.86067 0.02408      0.81475       0.9092
##   22.80    167       1  0.85551 0.02448      0.80886       0.9049
##   23.96    165       1  0.85033 0.02487      0.80295       0.9005
##   24.00    164       1  0.84514 0.02526      0.79706       0.8961
##   24.19    162       1  0.83993 0.02563      0.79116       0.8917
##   24.20    161       1  0.83471 0.02600      0.78528       0.8873
##   25.24    158       1  0.82943 0.02637      0.77933       0.8827
##   25.61    157       1  0.82414 0.02672      0.77340       0.8782
##   26.26    156       1  0.81886 0.02707      0.76749       0.8737
##   26.53    155       1  0.81358 0.02740      0.76160       0.8691
##   26.66    154       1  0.80830 0.02773      0.75573       0.8645
##   26.82    153       1  0.80301 0.02805      0.74988       0.8599
##   26.92    152       1  0.79773 0.02836      0.74404       0.8553
##   27.15    150       1  0.79241 0.02866      0.73818       0.8506
##   28.50    146       1  0.78698 0.02898      0.73219       0.8459
##   28.63    145       1  0.78156 0.02928      0.72623       0.8411
##   28.86    144       1  0.77613 0.02957      0.72027       0.8363
##   28.96    143       1  0.77070 0.02986      0.71434       0.8315
##   29.22    142       1  0.76527 0.03014      0.70842       0.8267
##   29.60    140       1  0.75981 0.03042      0.70247       0.8218
##   30.00    139       1  0.75434 0.03069      0.69653       0.8169
##   30.90    138       1  0.74888 0.03095      0.69061       0.8121
```

```
##   31.06    137       1  0.74341 0.03120      0.68471       0.8071
##   31.30    136       1  0.73794 0.03145      0.67881       0.8022
##   31.36    135       1  0.73248 0.03168      0.67294       0.7973
##   31.60    134       1  0.72701 0.03192      0.66707       0.7923
##   31.92    133       1  0.72154 0.03214      0.66122       0.7874
##   33.20    131       1  0.71604 0.03236      0.65533       0.7824
##   33.69    130       1  0.71053 0.03258      0.64946       0.7773
##   33.80    129       1  0.70502 0.03279      0.64360       0.7723
##   33.90    128       1  0.69951 0.03299      0.63775       0.7673
##   35.90    126       1  0.69396 0.03319      0.63186       0.7622
##   36.20    125       1  0.68841 0.03339      0.62598       0.7571
##   36.30    124       1  0.68286 0.03358      0.62012       0.7519
##   36.75    123       1  0.67731 0.03376      0.61426       0.7468
##   36.92    122       1  0.67175 0.03394      0.60842       0.7417
##   37.00    120       1  0.66616 0.03411      0.60254       0.7365
##   37.31    119       1  0.66056 0.03428      0.59667       0.7313
##   38.00    117       1  0.65491 0.03445      0.59075       0.7260
##   38.07    116       1  0.64927 0.03462      0.58485       0.7208
##   38.20    114       1  0.64357 0.03478      0.57889       0.7155
##   38.72    113       1  0.63788 0.03493      0.57296       0.7102
##   39.25    112       1  0.63218 0.03508      0.56703       0.7048
##   40.00    111       1  0.62648 0.03522      0.56111       0.6995
##   40.40    109       2  0.61499 0.03550      0.54920       0.6887
##   42.00    106       1  0.60919 0.03564      0.54319       0.6832
##   42.90    105       1  0.60339 0.03577      0.53720       0.6777
##   43.79    104       1  0.59758 0.03589      0.53122       0.6722
##   43.90    103       1  0.59178 0.03601      0.52525       0.6667
##   44.20    102       1  0.58598 0.03612      0.51929       0.6612
##   44.40    101       1  0.58018 0.03623      0.51335       0.6557
##   44.67    100       1  0.57438 0.03633      0.50741       0.6502
##   44.74     99       1  0.56858 0.03642      0.50149       0.6446
##   44.80     98       1  0.56277 0.03651      0.49558       0.6391
##   44.97     97       1  0.55697 0.03659      0.48968       0.6335
##   45.30     96       1  0.55117 0.03667      0.48380       0.6279
##   45.40     95       1  0.54537 0.03674      0.47792       0.6223
##   46.71     94       1  0.53957 0.03680      0.47205       0.6167
##   47.40     93       1  0.53376 0.03686      0.46620       0.6111
##   47.70     92       1  0.52796 0.03691      0.46035       0.6055
##   47.80     91       1  0.52216 0.03696      0.45452       0.5999
##   47.86     90       1  0.51636 0.03700      0.44870       0.5942
##   49.11     89       1  0.51056 0.03704      0.44289       0.5886
##   49.60     88       1  0.50476 0.03707      0.43709       0.5829
##   49.84     87       1  0.49895 0.03709      0.43130       0.5772
##   50.43     86       1  0.49315 0.03711      0.42552       0.5715
##   50.59     85       1  0.48735 0.03713      0.41975       0.5658
##   50.90     84       1  0.48155 0.03714      0.41400       0.5601
##   52.10     83       1  0.47575 0.03714      0.40825       0.5544
##   52.14     82       1  0.46994 0.03714      0.40252       0.5487
##   52.24     81       1  0.46414 0.03713      0.39679       0.5429
##   52.50     80       1  0.45834 0.03711      0.39108       0.5372
##   52.80     79       1  0.45254 0.03710      0.38537       0.5314
##   52.86     78       1  0.44674 0.03707      0.37968       0.5256
##   54.40     77       1  0.44094 0.03704      0.37400       0.5199
##   54.90     76       1  0.43513 0.03700      0.36833       0.5141
```

```
##   55.13    75       1  0.42933 0.03696      0.36267       0.5083
##   55.33    74       1  0.42353 0.03692      0.35702       0.5024
##   55.70    73       1  0.41773 0.03686      0.35138       0.4966
##   55.90    72       1  0.41193 0.03681      0.34575       0.4908
##   55.92    71       1  0.40613 0.03674      0.34014       0.4849
##   56.30    70       1  0.40032 0.03667      0.33453       0.4791
##   56.50    69       1  0.39452 0.03660      0.32894       0.4732
##   56.80    68       1  0.38872 0.03652      0.32335       0.4673
##   57.00    67       1  0.38292 0.03643      0.31778       0.4614
##   57.79    66       1  0.37712 0.03634      0.31222       0.4555
##   57.80    65       1  0.37131 0.03624      0.30667       0.4496
##   58.02    64       1  0.36551 0.03613      0.30113       0.4437
##   58.40    63       1  0.35971 0.03602      0.29561       0.4377
##   58.45    62       1  0.35391 0.03590      0.29009       0.4318
##   59.07    61       1  0.34811 0.03578      0.28459       0.4258
##   59.20    60       1  0.34231 0.03565      0.27910       0.4198
##   59.34    59       1  0.33650 0.03552      0.27362       0.4138
##   59.50    58       2  0.32490 0.03523      0.26270       0.4018
##   59.53    56       1  0.31910 0.03507      0.25726       0.3958
##   59.60    55       1  0.31330 0.03491      0.25183       0.3898
##   59.96    54       1  0.30749 0.03474      0.24641       0.3837
##   61.40    53       1  0.30169 0.03457      0.24101       0.3777
##   63.25    52       1  0.29589 0.03439      0.23562       0.3716
##   64.10    51       1  0.29009 0.03420      0.23024       0.3655
##   64.33    50       1  0.28429 0.03400      0.22488       0.3594
##   64.37    49       1  0.27849 0.03380      0.21953       0.3533
##   64.50    48       1  0.27268 0.03359      0.21419       0.3472
##   64.86    47       1  0.26688 0.03337      0.20887       0.3410
##   64.93    46       1  0.26108 0.03315      0.20356       0.3349
##   65.55    45       1  0.25528 0.03292      0.19827       0.3287
##   65.88    44       1  0.24948 0.03268      0.19299       0.3225
##   67.19    43       1  0.24368 0.03243      0.18773       0.3163
##   67.82    42       1  0.23787 0.03217      0.18249       0.3101
##   68.10    41       1  0.23207 0.03190      0.17726       0.3038
##   68.51    40       1  0.22627 0.03163      0.17204       0.2976
##   68.70    39       1  0.22047 0.03135      0.16685       0.2913
##   69.10    38       1  0.21467 0.03105      0.16167       0.2850
##   70.65    37       1  0.20886 0.03075      0.15651       0.2787
##   70.80    36       1  0.20306 0.03044      0.15137       0.2724
##   72.09    35       1  0.19726 0.03012      0.14624       0.2661
##   74.20    33       1  0.19128 0.02979      0.14096       0.2596
##   74.36    32       1  0.18531 0.02945      0.13570       0.2530
##   74.53    31       1  0.17933 0.02910      0.13047       0.2465
##   76.04    30       1  0.17335 0.02874      0.12525       0.2399
##   76.07    29       1  0.16737 0.02837      0.12007       0.2333
##   79.13    28       1  0.16140 0.02798      0.11491       0.2267
##   80.25    26       1  0.15519 0.02758      0.10954       0.2199
##   80.80    25       1  0.14898 0.02717      0.10421       0.2130
##   82.29    24       1  0.14277 0.02673      0.09891       0.2061
##   83.60    23       1  0.13657 0.02628      0.09365       0.1991
##   83.73    22       1  0.13036 0.02581      0.08843       0.1922
##   84.13    21       1  0.12415 0.02532      0.08325       0.1852
##   84.70    20       1  0.11794 0.02480      0.07811       0.1781
##   84.90    19       1  0.11174 0.02426      0.07301       0.1710
```

```
##   85.28     18       1  0.10553 0.02369       0.06796       0.1639
##   85.61     17       1  0.09932 0.02310       0.06296       0.1567
##   86.43     15       1  0.09270 0.02249       0.05762       0.1491
##   88.99     14       1  0.08608 0.02183       0.05236       0.1415
##   89.62     13       1  0.07946 0.02113       0.04718       0.1338
##   95.07     11       1  0.07223 0.02041       0.04152       0.1257
##   99.51     10       1  0.06501 0.01961       0.03600       0.1174
##  105.17      9       1  0.05779 0.01871       0.03063       0.1090
##  106.94      8       1  0.05056 0.01771       0.02545       0.1005
##  109.21      7       1  0.04334 0.01659       0.02047       0.0918
##  110.79      6       1  0.03612 0.01532       0.01573       0.0829
##  112.33      5       1  0.02889 0.01385       0.01129       0.0739
##  118.58      4       1  0.02167 0.01213       0.00724       0.0649
##  119.21      3       1  0.01445 0.01001       0.00372       0.0562
##  122.72      2       1  0.00722 0.00715       0.00104       0.0503
##  142.55      1       1  0.00000     NaN           NA           NA
```

```r
autoplot(kmsurvival_month, xlab="Time in Month", ylab="Survival Probability",
         surv.linetype = 'dashed',
         surv.colour = 'blue',
         conf.int.fill = 'dodgerblue3', conf.int.alpha = 0.5)
```



Fleming-Harrington non-parametric analysis

```r
fhsurvival_month <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~ 1,
                            type="fleming-harrington")
summary(fhsurvival_month)
```

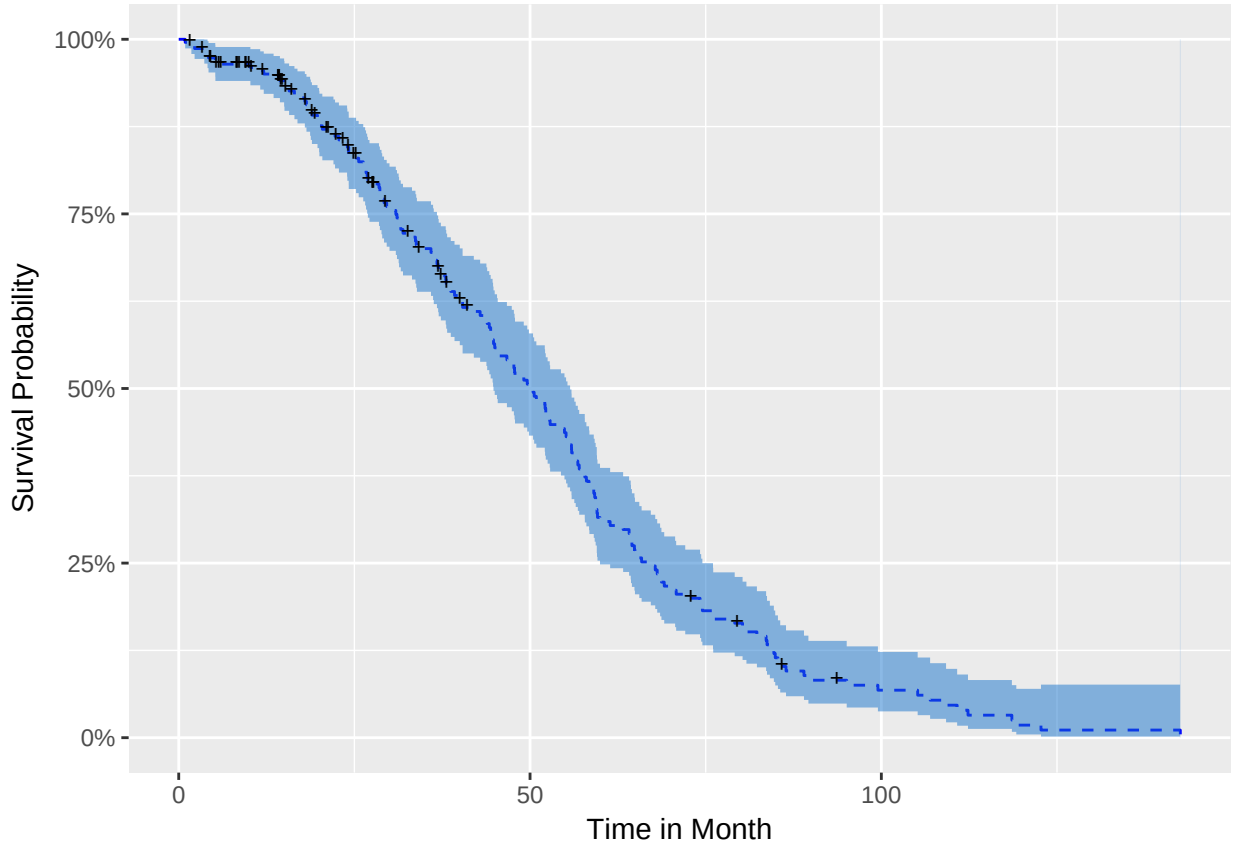
```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     1, type = "fleming-harrington")
##
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    226       1  0.99558 0.00442      0.98697       1.0000
##    1.80    224       1  0.99115 0.00624      0.97899       1.0000
##    2.26    223       1  0.98672 0.00764      0.97186       1.0000
##    3.64    221       1  0.98226 0.00881      0.96514       0.9997
##    4.10    220       1  0.97781 0.00984      0.95872       0.9973
##    4.24    219       1  0.97335 0.01076      0.95249       0.9947
##    5.20    216       1  0.96886 0.01161      0.94636       0.9919
##    5.22    215       1  0.96436 0.01240      0.94035       0.9890
##   10.20    205       1  0.95967 0.01320      0.93413       0.9859
##   11.60    203       1  0.95495 0.01396      0.92798       0.9827
##   12.10    201       1  0.95021 0.01468      0.92188       0.9794
##   13.50    200       1  0.94547 0.01535      0.91585       0.9761
##   14.40    195       1  0.94064 0.01602      0.90975       0.9726
##   15.00    192       1  0.93575 0.01667      0.90364       0.9690
##   15.05    191       1  0.93086 0.01729      0.89759       0.9654
##   15.71    189       1  0.92595 0.01789      0.89155       0.9617
##   16.47    187       1  0.92101 0.01846      0.88553       0.9579
##   16.90    186       1  0.91607 0.01902      0.87955       0.9541
##   17.95    185       1  0.91114 0.01955      0.87362       0.9503
##   18.18    183       1  0.90617 0.02007      0.86768       0.9464
##   18.70    182       1  0.90121 0.02056      0.86179       0.9424
##   18.80    181       1  0.89624 0.02105      0.85593       0.9385
##   18.96    179       1  0.89125 0.02152      0.85006       0.9344
##   19.75    177       1  0.88623 0.02198      0.84419       0.9304
##   19.98    176       1  0.88121 0.02242      0.83834       0.9263
##   20.02    175       1  0.87618 0.02285      0.83252       0.9221
##   20.44    174       1  0.87116 0.02327      0.82673       0.9180
##   22.02    171       1  0.86608 0.02368      0.82089       0.9138
##   22.25    170       1  0.86100 0.02409      0.81507       0.9095
##   22.80    167       1  0.85586 0.02449      0.80919       0.9052
##   23.96    165       1  0.85069 0.02488      0.80329       0.9009
##   24.00    164       1  0.84552 0.02527      0.79742       0.8965
##   24.19    162       1  0.84032 0.02565      0.79153       0.8921
##   24.20    161       1  0.83511 0.02601      0.78566       0.8877
##   25.24    158       1  0.82985 0.02638      0.77972       0.8832
##   25.61    157       1  0.82458 0.02674      0.77380       0.8787
##   26.26    156       1  0.81931 0.02708      0.76791       0.8741
##   26.53    155       1  0.81404 0.02742      0.76203       0.8696
##   26.66    154       1  0.80877 0.02775      0.75617       0.8650
##   26.82    153       1  0.80350 0.02807      0.75033       0.8604
##   26.92    152       1  0.79823 0.02837      0.74451       0.8558
##   27.15    150       1  0.79293 0.02868      0.73866       0.8512
##   28.50    146       1  0.78752 0.02900      0.73269       0.8464
##   28.63    145       1  0.78210 0.02930      0.72673       0.8417
##   28.86    144       1  0.77669 0.02960      0.72080       0.8369
##   28.96    143       1  0.77128 0.02988      0.71488       0.8321
```

```
##   29.22    142       1  0.76587 0.03016      0.70897       0.8273
##   29.60    140       1  0.76042 0.03044      0.70303       0.8225
##   30.00    139       1  0.75496 0.03071      0.69711       0.8176
##   30.90    138       1  0.74951 0.03097      0.69120       0.8127
##   31.06    137       1  0.74406 0.03123      0.68531       0.8079
##   31.30    136       1  0.73861 0.03147      0.67943       0.8029
##   31.36    135       1  0.73316 0.03171      0.67357       0.7980
##   31.60    134       1  0.72771 0.03195      0.66771       0.7931
##   31.92    133       1  0.72226 0.03217      0.66188       0.7881
##   33.20    131       1  0.71677 0.03240      0.65600       0.7832
##   33.69    130       1  0.71127 0.03261      0.65014       0.7782
##   33.80    129       1  0.70578 0.03282      0.64429       0.7731
##   33.90    128       1  0.70029 0.03303      0.63845       0.7681
##   35.90    126       1  0.69475 0.03323      0.63258       0.7630
##   36.20    125       1  0.68922 0.03343      0.62671       0.7580
##   36.30    124       1  0.68368 0.03362      0.62086       0.7529
##   36.75    123       1  0.67815 0.03380      0.61502       0.7477
##   36.92    122       1  0.67261 0.03398      0.60920       0.7426
##   37.00    120       1  0.66703 0.03416      0.60333       0.7375
##   37.31    119       1  0.66145 0.03433      0.59747       0.7323
##   38.00    117       1  0.65582 0.03450      0.59157       0.7270
##   38.07    116       1  0.65019 0.03466      0.58568       0.7218
##   38.20    114       1  0.64451 0.03483      0.57974       0.7165
##   38.72    113       1  0.63883 0.03498      0.57381       0.7112
##   39.25    112       1  0.63315 0.03514      0.56790       0.7059
##   40.00    111       1  0.62747 0.03528      0.56200       0.7006
##   40.40    109       2  0.61607 0.03557      0.55016       0.6899
##   42.00    106       1  0.61028 0.03570      0.54417       0.6844
##   42.90    105       1  0.60450 0.03584      0.53819       0.6790
##   43.79    104       1  0.59871 0.03596      0.53222       0.6735
##   43.90    103       1  0.59293 0.03608      0.52627       0.6680
##   44.20    102       1  0.58714 0.03619      0.52032       0.6625
##   44.40    101       1  0.58136 0.03630      0.51439       0.6570
##   44.67    100       1  0.57557 0.03640      0.50847       0.6515
##   44.74     99       1  0.56979 0.03650      0.50256       0.6460
##   44.80     98       1  0.56400 0.03659      0.49667       0.6405
##   44.97     97       1  0.55822 0.03667      0.49078       0.6349
##   45.30     96       1  0.55243 0.03675      0.48491       0.6294
##   45.40     95       1  0.54665 0.03682      0.47904       0.6238
##   46.71     94       1  0.54087 0.03689      0.47319       0.6182
##   47.40     93       1  0.53508 0.03695      0.46735       0.6126
##   47.70     92       1  0.52930 0.03701      0.46152       0.6070
##   47.80     91       1  0.52351 0.03705      0.45570       0.6014
##   47.86     90       1  0.51773 0.03710      0.44989       0.5958
##   49.11     89       1  0.51194 0.03714      0.44409       0.5902
##   49.60     88       1  0.50616 0.03717      0.43830       0.5845
##   49.84     87       1  0.50037 0.03720      0.43253       0.5789
##   50.43     86       1  0.49459 0.03722      0.42676       0.5732
##   50.59     85       1  0.48880 0.03724      0.42101       0.5675
##   50.90     84       1  0.48302 0.03725      0.41526       0.5618
##   52.10     83       1  0.47723 0.03725      0.40953       0.5561
##   52.14     82       1  0.47145 0.03726      0.40380       0.5504
##   52.24     81       1  0.46567 0.03725      0.39809       0.5447
##   52.50     80       1  0.45988 0.03724      0.39239       0.5390
```

```
##   52.80     79       1  0.45410 0.03722      0.38670       0.5332
##   52.86     78       1  0.44831 0.03720      0.38102       0.5275
##   54.40     77       1  0.44253 0.03717      0.37535       0.5217
##   54.90     76       1  0.43674 0.03714      0.36969       0.5160
##   55.13     75       1  0.43096 0.03710      0.36404       0.5102
##   55.33     74       1  0.42517 0.03706      0.35840       0.5044
##   55.70     73       1  0.41939 0.03701      0.35278       0.4986
##   55.90     72       1  0.41360 0.03696      0.34716       0.4928
##   55.92     71       1  0.40782 0.03689      0.34156       0.4869
##   56.30     70       1  0.40204 0.03683      0.33596       0.4811
##   56.50     69       1  0.39625 0.03676      0.33038       0.4753
##   56.80     68       1  0.39047 0.03668      0.32481       0.4694
##   57.00     67       1  0.38468 0.03660      0.31924       0.4635
##   57.79     66       1  0.37890 0.03651      0.31369       0.4577
##   57.80     65       1  0.37311 0.03641      0.30816       0.4518
##   58.02     64       1  0.36733 0.03631      0.30263       0.4459
##   58.40     63       1  0.36154 0.03620      0.29711       0.4399
##   58.45     62       1  0.35576 0.03609      0.29161       0.4340
##   59.07     61       1  0.34997 0.03597      0.28612       0.4281
##   59.20     60       1  0.34419 0.03585      0.28063       0.4221
##   59.34     59       1  0.33840 0.03572      0.27517       0.4162
##   59.50     58       2  0.32693 0.03545      0.26434       0.4043
##   59.53     56       1  0.32115 0.03530      0.25891       0.3983
##   59.60     55       1  0.31536 0.03514      0.25349       0.3923
##   59.96     54       1  0.30958 0.03498      0.24808       0.3863
##   61.40     53       1  0.30379 0.03481      0.24268       0.3803
##   63.25     52       1  0.29800 0.03463      0.23730       0.3742
##   64.10     51       1  0.29222 0.03445      0.23193       0.3682
##   64.33     50       1  0.28643 0.03426      0.22657       0.3621
##   64.37     49       1  0.28064 0.03406      0.22123       0.3560
##   64.50     48       1  0.27486 0.03386      0.21590       0.3499
##   64.86     47       1  0.26907 0.03365      0.21058       0.3438
##   64.93     46       1  0.26329 0.03343      0.20528       0.3377
##   65.55     45       1  0.25750 0.03320      0.20000       0.3315
##   65.88     44       1  0.25171 0.03297      0.19472       0.3254
##   67.19     43       1  0.24593 0.03273      0.18947       0.3192
##   67.82     42       1  0.24014 0.03248      0.18423       0.3130
##   68.10     41       1  0.23435 0.03222      0.17900       0.3068
##   68.51     40       1  0.22857 0.03195      0.17379       0.3006
##   68.70     39       1  0.22278 0.03167      0.16860       0.2944
##   69.10     38       1  0.21700 0.03139      0.16342       0.2881
##   70.65     37       1  0.21121 0.03110      0.15827       0.2819
##   70.80     36       1  0.20542 0.03079      0.15313       0.2756
##   72.09     35       1  0.19964 0.03048      0.14801       0.2693
##   74.20     33       1  0.19368 0.03017      0.14273       0.2628
##   74.36     32       1  0.18772 0.02984      0.13747       0.2563
##   74.53     31       1  0.18176 0.02950      0.13224       0.2498
##   76.04     30       1  0.17580 0.02915      0.12703       0.2433
##   76.07     29       1  0.16984 0.02878      0.12184       0.2368
##   79.13     28       1  0.16388 0.02841      0.11668       0.2302
##   80.25     26       1  0.15770 0.02803      0.11132       0.2234
##   80.80     25       1  0.15152 0.02763      0.10599       0.2166
##   82.29     24       1  0.14533 0.02721      0.10069       0.2098
##   83.60     23       1  0.13915 0.02678      0.09543       0.2029
```

```
##    83.73     22       1  0.13297 0.02633       0.09020       0.1960
##    84.13     21       1  0.12678 0.02585       0.08501       0.1891
##    84.70     20       1  0.12060 0.02536       0.07987       0.1821
##    84.90     19       1  0.11442 0.02484       0.07476       0.1751
##    85.28     18       1  0.10823 0.02430       0.06970       0.1681
##    85.61     17       1  0.10205 0.02373       0.06469       0.1610
##    86.43     15       1  0.09547 0.02316       0.05934       0.1536
##    88.99     14       1  0.08889 0.02255       0.05407       0.1461
##    89.62     13       1  0.08231 0.02189       0.04887       0.1386
##    95.07     11       1  0.07515 0.02124       0.04320       0.1308
##    99.51     10       1  0.06800 0.02051       0.03765       0.1228
##   105.17      9       1  0.06085 0.01970       0.03226       0.1148
##   106.94      8       1  0.05370 0.01881       0.02703       0.1067
##   109.21      7       1  0.04655 0.01782       0.02199       0.0986
##   110.79      6       1  0.03941 0.01671       0.01716       0.0905
##   112.33      5       1  0.03226 0.01547       0.01261       0.0826
##   118.58      4       1  0.02513 0.01406       0.00839       0.0752
##   119.21      3       1  0.01800 0.01247       0.00463       0.0700
##   122.72      2       1  0.01092 0.01081       0.00157       0.0760
##   142.55      1       1  0.00402     Inf       0.00000       1.0000
```

```r
autoplot(fhsurvival_month, xlab="Time in Month", ylab="Survival Probability",
         surv.linetype = 'dashed',
         surv.colour = 'blue',
         conf.int.fill = 'dodgerblue3', conf.int.alpha = 0.5)
```



In years

Kaplan-Meier non-parametric

```
kmsurvival_year <- survfit(Surv(clinical_data$dfs_time/12, clinical_data$dfs_event) ~ 1)
summary(kmsurvival_year)
```

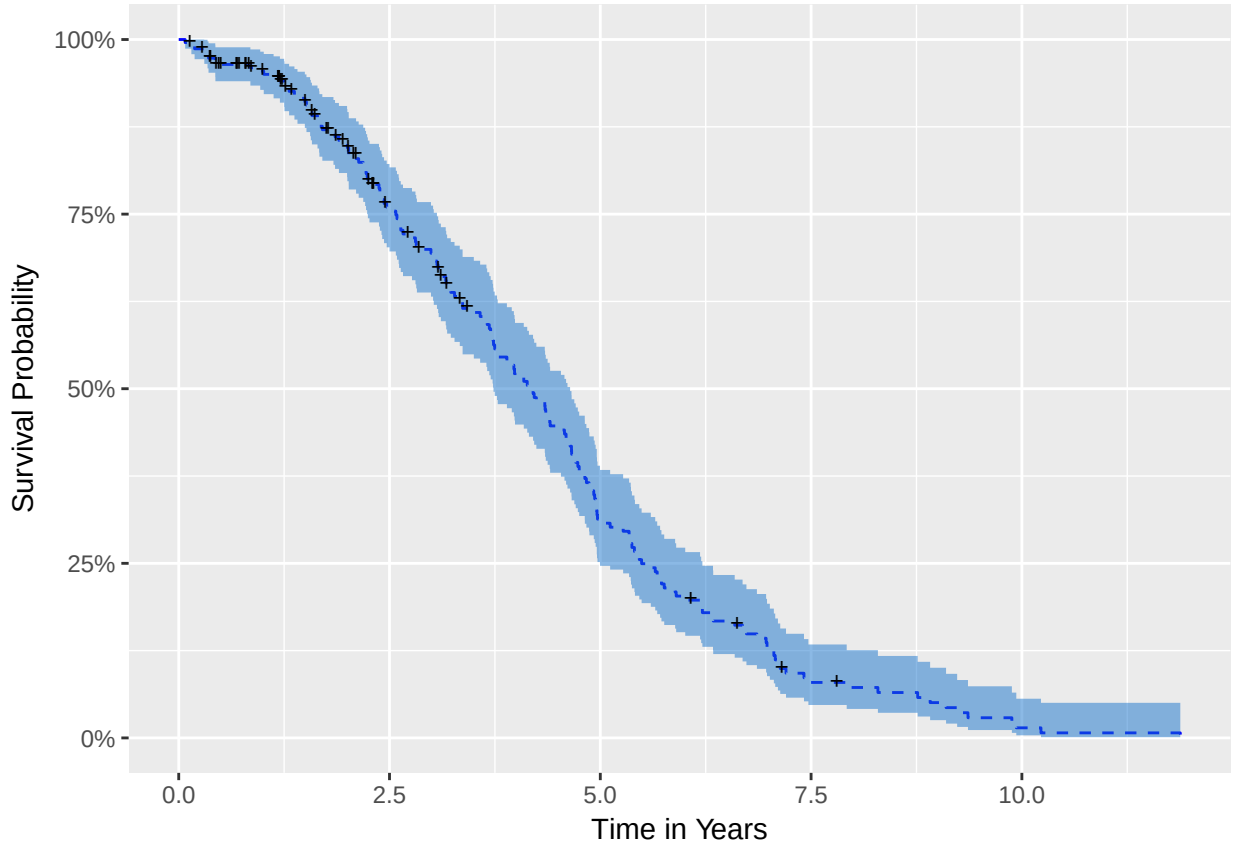
```
## Call: survfit(formula = Surv(clinical_data$dfs_time/12, clinical_data$dfs_event) ~
##     1)
##
##     time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   0.0767    226       1  0.99558 0.00441      0.98696       1.0000
##   0.1500    224       1  0.99113 0.00624      0.97897       1.0000
##   0.1883    223       1  0.98669 0.00764      0.97183       1.0000
##   0.3033    221       1  0.98222 0.00881      0.96511       0.9996
##   0.3417    220       1  0.97776 0.00984      0.95867       0.9972
##   0.3533    219       1  0.97329 0.01076      0.95244       0.9946
##   0.4333    216       1  0.96879 0.01161      0.94629       0.9918
##   0.4350    215       1  0.96428 0.01240      0.94028       0.9889
##   0.8500    205       1  0.95958 0.01320      0.93404       0.9858
##   0.9667    203       1  0.95485 0.01396      0.92788       0.9826
##   1.0083    201       1  0.95010 0.01468      0.92177       0.9793
##   1.1250    200       1  0.94535 0.01535      0.91573       0.9759
##   1.2000    195       1  0.94050 0.01602      0.90962       0.9724
##   1.2500    192       1  0.93560 0.01667      0.90350       0.9688
##   1.2542    191       1  0.93070 0.01729      0.89743       0.9652
##   1.3092    189       1  0.92578 0.01788      0.89138       0.9615
##   1.3725    187       1  0.92083 0.01846      0.88535       0.9577
##   1.4083    186       1  0.91588 0.01901      0.87936       0.9539
##   1.4958    185       1  0.91093 0.01954      0.87342       0.9500
##   1.5150    183       1  0.90595 0.02006      0.86747       0.9461
##   1.5583    182       1  0.90097 0.02056      0.86156       0.9422
##   1.5667    181       1  0.89599 0.02104      0.85569       0.9382
##   1.5800    179       1  0.89099 0.02151      0.84981       0.9342
##   1.6458    177       1  0.88595 0.02197      0.84393       0.9301
##   1.6650    176       1  0.88092 0.02241      0.83807       0.9260
##   1.6683    175       1  0.87589 0.02284      0.83224       0.9218
##   1.7033    174       1  0.87085 0.02326      0.82644       0.9177
##   1.8350    171       1  0.86576 0.02368      0.82058       0.9134
##   1.8542    170       1  0.86067 0.02408      0.81475       0.9092
##   1.9000    167       1  0.85551 0.02448      0.80886       0.9049
##   1.9967    165       1  0.85033 0.02487      0.80295       0.9005
##   2.0000    164       1  0.84514 0.02526      0.79706       0.8961
##   2.0158    162       1  0.83993 0.02563      0.79116       0.8917
##   2.0167    161       1  0.83471 0.02600      0.78528       0.8873
##   2.1033    158       1  0.82943 0.02637      0.77933       0.8827
##   2.1342    157       1  0.82414 0.02672      0.77340       0.8782
##   2.1883    156       1  0.81886 0.02707      0.76749       0.8737
##   2.2108    155       1  0.81358 0.02740      0.76160       0.8691
##   2.2217    154       1  0.80830 0.02773      0.75573       0.8645
##   2.2350    153       1  0.80301 0.02805      0.74988       0.8599
##   2.2433    152       1  0.79773 0.02836      0.74404       0.8553
##   2.2625    150       1  0.79241 0.02866      0.73818       0.8506
##   2.3750    146       1  0.78698 0.02898      0.73219       0.8459
```

```
##   2.3858    145       1  0.78156 0.02928      0.72623       0.8411
##   2.4050    144       1  0.77613 0.02957      0.72027       0.8363
##   2.4133    143       1  0.77070 0.02986      0.71434       0.8315
##   2.4350    142       1  0.76527 0.03014      0.70842       0.8267
##   2.4667    140       1  0.75981 0.03042      0.70247       0.8218
##   2.5000    139       1  0.75434 0.03069      0.69653       0.8169
##   2.5750    138       1  0.74888 0.03095      0.69061       0.8121
##   2.5883    137       1  0.74341 0.03120      0.68471       0.8071
##   2.6083    136       1  0.73794 0.03145      0.67881       0.8022
##   2.6133    135       1  0.73248 0.03168      0.67294       0.7973
##   2.6333    134       1  0.72701 0.03192      0.66707       0.7923
##   2.6600    133       1  0.72154 0.03214      0.66122       0.7874
##   2.7667    131       1  0.71604 0.03236      0.65533       0.7824
##   2.8075    130       1  0.71053 0.03258      0.64946       0.7773
##   2.8167    129       1  0.70502 0.03279      0.64360       0.7723
##   2.8250    128       1  0.69951 0.03299      0.63775       0.7673
##   2.9917    126       1  0.69396 0.03319      0.63186       0.7622
##   3.0167    125       1  0.68841 0.03339      0.62598       0.7571
##   3.0250    124       1  0.68286 0.03358      0.62012       0.7519
##   3.0625    123       1  0.67731 0.03376      0.61426       0.7468
##   3.0767    122       1  0.67175 0.03394      0.60842       0.7417
##   3.0833    120       1  0.66616 0.03411      0.60254       0.7365
##   3.1092    119       1  0.66056 0.03428      0.59667       0.7313
##   3.1667    117       1  0.65491 0.03445      0.59075       0.7260
##   3.1725    116       1  0.64927 0.03462      0.58485       0.7208
##   3.1833    114       1  0.64357 0.03478      0.57889       0.7155
##   3.2267    113       1  0.63788 0.03493      0.57296       0.7102
##   3.2708    112       1  0.63218 0.03508      0.56703       0.7048
##   3.3333    111       1  0.62648 0.03522      0.56111       0.6995
##   3.3667    109       2  0.61499 0.03550      0.54920       0.6887
##   3.5000    106       1  0.60919 0.03564      0.54319       0.6832
##   3.5750    105       1  0.60339 0.03577      0.53720       0.6777
##   3.6492    104       1  0.59758 0.03589      0.53122       0.6722
##   3.6583    103       1  0.59178 0.03601      0.52525       0.6667
##   3.6833    102       1  0.58598 0.03612      0.51929       0.6612
##   3.7000    101       1  0.58018 0.03623      0.51335       0.6557
##   3.7225    100       1  0.57438 0.03633      0.50741       0.6502
##   3.7283     99       1  0.56858 0.03642      0.50149       0.6446
##   3.7333     98       1  0.56277 0.03651      0.49558       0.6391
##   3.7475     97       1  0.55697 0.03659      0.48968       0.6335
##   3.7750     96       1  0.55117 0.03667      0.48380       0.6279
##   3.7833     95       1  0.54537 0.03674      0.47792       0.6223
##   3.8925     94       1  0.53957 0.03680      0.47205       0.6167
##   3.9500     93       1  0.53376 0.03686      0.46620       0.6111
##   3.9750     92       1  0.52796 0.03691      0.46035       0.6055
##   3.9833     91       1  0.52216 0.03696      0.45452       0.5999
##   3.9883     90       1  0.51636 0.03700      0.44870       0.5942
##   4.0925     89       1  0.51056 0.03704      0.44289       0.5886
##   4.1333     88       1  0.50476 0.03707      0.43709       0.5829
##   4.1533     87       1  0.49895 0.03709      0.43130       0.5772
##   4.2025     86       1  0.49315 0.03711      0.42552       0.5715
##   4.2158     85       1  0.48735 0.03713      0.41975       0.5658
##   4.2417     84       1  0.48155 0.03714      0.41400       0.5601
##   4.3417     83       1  0.47575 0.03714      0.40825       0.5544
```

```
##   4.3450     82       1  0.46994 0.03714      0.40252       0.5487
##   4.3533     81       1  0.46414 0.03713      0.39679       0.5429
##   4.3750     80       1  0.45834 0.03711      0.39108       0.5372
##   4.4000     79       1  0.45254 0.03710      0.38537       0.5314
##   4.4050     78       1  0.44674 0.03707      0.37968       0.5256
##   4.5333     77       1  0.44094 0.03704      0.37400       0.5199
##   4.5750     76       1  0.43513 0.03700      0.36833       0.5141
##   4.5942     75       1  0.42933 0.03696      0.36267       0.5083
##   4.6108     74       1  0.42353 0.03692      0.35702       0.5024
##   4.6417     73       1  0.41773 0.03686      0.35138       0.4966
##   4.6583     72       1  0.41193 0.03681      0.34575       0.4908
##   4.6600     71       1  0.40613 0.03674      0.34014       0.4849
##   4.6917     70       1  0.40032 0.03667      0.33453       0.4791
##   4.7083     69       1  0.39452 0.03660      0.32894       0.4732
##   4.7333     68       1  0.38872 0.03652      0.32335       0.4673
##   4.7500     67       1  0.38292 0.03643      0.31778       0.4614
##   4.8158     66       1  0.37712 0.03634      0.31222       0.4555
##   4.8167     65       1  0.37131 0.03624      0.30667       0.4496
##   4.8350     64       1  0.36551 0.03613      0.30113       0.4437
##   4.8667     63       1  0.35971 0.03602      0.29561       0.4377
##   4.8708     62       1  0.35391 0.03590      0.29009       0.4318
##   4.9225     61       1  0.34811 0.03578      0.28459       0.4258
##   4.9333     60       1  0.34231 0.03565      0.27910       0.4198
##   4.9450     59       1  0.33650 0.03552      0.27362       0.4138
##   4.9583     58       2  0.32490 0.03523      0.26270       0.4018
##   4.9608     56       1  0.31910 0.03507      0.25726       0.3958
##   4.9667     55       1  0.31330 0.03491      0.25183       0.3898
##   4.9967     54       1  0.30749 0.03474      0.24641       0.3837
##   5.1167     53       1  0.30169 0.03457      0.24101       0.3777
##   5.2708     52       1  0.29589 0.03439      0.23562       0.3716
##   5.3417     51       1  0.29009 0.03420      0.23024       0.3655
##   5.3608     50       1  0.28429 0.03400      0.22488       0.3594
##   5.3642     49       1  0.27849 0.03380      0.21953       0.3533
##   5.3750     48       1  0.27268 0.03359      0.21419       0.3472
##   5.4050     47       1  0.26688 0.03337      0.20887       0.3410
##   5.4108     46       1  0.26108 0.03315      0.20356       0.3349
##   5.4625     45       1  0.25528 0.03292      0.19827       0.3287
##   5.4900     44       1  0.24948 0.03268      0.19299       0.3225
##   5.5992     43       1  0.24368 0.03243      0.18773       0.3163
##   5.6517     42       1  0.23787 0.03217      0.18249       0.3101
##   5.6750     41       1  0.23207 0.03190      0.17726       0.3038
##   5.7092     40       1  0.22627 0.03163      0.17204       0.2976
##   5.7250     39       1  0.22047 0.03135      0.16685       0.2913
##   5.7583     38       1  0.21467 0.03105      0.16167       0.2850
##   5.8875     37       1  0.20886 0.03075      0.15651       0.2787
##   5.9000     36       1  0.20306 0.03044      0.15137       0.2724
##   6.0075     35       1  0.19726 0.03012      0.14624       0.2661
##   6.1833     33       1  0.19128 0.02979      0.14096       0.2596
##   6.1967     32       1  0.18531 0.02945      0.13570       0.2530
##   6.2108     31       1  0.17933 0.02910      0.13047       0.2465
##   6.3367     30       1  0.17335 0.02874      0.12525       0.2399
##   6.3392     29       1  0.16737 0.02837      0.12007       0.2333
##   6.5942     28       1  0.16140 0.02798      0.11491       0.2267
##   6.6875     26       1  0.15519 0.02758      0.10954       0.2199
```

```
##   6.7333     25       1  0.14898 0.02717      0.10421       0.2130
##   6.8575     24       1  0.14277 0.02673      0.09891       0.2061
##   6.9667     23       1  0.13657 0.02628      0.09365       0.1991
##   6.9775     22       1  0.13036 0.02581      0.08843       0.1922
##   7.0108     21       1  0.12415 0.02532      0.08325       0.1852
##   7.0583     20       1  0.11794 0.02480      0.07811       0.1781
##   7.0750     19       1  0.11174 0.02426      0.07301       0.1710
##   7.1067     18       1  0.10553 0.02369      0.06796       0.1639
##   7.1342     17       1  0.09932 0.02310      0.06296       0.1567
##   7.2025     15       1  0.09270 0.02249      0.05762       0.1491
##   7.4158     14       1  0.08608 0.02183      0.05236       0.1415
##   7.4683     13       1  0.07946 0.02113      0.04718       0.1338
##   7.9225     11       1  0.07223 0.02041      0.04152       0.1257
##   8.2925     10       1  0.06501 0.01961      0.03600       0.1174
##   8.7642      9       1  0.05779 0.01871      0.03063       0.1090
##   8.9117      8       1  0.05056 0.01771      0.02545       0.1005
##   9.1008      7       1  0.04334 0.01659      0.02047       0.0918
##   9.2325      6       1  0.03612 0.01532      0.01573       0.0829
##   9.3608      5       1  0.02889 0.01385      0.01129       0.0739
##   9.8817      4       1  0.02167 0.01213      0.00724       0.0649
##   9.9342      3       1  0.01445 0.01001      0.00372       0.0562
##  10.2267      2       1  0.00722 0.00715      0.00104       0.0503
##  11.8792      1       1  0.00000     NaN          NA           NA
```

```r
autoplot(kmsurvival_year, xlab="Time in Years", ylab="Survival Probability",
         surv.linetype = 'dashed',
         surv.colour = 'blue',
         conf.int.fill = 'dodgerblue3', conf.int.alpha = 0.5)
```



Fleming-Harrington non-parametric analysis

```
fhsurvival_year <- survfit(Surv(clinical_data$dfs_time/12, clinical_data$dfs_event) ~ 1,
                           type="fleming-harrington")
summary(fhsurvival_year)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time/12, clinical_data$dfs_event) ~
##     1, type = "fleming-harrington")
##
##     time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   0.0767    226       1  0.99558 0.00442      0.98697       1.0000
##   0.1500    224       1  0.99115 0.00624      0.97899       1.0000
##   0.1883    223       1  0.98672 0.00764      0.97186       1.0000
##   0.3033    221       1  0.98226 0.00881      0.96514       0.9997
##   0.3417    220       1  0.97781 0.00984      0.95872       0.9973
##   0.3533    219       1  0.97335 0.01076      0.95249       0.9947
##   0.4333    216       1  0.96886 0.01161      0.94636       0.9919
##   0.4350    215       1  0.96436 0.01240      0.94035       0.9890
##   0.8500    205       1  0.95967 0.01320      0.93413       0.9859
##   0.9667    203       1  0.95495 0.01396      0.92798       0.9827
##   1.0083    201       1  0.95021 0.01468      0.92188       0.9794
##   1.1250    200       1  0.94547 0.01535      0.91585       0.9761
##   1.2000    195       1  0.94064 0.01602      0.90975       0.9726
##   1.2500    192       1  0.93575 0.01667      0.90364       0.9690
##   1.2542    191       1  0.93086 0.01729      0.89759       0.9654
```

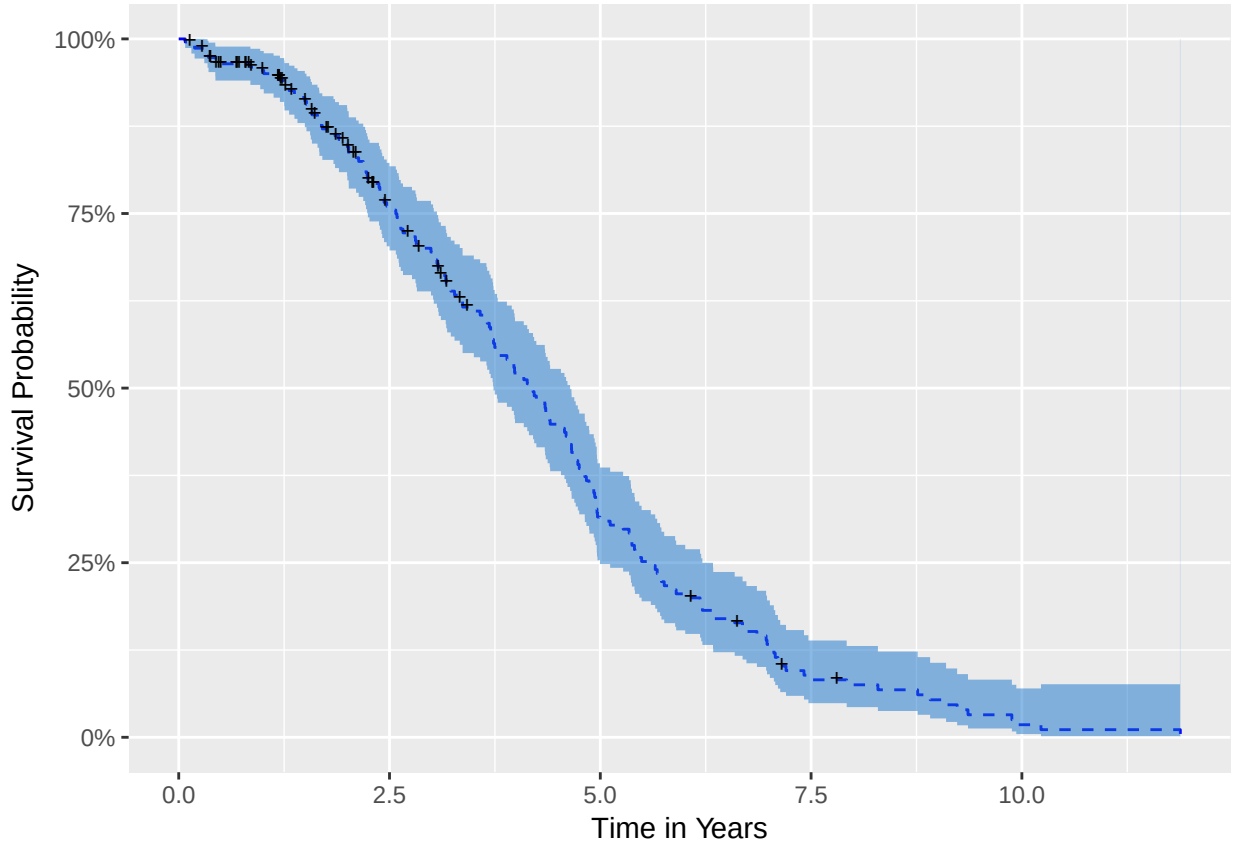
```
##   1.3092    189       1  0.92595 0.01789      0.89155       0.9617
##   1.3725    187       1  0.92101 0.01846      0.88553       0.9579
##   1.4083    186       1  0.91607 0.01902      0.87955       0.9541
##   1.4958    185       1  0.91114 0.01955      0.87362       0.9503
##   1.5150    183       1  0.90617 0.02007      0.86768       0.9464
##   1.5583    182       1  0.90121 0.02056      0.86179       0.9424
##   1.5667    181       1  0.89624 0.02105      0.85593       0.9385
##   1.5800    179       1  0.89125 0.02152      0.85006       0.9344
##   1.6458    177       1  0.88623 0.02198      0.84419       0.9304
##   1.6650    176       1  0.88121 0.02242      0.83834       0.9263
##   1.6683    175       1  0.87618 0.02285      0.83252       0.9221
##   1.7033    174       1  0.87116 0.02327      0.82673       0.9180
##   1.8350    171       1  0.86608 0.02368      0.82089       0.9138
##   1.8542    170       1  0.86100 0.02409      0.81507       0.9095
##   1.9000    167       1  0.85586 0.02449      0.80919       0.9052
##   1.9967    165       1  0.85069 0.02488      0.80329       0.9009
##   2.0000    164       1  0.84552 0.02527      0.79742       0.8965
##   2.0158    162       1  0.84032 0.02565      0.79153       0.8921
##   2.0167    161       1  0.83511 0.02601      0.78566       0.8877
##   2.1033    158       1  0.82985 0.02638      0.77972       0.8832
##   2.1342    157       1  0.82458 0.02674      0.77380       0.8787
##   2.1883    156       1  0.81931 0.02708      0.76791       0.8741
##   2.2108    155       1  0.81404 0.02742      0.76203       0.8696
##   2.2217    154       1  0.80877 0.02775      0.75617       0.8650
##   2.2350    153       1  0.80350 0.02807      0.75033       0.8604
##   2.2433    152       1  0.79823 0.02837      0.74451       0.8558
##   2.2625    150       1  0.79293 0.02868      0.73866       0.8512
##   2.3750    146       1  0.78752 0.02900      0.73269       0.8464
##   2.3858    145       1  0.78210 0.02930      0.72673       0.8417
##   2.4050    144       1  0.77669 0.02960      0.72080       0.8369
##   2.4133    143       1  0.77128 0.02988      0.71488       0.8321
##   2.4350    142       1  0.76587 0.03016      0.70897       0.8273
##   2.4667    140       1  0.76042 0.03044      0.70303       0.8225
##   2.5000    139       1  0.75496 0.03071      0.69711       0.8176
##   2.5750    138       1  0.74951 0.03097      0.69120       0.8127
##   2.5883    137       1  0.74406 0.03123      0.68531       0.8079
##   2.6083    136       1  0.73861 0.03147      0.67943       0.8029
##   2.6133    135       1  0.73316 0.03171      0.67357       0.7980
##   2.6333    134       1  0.72771 0.03195      0.66771       0.7931
##   2.6600    133       1  0.72226 0.03217      0.66188       0.7881
##   2.7667    131       1  0.71677 0.03240      0.65600       0.7832
##   2.8075    130       1  0.71127 0.03261      0.65014       0.7782
##   2.8167    129       1  0.70578 0.03282      0.64429       0.7731
##   2.8250    128       1  0.70029 0.03303      0.63845       0.7681
##   2.9917    126       1  0.69475 0.03323      0.63258       0.7630
##   3.0167    125       1  0.68922 0.03343      0.62671       0.7580
##   3.0250    124       1  0.68368 0.03362      0.62086       0.7529
##   3.0625    123       1  0.67815 0.03380      0.61502       0.7477
##   3.0767    122       1  0.67261 0.03398      0.60920       0.7426
##   3.0833    120       1  0.66703 0.03416      0.60333       0.7375
##   3.1092    119       1  0.66145 0.03433      0.59747       0.7323
##   3.1667    117       1  0.65582 0.03450      0.59157       0.7270
##   3.1725    116       1  0.65019 0.03466      0.58568       0.7218
##   3.1833    114       1  0.64451 0.03483      0.57974       0.7165
```

```
##   3.2267    113       1  0.63883 0.03498      0.57381       0.7112
##   3.2708    112       1  0.63315 0.03514      0.56790       0.7059
##   3.3333    111       1  0.62747 0.03528      0.56200       0.7006
##   3.3667    109       2  0.61607 0.03557      0.55016       0.6899
##   3.5000    106       1  0.61028 0.03570      0.54417       0.6844
##   3.5750    105       1  0.60450 0.03584      0.53819       0.6790
##   3.6492    104       1  0.59871 0.03596      0.53222       0.6735
##   3.6583    103       1  0.59293 0.03608      0.52627       0.6680
##   3.6833    102       1  0.58714 0.03619      0.52032       0.6625
##   3.7000    101       1  0.58136 0.03630      0.51439       0.6570
##   3.7225    100       1  0.57557 0.03640      0.50847       0.6515
##   3.7283     99       1  0.56979 0.03650      0.50256       0.6460
##   3.7333     98       1  0.56400 0.03659      0.49667       0.6405
##   3.7475     97       1  0.55822 0.03667      0.49078       0.6349
##   3.7750     96       1  0.55243 0.03675      0.48491       0.6294
##   3.7833     95       1  0.54665 0.03682      0.47904       0.6238
##   3.8925     94       1  0.54087 0.03689      0.47319       0.6182
##   3.9500     93       1  0.53508 0.03695      0.46735       0.6126
##   3.9750     92       1  0.52930 0.03701      0.46152       0.6070
##   3.9833     91       1  0.52351 0.03705      0.45570       0.6014
##   3.9883     90       1  0.51773 0.03710      0.44989       0.5958
##   4.0925     89       1  0.51194 0.03714      0.44409       0.5902
##   4.1333     88       1  0.50616 0.03717      0.43830       0.5845
##   4.1533     87       1  0.50037 0.03720      0.43253       0.5789
##   4.2025     86       1  0.49459 0.03722      0.42676       0.5732
##   4.2158     85       1  0.48880 0.03724      0.42101       0.5675
##   4.2417     84       1  0.48302 0.03725      0.41526       0.5618
##   4.3417     83       1  0.47723 0.03725      0.40953       0.5561
##   4.3450     82       1  0.47145 0.03726      0.40380       0.5504
##   4.3533     81       1  0.46567 0.03725      0.39809       0.5447
##   4.3750     80       1  0.45988 0.03724      0.39239       0.5390
##   4.4000     79       1  0.45410 0.03722      0.38670       0.5332
##   4.4050     78       1  0.44831 0.03720      0.38102       0.5275
##   4.5333     77       1  0.44253 0.03717      0.37535       0.5217
##   4.5750     76       1  0.43674 0.03714      0.36969       0.5160
##   4.5942     75       1  0.43096 0.03710      0.36404       0.5102
##   4.6108     74       1  0.42517 0.03706      0.35840       0.5044
##   4.6417     73       1  0.41939 0.03701      0.35278       0.4986
##   4.6583     72       1  0.41360 0.03696      0.34716       0.4928
##   4.6600     71       1  0.40782 0.03689      0.34156       0.4869
##   4.6917     70       1  0.40204 0.03683      0.33596       0.4811
##   4.7083     69       1  0.39625 0.03676      0.33038       0.4753
##   4.7333     68       1  0.39047 0.03668      0.32481       0.4694
##   4.7500     67       1  0.38468 0.03660      0.31924       0.4635
##   4.8158     66       1  0.37890 0.03651      0.31369       0.4577
##   4.8167     65       1  0.37311 0.03641      0.30816       0.4518
##   4.8350     64       1  0.36733 0.03631      0.30263       0.4459
##   4.8667     63       1  0.36154 0.03620      0.29711       0.4399
##   4.8708     62       1  0.35576 0.03609      0.29161       0.4340
##   4.9225     61       1  0.34997 0.03597      0.28612       0.4281
##   4.9333     60       1  0.34419 0.03585      0.28063       0.4221
##   4.9450     59       1  0.33840 0.03572      0.27517       0.4162
##   4.9583     58       2  0.32693 0.03545      0.26434       0.4043
##   4.9608     56       1  0.32115 0.03530      0.25891       0.3983
```

```
##   4.9667     55       1  0.31536 0.03514      0.25349       0.3923
##   4.9967     54       1  0.30958 0.03498      0.24808       0.3863
##   5.1167     53       1  0.30379 0.03481      0.24268       0.3803
##   5.2708     52       1  0.29800 0.03463      0.23730       0.3742
##   5.3417     51       1  0.29222 0.03445      0.23193       0.3682
##   5.3608     50       1  0.28643 0.03426      0.22657       0.3621
##   5.3642     49       1  0.28064 0.03406      0.22123       0.3560
##   5.3750     48       1  0.27486 0.03386      0.21590       0.3499
##   5.4050     47       1  0.26907 0.03365      0.21058       0.3438
##   5.4108     46       1  0.26329 0.03343      0.20528       0.3377
##   5.4625     45       1  0.25750 0.03320      0.20000       0.3315
##   5.4900     44       1  0.25171 0.03297      0.19472       0.3254
##   5.5992     43       1  0.24593 0.03273      0.18947       0.3192
##   5.6517     42       1  0.24014 0.03248      0.18423       0.3130
##   5.6750     41       1  0.23435 0.03222      0.17900       0.3068
##   5.7092     40       1  0.22857 0.03195      0.17379       0.3006
##   5.7250     39       1  0.22278 0.03167      0.16860       0.2944
##   5.7583     38       1  0.21700 0.03139      0.16342       0.2881
##   5.8875     37       1  0.21121 0.03110      0.15827       0.2819
##   5.9000     36       1  0.20542 0.03079      0.15313       0.2756
##   6.0075     35       1  0.19964 0.03048      0.14801       0.2693
##   6.1833     33       1  0.19368 0.03017      0.14273       0.2628
##   6.1967     32       1  0.18772 0.02984      0.13747       0.2563
##   6.2108     31       1  0.18176 0.02950      0.13224       0.2498
##   6.3367     30       1  0.17580 0.02915      0.12703       0.2433
##   6.3392     29       1  0.16984 0.02878      0.12184       0.2368
##   6.5942     28       1  0.16388 0.02841      0.11668       0.2302
##   6.6875     26       1  0.15770 0.02803      0.11132       0.2234
##   6.7333     25       1  0.15152 0.02763      0.10599       0.2166
##   6.8575     24       1  0.14533 0.02721      0.10069       0.2098
##   6.9667     23       1  0.13915 0.02678      0.09543       0.2029
##   6.9775     22       1  0.13297 0.02633      0.09020       0.1960
##   7.0108     21       1  0.12678 0.02585      0.08501       0.1891
##   7.0583     20       1  0.12060 0.02536      0.07987       0.1821
##   7.0750     19       1  0.11442 0.02484      0.07476       0.1751
##   7.1067     18       1  0.10823 0.02430      0.06970       0.1681
##   7.1342     17       1  0.10205 0.02373      0.06469       0.1610
##   7.2025     15       1  0.09547 0.02316      0.05934       0.1536
##   7.4158     14       1  0.08889 0.02255      0.05407       0.1461
##   7.4683     13       1  0.08231 0.02189      0.04887       0.1386
##   7.9225     11       1  0.07515 0.02124      0.04320       0.1308
##   8.2925     10       1  0.06800 0.02051      0.03765       0.1228
##   8.7642      9       1  0.06085 0.01970      0.03226       0.1148
##   8.9117      8       1  0.05370 0.01881      0.02703       0.1067
##   9.1008      7       1  0.04655 0.01782      0.02199       0.0986
##   9.2325      6       1  0.03941 0.01671      0.01716       0.0905
##   9.3608      5       1  0.03226 0.01547      0.01261       0.0826
##   9.8817      4       1  0.02513 0.01406      0.00839       0.0752
##   9.9342      3       1  0.01800 0.01247      0.00463       0.0700
##  10.2267      2       1  0.01092 0.01081      0.00157       0.0760
##  11.8792      1       1  0.00402     Inf      0.00000       1.0000
```

```
autoplot(fhsurvival_year, xlab="Time in Years", ylab="Survival Probability",
         surv.linetype = 'dashed',
```

```
        surv.colour = 'blue',
        conf.int.fill = 'dodgerblue3', conf.int.alpha = 0.5)
```



Non-Parametric Groups Analysis

This section aims to perform different group analysis on the dataset.

Gender Analysis

It seems from the analysis that males are living longer than females

Kaplan-Meier non-parametric

```
kmsurvival1_gender <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$gender)
summary(kmsurvival1_gender)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$gender)
##
##                 clinical_data$gender=F
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
```

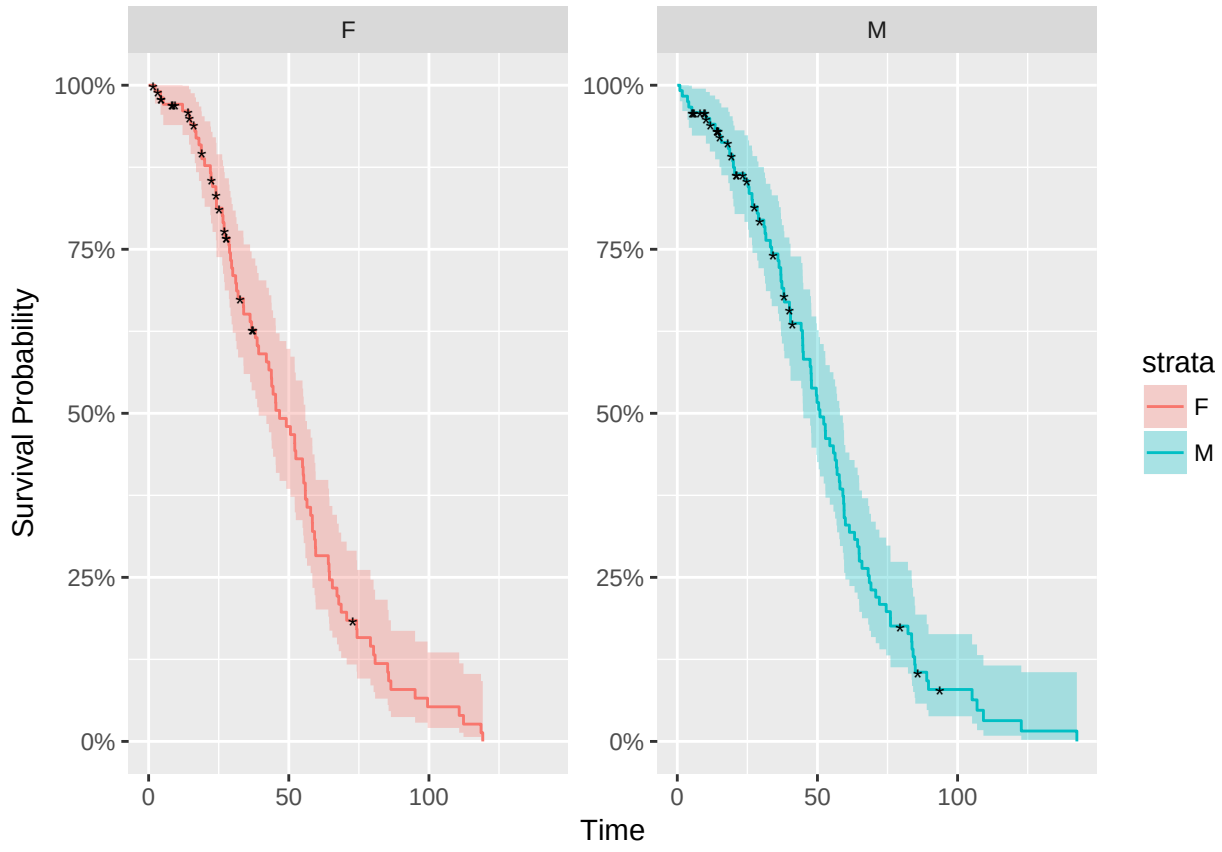
```
##    2.26    105       1   0.9905 0.00948      0.97207        1.000
##    4.24    103       1   0.9809 0.01340      0.95494        1.000
##    5.22    100       1   0.9711 0.01647      0.93930        1.000
##   12.10     96       1   0.9609 0.01916      0.92411        0.999
##   14.40     94       1   0.9507 0.02151      0.90948        0.994
##   15.00     92       1   0.9404 0.02363      0.89519        0.988
##   16.47     90       1   0.9299 0.02557      0.88114        0.981
##   16.90     89       1   0.9195 0.02733      0.86744        0.975
##   17.95     88       1   0.9090 0.02895      0.85402        0.968
##   18.80     87       1   0.8986 0.03045      0.84085        0.960
##   18.96     85       1   0.8880 0.03187      0.82769        0.953
##   19.98     84       1   0.8774 0.03320      0.81473        0.945
##   22.02     83       1   0.8669 0.03444      0.80193        0.937
##   22.25     82       1   0.8563 0.03561      0.78928        0.929
##   22.80     79       1   0.8455 0.03677      0.77638        0.921
##   24.00     78       1   0.8346 0.03786      0.76362        0.912
##   24.19     76       1   0.8236 0.03892      0.75078        0.904
##   24.20     75       1   0.8127 0.03992      0.73806        0.895
##   26.26     73       1   0.8015 0.04090      0.72524        0.886
##   26.53     72       1   0.7904 0.04182      0.71254        0.877
##   26.92     71       1   0.7793 0.04269      0.69993        0.868
##   27.15     69       1   0.7680 0.04354      0.68721        0.858
##   28.63     66       1   0.7563 0.04440      0.67412        0.849
##   28.86     65       1   0.7447 0.04522      0.66114        0.839
##   29.22     64       1   0.7331 0.04599      0.64825        0.829
##   29.60     63       1   0.7214 0.04670      0.63545        0.819
##   30.00     62       1   0.7098 0.04738      0.62274        0.809
##   31.06     61       1   0.6982 0.04801      0.61012        0.799
##   31.36     60       1   0.6865 0.04860      0.59758        0.789
##   31.92     59       1   0.6749 0.04915      0.58511        0.778
##   33.80     57       1   0.6630 0.04969      0.57246        0.768
##   33.90     56       1   0.6512 0.05020      0.55989        0.757
##   36.20     55       1   0.6394 0.05066      0.54739        0.747
##   36.75     54       1   0.6275 0.05109      0.53497        0.736
##   38.07     51       1   0.6152 0.05155      0.52205        0.725
##   38.72     50       1   0.6029 0.05196      0.50920        0.714
##   39.25     49       1   0.5906 0.05234      0.49644        0.703
##   42.00     48       1   0.5783 0.05267      0.48375        0.691
##   42.90     47       1   0.5660 0.05297      0.47114        0.680
##   43.79     46       1   0.5537 0.05323      0.45861        0.668
##   43.90     45       1   0.5414 0.05345      0.44614        0.657
##   44.40     44       1   0.5291 0.05363      0.43375        0.645
##   45.30     43       1   0.5168 0.05378      0.42143        0.634
##   45.40     42       1   0.5045 0.05389      0.40918        0.622
##   46.71     41       1   0.4922 0.05396      0.39700        0.610
##   49.11     40       1   0.4799 0.05399      0.38490        0.598
##   50.59     39       1   0.4676 0.05399      0.37286        0.586
##   52.10     38       1   0.4553 0.05396      0.36089        0.574
##   52.14     37       1   0.4430 0.05388      0.34899        0.562
##   52.50     36       1   0.4307 0.05377      0.33716        0.550
##   54.90     35       1   0.4183 0.05363      0.32541        0.538
##   55.13     34       1   0.4060 0.05344      0.31372        0.526
##   55.33     33       1   0.3937 0.05322      0.30210        0.513
##   55.90     32       1   0.3814 0.05296      0.29056        0.501
```

```
##   55.92     31       1   0.3691 0.05266      0.27909        0.488
##   56.50     30       1   0.3568 0.05232      0.26769        0.476
##   57.80     29       1   0.3445 0.05195      0.25637        0.463
##   58.40     28       1   0.3322 0.05153      0.24513        0.450
##   58.45     27       1   0.3199 0.05107      0.23397        0.437
##   59.20     26       1   0.3076 0.05056      0.22288        0.425
##   59.50     25       1   0.2953 0.05002      0.21188        0.412
##   59.60     24       1   0.2830 0.04942      0.20097        0.399
##   64.10     23       1   0.2707 0.04878      0.19015        0.385
##   64.37     22       1   0.2584 0.04809      0.17941        0.372
##   64.50     21       1   0.2461 0.04735      0.16878        0.359
##   65.55     20       1   0.2338 0.04655      0.15824        0.345
##   67.19     19       1   0.2215 0.04570      0.14781        0.332
##   67.82     18       1   0.2092 0.04479      0.13748        0.318
##   68.70     17       1   0.1969 0.04381      0.12728        0.305
##   70.65     16       1   0.1846 0.04276      0.11720        0.291
##   74.20     14       1   0.1714 0.04169      0.10639        0.276
##   74.36     13       1   0.1582 0.04052      0.09576        0.261
##   79.13     12       1   0.1450 0.03923      0.08534        0.246
##   80.25     11       1   0.1318 0.03781      0.07514        0.231
##   80.80     10       1   0.1186 0.03625      0.06519        0.216
##   85.28      9       1   0.1055 0.03454      0.05551        0.200
##   85.61      8       1   0.0923 0.03264      0.04614        0.185
##   86.43      7       1   0.0791 0.03052      0.03713        0.169
##   95.07      6       1   0.0659 0.02814      0.02855        0.152
##   99.51      5       1   0.0527 0.02541      0.02050        0.136
##  110.79      4       1   0.0395 0.02222      0.01315        0.119
##  112.33      3       1   0.0264 0.01831      0.00676        0.103
##  118.58      2       1   0.0132 0.01307      0.00189        0.092
##  119.21      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$gender=M
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    120       1   0.9917  0.0083      0.97553        1.000
##    1.80    119       1   0.9833  0.0117      0.96069        1.000
##    3.64    118       1   0.9750  0.0143      0.94746        1.000
##    4.10    117       1   0.9667  0.0164      0.93508        0.999
##    5.20    116       1   0.9583  0.0182      0.92324        0.995
##   10.20    109       1   0.9495  0.0201      0.91099        0.990
##   11.60    107       1   0.9407  0.0218      0.89896        0.984
##   13.50    105       1   0.9317  0.0233      0.88709        0.979
##   15.05    100       1   0.9224  0.0249      0.87488        0.972
##   15.71     98       1   0.9130  0.0264      0.86276        0.966
##   18.18     96       1   0.9035  0.0277      0.85070        0.960
##   18.70     95       1   0.8940  0.0290      0.83883        0.953
##   19.75     93       1   0.8843  0.0303      0.82696        0.946
##   20.02     92       1   0.8747  0.0314      0.81525        0.939
##   20.44     91       1   0.8651  0.0325      0.80367        0.931
##   23.96     87       1   0.8552  0.0336      0.79173        0.924
##   25.24     85       1   0.8451  0.0347      0.77975        0.916
##   25.61     84       1   0.8351  0.0357      0.76789        0.908
##   26.66     83       1   0.8250  0.0367      0.75614        0.900
##   26.82     82       1   0.8149  0.0376      0.74449        0.892
##   28.50     80       1   0.8047  0.0385      0.73276        0.884
```

```
##   28.96     79       1   0.7946  0.0393      0.72112        0.875
##   30.90     77       1   0.7842  0.0401      0.70939        0.867
##   31.30     76       1   0.7739  0.0409      0.69775        0.858
##   31.60     75       1   0.7636  0.0416      0.68618        0.850
##   33.20     74       1   0.7533  0.0423      0.67470        0.841
##   33.69     73       1   0.7430  0.0430      0.66328        0.832
##   35.90     71       1   0.7325  0.0437      0.65175        0.823
##   36.30     70       1   0.7220  0.0443      0.64029        0.814
##   36.92     69       1   0.7116  0.0448      0.62889        0.805
##   37.00     68       1   0.7011  0.0454      0.61756        0.796
##   37.31     67       1   0.6906  0.0459      0.60629        0.787
##   38.00     66       1   0.6802  0.0464      0.59508        0.777
##   38.20     64       1   0.6696  0.0469      0.58373        0.768
##   40.00     63       1   0.6589  0.0473      0.57243        0.758
##   40.40     61       2   0.6373  0.0482      0.54959        0.739
##   44.20     58       1   0.6263  0.0486      0.53802        0.729
##   44.67     57       1   0.6153  0.0489      0.52652        0.719
##   44.74     56       1   0.6044  0.0493      0.51508        0.709
##   44.80     55       1   0.5934  0.0496      0.50370        0.699
##   44.97     54       1   0.5824  0.0499      0.49238        0.689
##   47.40     53       1   0.5714  0.0501      0.48111        0.679
##   47.70     52       1   0.5604  0.0504      0.46990        0.668
##   47.80     51       1   0.5494  0.0506      0.45874        0.658
##   47.86     50       1   0.5384  0.0507      0.44764        0.648
##   49.60     49       1   0.5274  0.0509      0.43659        0.637
##   49.84     48       1   0.5164  0.0510      0.42560        0.627
##   50.43     47       1   0.5055  0.0511      0.41466        0.616
##   50.90     46       1   0.4945  0.0511      0.40377        0.606
##   52.24     45       1   0.4835  0.0512      0.39293        0.595
##   52.80     44       1   0.4725  0.0512      0.38215        0.584
##   52.86     43       1   0.4615  0.0511      0.37142        0.573
##   54.40     42       1   0.4505  0.0511      0.36074        0.563
##   55.70     41       1   0.4395  0.0510      0.35011        0.552
##   56.30     40       1   0.4285  0.0509      0.33954        0.541
##   56.80     39       1   0.4176  0.0508      0.32901        0.530
##   57.00     38       1   0.4066  0.0506      0.31855        0.519
##   57.79     37       1   0.3956  0.0504      0.30813        0.508
##   58.02     36       1   0.3846  0.0502      0.29777        0.497
##   59.07     35       1   0.3736  0.0500      0.28747        0.486
##   59.34     34       1   0.3626  0.0497      0.27722        0.474
##   59.50     33       1   0.3516  0.0494      0.26702        0.463
##   59.53     32       1   0.3406  0.0490      0.25689        0.452
##   59.96     31       1   0.3296  0.0487      0.24681        0.440
##   61.40     30       1   0.3187  0.0483      0.23680        0.429
##   63.25     29       1   0.3077  0.0478      0.22684        0.417
##   64.33     28       1   0.2967  0.0474      0.21695        0.406
##   64.86     27       1   0.2857  0.0469      0.20712        0.394
##   64.93     26       1   0.2747  0.0464      0.19736        0.382
##   65.88     25       1   0.2637  0.0458      0.18766        0.371
##   68.10     24       1   0.2527  0.0452      0.17804        0.359
##   68.51     23       1   0.2417  0.0445      0.16849        0.347
##   69.10     22       1   0.2308  0.0438      0.15902        0.335
##   70.80     21       1   0.2198  0.0431      0.14963        0.323
##   72.09     20       1   0.2088  0.0423      0.14032        0.311
```

```
##   74.53     19       1   0.1978  0.0415       0.13110        0.298
##   76.04     18       1   0.1868  0.0406       0.12197        0.286
##   76.07     17       1   0.1758  0.0397       0.11295        0.274
##   82.29     15       1   0.1641  0.0387       0.10331        0.261
##   83.60     14       1   0.1524  0.0377       0.09382        0.247
##   83.73     13       1   0.1406  0.0366       0.08448        0.234
##   84.13     12       1   0.1289  0.0354       0.07532        0.221
##   84.70     11       1   0.1172  0.0340       0.06635        0.207
##   84.90     10       1   0.1055  0.0326       0.05758        0.193
##   88.99      8       1   0.0923  0.0311       0.04772        0.179
##   89.62      7       1   0.0791  0.0293       0.03829        0.163
##  105.17      5       1   0.0633  0.0274       0.02711        0.148
##  106.94      4       1   0.0475  0.0247       0.01713        0.132
##  109.21      3       1   0.0316  0.0209       0.00866        0.116
##  122.72      2       1   0.0158  0.0153       0.00237        0.106
##  142.55      1       1   0.0000     NaN            NA           NA
```

```
autoplot(kmsurvival1_gender,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_gender <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$gender, type="fleming-harrington")
```

```r
summary(fhsurvival1_gender)
```

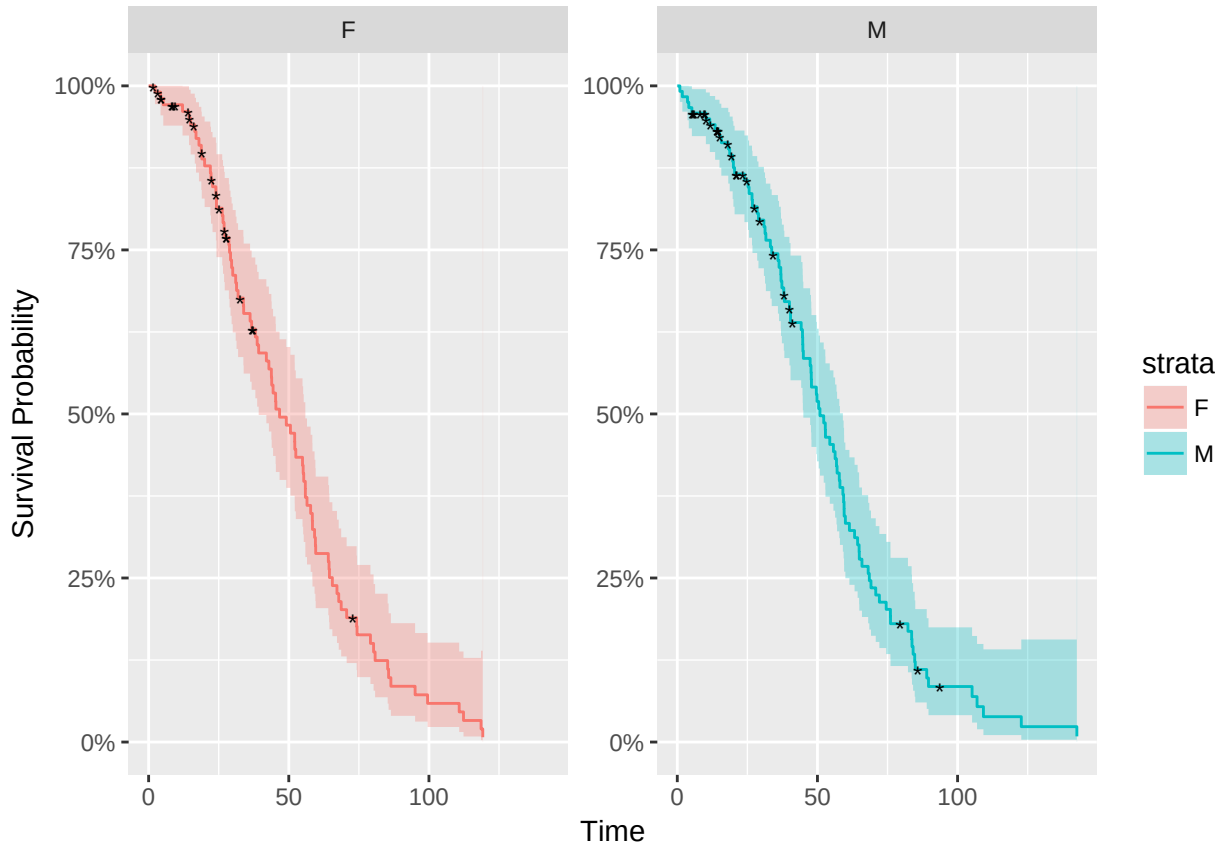
```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$gender, type = "fleming-harrington")
##
##                 clinical_data$gender=F
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    2.26    105       1  0.99052 0.00948      0.97212        1.000
##    4.24    103       1  0.98095 0.01341      0.95503        1.000
##    5.22    100       1  0.97119 0.01648      0.93943        1.000
##   12.10     96       1  0.96113 0.01916      0.92430        0.999
##   14.40     94       1  0.95096 0.02151      0.90971        0.994
##   15.00     92       1  0.94068 0.02363      0.89548        0.988
##   16.47     90       1  0.93028 0.02558      0.88147        0.982
##   16.90     89       1  0.91989 0.02735      0.86782        0.975
##   17.95     88       1  0.90949 0.02897      0.85445        0.968
##   18.80     87       1  0.89910 0.03046      0.84133        0.961
##   18.96     85       1  0.88858 0.03189      0.82823        0.953
##   19.98     84       1  0.87807 0.03322      0.81531        0.946
##   22.02     83       1  0.86755 0.03447      0.80256        0.938
##   22.25     82       1  0.85704 0.03564      0.78996        0.930
##   22.80     79       1  0.84626 0.03680      0.77711        0.922
##   24.00     78       1  0.83548 0.03790      0.76440        0.913
##   24.19     76       1  0.82455 0.03897      0.75161        0.905
##   24.20     75       1  0.81363 0.03997      0.73895        0.896
##   26.26     73       1  0.80256 0.04095      0.72618        0.887
##   26.53     72       1  0.79149 0.04188      0.71353        0.878
##   26.92     71       1  0.78042 0.04275      0.70098        0.869
##   27.15     69       1  0.76920 0.04360      0.68831        0.860
##   28.63     66       1  0.75763 0.04448      0.67528        0.850
##   28.86     65       1  0.74606 0.04530      0.66235        0.840
##   29.22     64       1  0.73450 0.04608      0.64952        0.831
##   29.60     63       1  0.72293 0.04680      0.63678        0.821
##   30.00     62       1  0.71136 0.04748      0.62413        0.811
##   31.06     61       1  0.69980 0.04812      0.61156        0.801
##   31.36     60       1  0.68823 0.04872      0.59907        0.791
##   31.92     59       1  0.67666 0.04928      0.58666        0.780
##   33.80     57       1  0.66490 0.04983      0.57406        0.770
##   33.90     56       1  0.65313 0.05034      0.56155        0.760
##   36.20     55       1  0.64136 0.05082      0.54911        0.749
##   36.75     54       1  0.62959 0.05126      0.53674        0.739
##   38.07     51       1  0.61737 0.05173      0.52387        0.728
##   38.72     50       1  0.60514 0.05215      0.51109        0.717
##   39.25     49       1  0.59292 0.05254      0.49838        0.705
##   42.00     48       1  0.58069 0.05289      0.48575        0.694
##   42.90     47       1  0.56847 0.05320      0.47320        0.683
##   43.79     46       1  0.55624 0.05347      0.46072        0.672
##   43.90     45       1  0.54402 0.05371      0.44831        0.660
##   44.40     44       1  0.53179 0.05391      0.43597        0.649
##   45.30     43       1  0.51957 0.05407      0.42371        0.637
##   45.40     42       1  0.50735 0.05419      0.41151        0.625
##   46.71     41       1  0.49512 0.05428      0.39938        0.614
##   49.11     40       1  0.48290 0.05434      0.38733        0.602
##   50.59     39       1  0.47067 0.05435      0.37534        0.590
```

```
##   52.10     38       1  0.45845 0.05433      0.36342        0.578
##   52.14     37       1  0.44622 0.05428      0.35157        0.566
##   52.50     36       1  0.43400 0.05419      0.33978        0.554
##   54.90     35       1  0.42177 0.05407      0.32807        0.542
##   55.13     34       1  0.40955 0.05390      0.31643        0.530
##   55.33     33       1  0.39732 0.05370      0.30485        0.518
##   55.90     32       1  0.38510 0.05347      0.29335        0.506
##   55.92     31       1  0.37288 0.05320      0.28192        0.493
##   56.50     30       1  0.36065 0.05288      0.27056        0.481
##   57.80     29       1  0.34843 0.05254      0.25928        0.468
##   58.40     28       1  0.33620 0.05215      0.24807        0.456
##   58.45     27       1  0.32398 0.05172      0.23694        0.443
##   59.20     26       1  0.31175 0.05125      0.22589        0.430
##   59.50     25       1  0.29953 0.05073      0.21492        0.417
##   59.60     24       1  0.28731 0.05017      0.20403        0.405
##   64.10     23       1  0.27508 0.04957      0.19323        0.392
##   64.37     22       1  0.26286 0.04892      0.18252        0.379
##   64.50     21       1  0.25064 0.04822      0.17190        0.365
##   65.55     20       1  0.23841 0.04747      0.16137        0.352
##   67.19     19       1  0.22619 0.04667      0.15095        0.339
##   67.82     18       1  0.21396 0.04581      0.14063        0.326
##   68.70     17       1  0.20174 0.04489      0.13043        0.312
##   70.65     16       1  0.18952 0.04391      0.12034        0.298
##   74.20     14       1  0.17645 0.04293      0.10954        0.284
##   74.36     13       1  0.16339 0.04185      0.09891        0.270
##   79.13     12       1  0.15033 0.04066      0.08847        0.255
##   80.25     11       1  0.13726 0.03937      0.07824        0.241
##   80.80     10       1  0.12420 0.03795      0.06824        0.226
##   85.28      9       1  0.11114 0.03640      0.05849        0.211
##   85.61      8       1  0.09808 0.03469      0.04903        0.196
##   86.43      7       1  0.08502 0.03281      0.03991        0.181
##   95.07      6       1  0.07197 0.03073      0.03117        0.166
##   99.51      5       1  0.05892 0.02840      0.02291        0.152
##  110.79      4       1  0.04589 0.02578      0.01526        0.138
##  112.33      3       1  0.03288 0.02283      0.00843        0.128
##  118.58      2       1  0.01994 0.01977      0.00286        0.139
##  119.21      1       1  0.00734     Inf      0.00000        1.000
##
##                clinical_data$gender=M
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    120       1  0.99170  0.0083      0.97557        1.000
##    1.80    119       1  0.98340  0.0117      0.96076        1.000
##    3.64    118       1  0.97510  0.0143      0.94756        1.000
##    4.10    117       1  0.96681  0.0164      0.93521        0.999
##    5.20    116       1  0.95851  0.0182      0.92341        0.995
##   10.20    109       1  0.94975  0.0201      0.91119        0.990
##   11.60    107       1  0.94092  0.0218      0.89920        0.985
##   13.50    105       1  0.93200  0.0233      0.88736        0.979
##   15.05    100       1  0.92273  0.0249      0.87520        0.973
##   15.71     98       1  0.91336  0.0264      0.86312        0.967
##   18.18     96       1  0.90389  0.0278      0.85110        0.960
##   18.70     95       1  0.89443  0.0290      0.83927        0.953
##   19.75     93       1  0.88486  0.0303      0.82744        0.946
##   20.02     92       1  0.87530  0.0315      0.81577        0.939
```

```
##   20.44     91       1  0.86573  0.0325      0.80424        0.932
##   23.96     87       1  0.85584  0.0337      0.79234        0.924
##   25.24     85       1  0.84583  0.0347      0.78041        0.917
##   25.61     84       1  0.83582  0.0358      0.76859        0.909
##   26.66     83       1  0.82581  0.0367      0.75688        0.901
##   26.82     82       1  0.81580  0.0376      0.74528        0.893
##   28.50     80       1  0.80566  0.0385      0.73359        0.885
##   28.96     79       1  0.79553  0.0394      0.72200        0.877
##   30.90     77       1  0.78527  0.0402      0.71032        0.868
##   31.30     76       1  0.77500  0.0410      0.69872        0.860
##   31.60     75       1  0.76474  0.0417      0.68720        0.851
##   33.20     74       1  0.75447  0.0424      0.67576        0.842
##   33.69     73       1  0.74421  0.0431      0.66439        0.834
##   35.90     71       1  0.73380  0.0437      0.65290        0.825
##   36.30     70       1  0.72339  0.0443      0.64149        0.816
##   36.92     69       1  0.71298  0.0449      0.63014        0.807
##   37.00     68       1  0.70257  0.0455      0.61885        0.798
##   37.31     67       1  0.69216  0.0460      0.60763        0.788
##   38.00     66       1  0.68176  0.0465      0.59646        0.779
##   38.20     64       1  0.67119  0.0470      0.58515        0.770
##   40.00     63       1  0.66062  0.0474      0.57390        0.760
##   40.40     61       2  0.63931  0.0483      0.55130        0.741
##   44.20     58       1  0.62838  0.0487      0.53978        0.732
##   44.67     57       1  0.61745  0.0491      0.52833        0.722
##   44.74     56       1  0.60652  0.0495      0.51693        0.712
##   44.80     55       1  0.59560  0.0498      0.50559        0.702
##   44.97     54       1  0.58467  0.0501      0.49431        0.692
##   47.40     53       1  0.57374  0.0503      0.48309        0.681
##   47.70     52       1  0.56281  0.0506      0.47192        0.671
##   47.80     51       1  0.55188  0.0508      0.46080        0.661
##   47.86     50       1  0.54096  0.0510      0.44974        0.651
##   49.60     49       1  0.53003  0.0511      0.43874        0.640
##   49.84     48       1  0.51910  0.0512      0.42778        0.630
##   50.43     47       1  0.50817  0.0513      0.41688        0.619
##   50.90     46       1  0.49724  0.0514      0.40603        0.609
##   52.24     45       1  0.48632  0.0515      0.39523        0.598
##   52.80     44       1  0.47539  0.0515      0.38449        0.588
##   52.86     43       1  0.46446  0.0515      0.37379        0.577
##   54.40     42       1  0.45353  0.0514      0.36315        0.566
##   55.70     41       1  0.44260  0.0514      0.35256        0.556
##   56.30     40       1  0.43168  0.0513      0.34202        0.545
##   56.80     39       1  0.42075  0.0512      0.33153        0.534
##   57.00     38       1  0.40982  0.0510      0.32110        0.523
##   57.79     37       1  0.39889  0.0508      0.31071        0.512
##   58.02     36       1  0.38796  0.0506      0.30038        0.501
##   59.07     35       1  0.37704  0.0504      0.29011        0.490
##   59.34     34       1  0.36611  0.0502      0.27989        0.479
##   59.50     33       1  0.35518  0.0499      0.26973        0.468
##   59.53     32       1  0.34425  0.0496      0.25962        0.456
##   59.96     31       1  0.33333  0.0492      0.24957        0.445
##   61.40     30       1  0.32240  0.0488      0.23957        0.434
##   63.25     29       1  0.31147  0.0484      0.22964        0.422
##   64.33     28       1  0.30054  0.0480      0.21977        0.411
##   64.86     27       1  0.28962  0.0475      0.20996        0.399
```

```
##   64.93     26       1  0.27869  0.0470      0.20022        0.388
##   65.88     25       1  0.26776  0.0465      0.19054        0.376
##   68.10     24       1  0.25683  0.0459      0.18093        0.365
##   68.51     23       1  0.24591  0.0453      0.17139        0.353
##   69.10     22       1  0.23498  0.0446      0.16193        0.341
##   70.80     21       1  0.22405  0.0439      0.15254        0.329
##   72.09     20       1  0.21312  0.0432      0.14324        0.317
##   74.53     19       1  0.20220  0.0424      0.13402        0.305
##   76.04     18       1  0.19127  0.0416      0.12489        0.293
##   76.07     17       1  0.18034  0.0407      0.11586        0.281
##   82.29     15       1  0.16871  0.0398      0.10622        0.268
##   83.60     14       1  0.15708  0.0389      0.09672        0.255
##   83.73     13       1  0.14545  0.0378      0.08737        0.242
##   84.13     12       1  0.13382  0.0367      0.07818        0.229
##   84.70     11       1  0.12219  0.0355      0.06917        0.216
##   84.90     10       1  0.11056  0.0342      0.06035        0.203
##   88.99      8       1  0.09757  0.0328      0.05045        0.189
##   89.62      7       1  0.08458  0.0313      0.04094        0.175
##  105.17      5       1  0.06925  0.0300      0.02967        0.162
##  106.94      4       1  0.05393  0.0280      0.01946        0.149
##  109.21      3       1  0.03864  0.0255      0.01058        0.141
##  122.72      2       1  0.02344  0.0227      0.00352        0.156
##  142.55      1       1  0.00862     Inf      0.00000        1.000
```

```r
autoplot(fhsurvival1_gender,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Tumor Location

It seems from the analysis that Colon cancer is the most dengraous cancer location.

Kaplan-Meier non-parametric

```
kmsurvival1_location <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                                ~ clinical_data$location)
summary(kmsurvival1_location)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$location)
##
##                 clinical_data$location=Rectum
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   10.2     29       1   0.9655  0.0339       0.9013        1.000
##   11.6     28       1   0.9310  0.0471       0.8432        1.000
##   16.9     24       1   0.8922  0.0590       0.7839        1.000
##   18.8     23       1   0.8534  0.0680       0.7301        0.998
##   22.8     21       1   0.8128  0.0759       0.6768        0.976
##   30.9     20       1   0.7722  0.0823       0.6266        0.952
##   37.0     19       1   0.7315  0.0874       0.5788        0.925
##   38.2     17       1   0.6885  0.0923       0.5295        0.895
##   40.4     16       1   0.6455  0.0960       0.4822        0.864
```

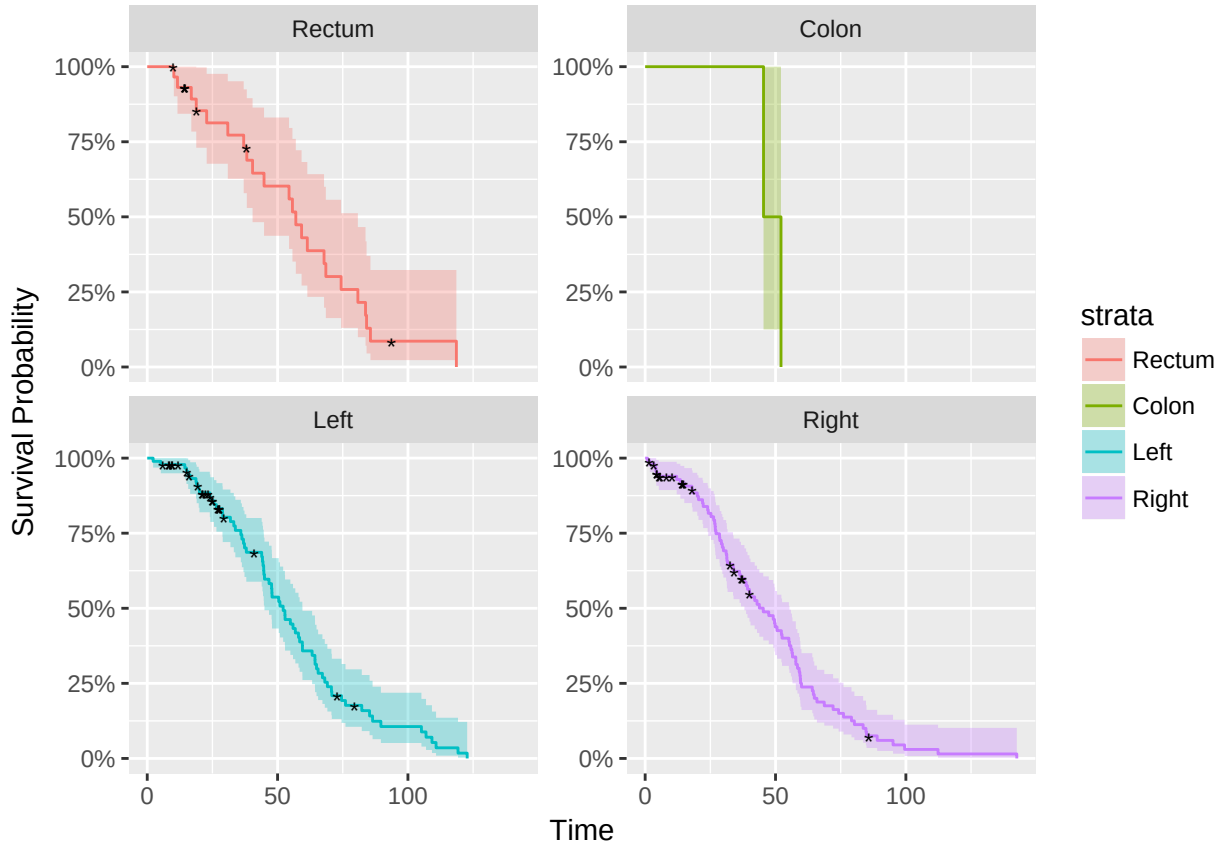
```
##   44.8     15       1   0.6024  0.0988       0.4369        0.831
##   54.4     14       1   0.5594  0.1007       0.3932        0.796
##   55.7     13       1   0.5164  0.1017       0.3510        0.760
##   57.0     12       1   0.4733  0.1019       0.3104        0.722
##   59.2     11       1   0.4303  0.1013       0.2712        0.683
##   61.4     10       1   0.3873  0.0999       0.2336        0.642
##   67.8      9       1   0.3442  0.0976       0.1974        0.600
##   68.5      8       1   0.3012  0.0944       0.1629        0.557
##   74.4      7       1   0.2582  0.0902       0.1302        0.512
##   80.8      6       1   0.2152  0.0848       0.0993        0.466
##   83.7      5       1   0.1721  0.0780       0.0708        0.418
##   84.1      4       1   0.1291  0.0694       0.0450        0.370
##   85.6      3       1   0.0861  0.0581       0.0229        0.323
##  118.6      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$location=Colon
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##  45.4      2       1      0.5   0.354        0.125            1
##  52.1      1       1      0.0     NaN           NA           NA
##
##                clinical_data$location=Left
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    2.26     93       1   0.9892  0.0107      0.96851        1.000
##    5.20     92       1   0.9785  0.0150      0.94945        1.000
##   14.40     85       1   0.9670  0.0188      0.93090        1.000
##   15.05     84       1   0.9555  0.0218      0.91372        0.999
##   15.71     82       1   0.9438  0.0244      0.89712        0.993
##   16.47     80       1   0.9320  0.0268      0.88089        0.986
##   18.70     79       1   0.9202  0.0290      0.86517        0.979
##   18.96     78       1   0.9084  0.0309      0.84983        0.971
##   19.75     76       1   0.8965  0.0327      0.83457        0.963
##   20.02     75       1   0.8845  0.0344      0.81959        0.955
##   24.00     69       1   0.8717  0.0362      0.80353        0.946
##   24.20     67       1   0.8587  0.0379      0.78746        0.936
##   25.61     64       1   0.8453  0.0396      0.77103        0.927
##   26.53     63       1   0.8319  0.0412      0.75485        0.917
##   28.86     58       1   0.8175  0.0429      0.73754        0.906
##   28.96     57       1   0.8032  0.0445      0.72049        0.895
##   31.92     55       1   0.7886  0.0460      0.70330        0.884
##   33.20     54       1   0.7740  0.0474      0.68634        0.873
##   33.80     53       1   0.7594  0.0487      0.66959        0.861
##   35.90     52       1   0.7448  0.0499      0.65302        0.849
##   36.30     51       1   0.7302  0.0511      0.63664        0.837
##   36.92     50       1   0.7156  0.0521      0.62042        0.825
##   37.31     49       1   0.7009  0.0530      0.60435        0.813
##   38.00     48       1   0.6863  0.0539      0.58844        0.801
##   43.90     46       1   0.6714  0.0548      0.57225        0.788
##   44.20     45       1   0.6565  0.0555      0.55621        0.775
##   44.40     44       1   0.6416  0.0562      0.54031        0.762
##   44.67     43       1   0.6267  0.0569      0.52454        0.749
##   44.74     42       1   0.6117  0.0574      0.50891        0.735
##   44.97     41       1   0.5968  0.0579      0.49340        0.722
##   46.71     40       1   0.5819  0.0584      0.47801        0.708
##   47.70     39       1   0.5670  0.0588      0.46274        0.695
```

```
##   47.80     38       1   0.5521  0.0591      0.44760        0.681
##   47.86     37       1   0.5371  0.0593      0.43256        0.667
##   50.43     36       1   0.5222  0.0595      0.41764        0.653
##   50.90     35       1   0.5073  0.0597      0.40284        0.639
##   52.14     34       1   0.4924  0.0598      0.38814        0.625
##   52.80     33       1   0.4775  0.0598      0.37356        0.610
##   52.86     32       1   0.4625  0.0597      0.35908        0.596
##   54.90     31       1   0.4476  0.0597      0.34472        0.581
##   55.92     30       1   0.4327  0.0595      0.33047        0.567
##   56.80     29       1   0.4178  0.0593      0.31633        0.552
##   58.02     28       1   0.4029  0.0590      0.30230        0.537
##   58.45     27       1   0.3879  0.0587      0.28839        0.522
##   59.50     26       1   0.3730  0.0583      0.27459        0.507
##   59.53     25       1   0.3581  0.0578      0.26091        0.491
##   63.25     24       1   0.3432  0.0573      0.24735        0.476
##   64.33     23       1   0.3283  0.0567      0.23392        0.461
##   64.37     22       1   0.3133  0.0561      0.22061        0.445
##   64.93     21       1   0.2984  0.0554      0.20743        0.429
##   65.55     20       1   0.2835  0.0546      0.19439        0.413
##   67.19     19       1   0.2686  0.0537      0.18149        0.397
##   68.10     18       1   0.2536  0.0528      0.16874        0.381
##   69.10     17       1   0.2387  0.0517      0.15614        0.365
##   70.65     16       1   0.2238  0.0506      0.14370        0.349
##   70.80     15       1   0.2089  0.0494      0.13144        0.332
##   74.53     13       1   0.1928  0.0481      0.11824        0.314
##   76.04     12       1   0.1768  0.0467      0.10530        0.297
##   82.29     10       1   0.1591  0.0453      0.09108        0.278
##   85.28      9       1   0.1414  0.0435      0.07732        0.259
##   86.43      8       1   0.1237  0.0415      0.06408        0.239
##   89.62      7       1   0.1061  0.0392      0.05141        0.219
##  105.17      6       1   0.0884  0.0364      0.03940        0.198
##  106.94      5       1   0.0707  0.0331      0.02820        0.177
##  109.21      4       1   0.0530  0.0292      0.01802        0.156
##  110.79      3       1   0.0354  0.0242      0.00922        0.135
##  119.21      2       1   0.0177  0.0174      0.00257        0.122
##  122.72      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$location=Right
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    101       1   0.9901 0.00985      0.97098        1.000
##    1.80     99       1   0.9801 0.01393      0.95317        1.000
##    3.64     97       1   0.9700 0.01706      0.93712        1.000
##    4.10     96       1   0.9599 0.01965      0.92214        0.999
##    4.24     95       1   0.9498 0.02189      0.90784        0.994
##    5.22     92       1   0.9395 0.02396      0.89365        0.988
##   12.10     87       1   0.9287 0.02601      0.87907        0.981
##   13.50     86       1   0.9179 0.02786      0.86486        0.974
##   15.00     82       1   0.9067 0.02968      0.85033        0.967
##   17.95     81       1   0.8955 0.03135      0.83609        0.959
##   18.18     79       1   0.8841 0.03294      0.82188        0.951
##   19.98     78       1   0.8728 0.03441      0.80790        0.943
##   20.44     77       1   0.8615 0.03579      0.79411        0.935
##   22.02     76       1   0.8501 0.03707      0.78051        0.926
##   22.25     75       1   0.8388 0.03827      0.76706        0.917
```

```
##   23.96     74       1   0.8275 0.03939      0.75375        0.908
##   24.19     73       1   0.8161 0.04045      0.74058        0.899
##   25.24     72       1   0.8048 0.04145      0.72753        0.890
##   26.26     71       1   0.7935 0.04238      0.71459        0.881
##   26.66     70       1   0.7821 0.04327      0.70176        0.872
##   26.82     69       1   0.7708 0.04410      0.68903        0.862
##   26.92     68       1   0.7595 0.04489      0.67639        0.853
##   27.15     67       1   0.7481 0.04562      0.66384        0.843
##   28.50     66       1   0.7368 0.04632      0.65137        0.833
##   28.63     65       1   0.7255 0.04697      0.63899        0.824
##   29.22     64       1   0.7141 0.04759      0.62668        0.814
##   29.60     63       1   0.7028 0.04816      0.61445        0.804
##   30.00     62       1   0.6914 0.04870      0.60229        0.794
##   31.06     61       1   0.6801 0.04920      0.59020        0.784
##   31.30     60       1   0.6688 0.04967      0.57817        0.774
##   31.36     59       1   0.6574 0.05011      0.56621        0.763
##   31.60     58       1   0.6461 0.05051      0.55432        0.753
##   33.69     56       1   0.6346 0.05091      0.54224        0.743
##   33.90     55       1   0.6230 0.05127      0.53022        0.732
##   36.20     53       1   0.6113 0.05164      0.51800        0.721
##   36.75     52       1   0.5995 0.05196      0.50585        0.711
##   38.07     49       1   0.5873 0.05232      0.49319        0.699
##   38.72     48       1   0.5750 0.05265      0.48059        0.688
##   39.25     47       1   0.5628 0.05293      0.46808        0.677
##   40.00     46       1   0.5506 0.05317      0.45563        0.665
##   40.40     44       1   0.5381 0.05342      0.44293        0.654
##   42.00     43       1   0.5256 0.05362      0.43030        0.642
##   42.90     42       1   0.5130 0.05378      0.41775        0.630
##   43.79     41       1   0.5005 0.05391      0.40528        0.618
##   45.30     40       1   0.4880 0.05399      0.39288        0.606
##   47.40     39       1   0.4755 0.05404      0.38055        0.594
##   49.11     38       1   0.4630 0.05405      0.36830        0.582
##   49.60     37       1   0.4505 0.05401      0.35613        0.570
##   49.84     36       1   0.4380 0.05394      0.34403        0.558
##   50.59     35       1   0.4254 0.05383      0.33200        0.545
##   52.24     34       1   0.4129 0.05369      0.32005        0.533
##   52.50     33       1   0.4004 0.05350      0.30817        0.520
##   55.13     32       1   0.3879 0.05327      0.29637        0.508
##   55.33     31       1   0.3754 0.05300      0.28465        0.495
##   55.90     30       1   0.3629 0.05269      0.27301        0.482
##   56.30     29       1   0.3504 0.05234      0.26144        0.470
##   56.50     28       1   0.3379 0.05194      0.24996        0.457
##   57.79     27       1   0.3253 0.05150      0.23856        0.444
##   57.80     26       1   0.3128 0.05102      0.22724        0.431
##   58.40     25       1   0.3003 0.05049      0.21601        0.418
##   59.07     24       1   0.2878 0.04991      0.20487        0.404
##   59.34     23       1   0.2753 0.04929      0.19382        0.391
##   59.50     22       1   0.2628 0.04861      0.18286        0.378
##   59.60     21       1   0.2503 0.04788      0.17201        0.364
##   59.96     20       1   0.2377 0.04709      0.16126        0.351
##   64.10     19       1   0.2252 0.04624      0.15062        0.337
##   64.50     18       1   0.2127 0.04534      0.14009        0.323
##   64.86     17       1   0.2002 0.04436      0.12968        0.309
##   65.88     16       1   0.1877 0.04332      0.11940        0.295
```

```
##    68.70     15       1   0.1752 0.04220      0.10926        0.281
##    72.09     14       1   0.1627 0.04100      0.09926        0.267
##    74.20     13       1   0.1502 0.03971      0.08942        0.252
##    76.07     12       1   0.1376 0.03832      0.07976        0.238
##    79.13     11       1   0.1251 0.03682      0.07029        0.223
##    80.25     10       1   0.1126 0.03520      0.06103        0.208
##    83.60      9       1   0.1001 0.03344      0.05201        0.193
##    84.70      8       1   0.0876 0.03152      0.04327        0.177
##    84.90      7       1   0.0751 0.02939      0.03486        0.162
##    88.99      5       1   0.0601 0.02708      0.02482        0.145
##    95.07      4       1   0.0450 0.02412      0.01578        0.129
##    99.51      3       1   0.0300 0.02022      0.00803        0.112
##   112.33      2       1   0.0150 0.01466      0.00222        0.102
##   142.55      1       1   0.0000     NaN           NA           NA
```

```
autoplot(kmsurvival1_location,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_location <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                                ~ clinical_data$location, type="fleming-harrington")
summary(fhsurvival1_location)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
```

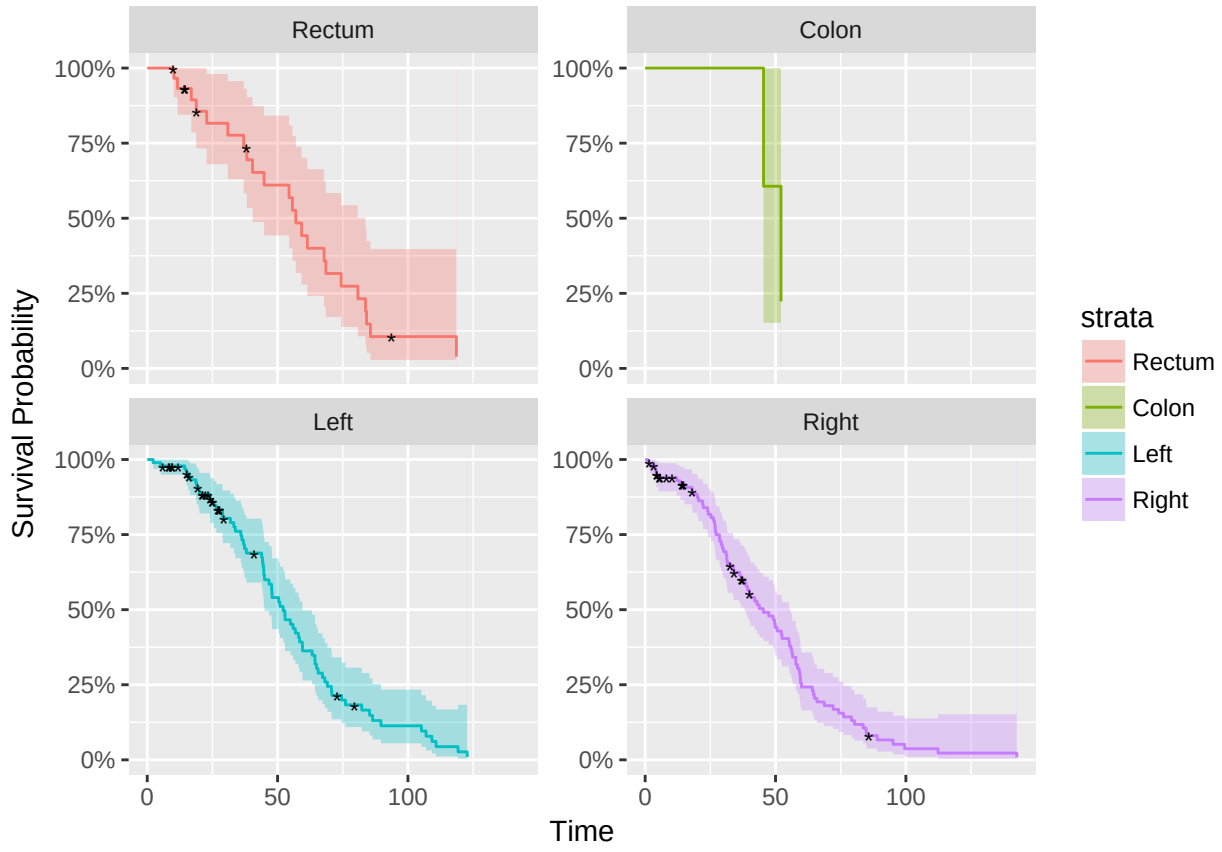
```
##     clinical_data$location, type = "fleming-harrington")
##
##                 clinical_data$location=Rectum
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   10.2     29       1    0.966  0.0339       0.9019        1.000
##   11.6     28       1    0.932  0.0471       0.8443        1.000
##   16.9     24       1    0.894  0.0591       0.7856        1.000
##   18.8     23       1    0.856  0.0682       0.7324        1.000
##   22.8     21       1    0.816  0.0762       0.6798        0.980
##   30.9     20       1    0.776  0.0827       0.6301        0.957
##   37.0     19       1    0.737  0.0880       0.5829        0.931
##   38.2     17       1    0.695  0.0931       0.5342        0.903
##   40.4     16       1    0.653  0.0971       0.4875        0.873
##   44.8     15       1    0.610  0.1001       0.4427        0.842
##   54.4     14       1    0.568  0.1023       0.3994        0.809
##   55.7     13       1    0.526  0.1036       0.3577        0.774
##   57.0     12       1    0.484  0.1043       0.3175        0.738
##   59.2     11       1    0.442  0.1041       0.2787        0.701
##   61.4     10       1    0.400  0.1032       0.2413        0.663
##   67.8      9       1    0.358  0.1015       0.2053        0.624
##   68.5      8       1    0.316  0.0991       0.1709        0.584
##   74.4      7       1    0.274  0.0957       0.1381        0.543
##   80.8      6       1    0.232  0.0914       0.1070        0.502
##   83.7      5       1    0.190  0.0860       0.0781        0.461
##   84.1      4       1    0.148  0.0794       0.0516        0.424
##   85.6      3       1    0.106  0.0715       0.0282        0.398
##  118.6      1       1    0.039     Inf       0.0000        1.000
##
##                 clinical_data$location=Colon
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##  45.4      2       1    0.607   0.429        0.152            1
##  52.1      1       1    0.223     Inf        0.000            1
##
##                 clinical_data$location=Left
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    2.26     93       1  0.98930  0.0107      0.96856        1.000
##    5.20     92       1  0.97861  0.0150      0.94956        1.000
##   14.40     85       1  0.96716  0.0188      0.93108        1.000
##   15.05     84       1  0.95572  0.0218      0.91395        0.999
##   15.71     82       1  0.94413  0.0244      0.89742        0.993
##   16.47     80       1  0.93241  0.0268      0.88126        0.987
##   18.70     79       1  0.92068  0.0290      0.86559        0.979
##   18.96     78       1  0.90895  0.0309      0.85032        0.972
##   19.75     76       1  0.89707  0.0327      0.83512        0.964
##   20.02     75       1  0.88519  0.0344      0.82021        0.955
##   24.00     69       1  0.87245  0.0362      0.80422        0.946
##   24.20     67       1  0.85953  0.0380      0.78822        0.937
##   25.61     64       1  0.84620  0.0397      0.77187        0.928
##   26.53     63       1  0.83287  0.0413      0.75578        0.918
##   28.86     58       1  0.81864  0.0430      0.73856        0.907
##   28.96     57       1  0.80440  0.0446      0.72159        0.897
##   31.92     55       1  0.78991  0.0461      0.70450        0.886
##   33.20     54       1  0.77541  0.0475      0.68762        0.874
##   33.80     53       1  0.76092  0.0488      0.67096        0.863
```

```
##   35.90     52       1  0.74643  0.0501      0.65448        0.851
##   36.30     51       1  0.73193  0.0512      0.63819        0.839
##   36.92     50       1  0.71744  0.0522      0.62205        0.827
##   37.31     49       1  0.70295  0.0532      0.60607        0.815
##   38.00     48       1  0.68845  0.0541      0.59024        0.803
##   43.90     46       1  0.67365  0.0549      0.57414        0.790
##   44.20     45       1  0.65884  0.0557      0.55819        0.778
##   44.40     44       1  0.64404  0.0565      0.54238        0.765
##   44.67     43       1  0.62923  0.0571      0.52669        0.752
##   44.74     42       1  0.61443  0.0577      0.51114        0.739
##   44.97     41       1  0.59963  0.0582      0.49571        0.725
##   46.71     40       1  0.58482  0.0587      0.48041        0.712
##   47.70     39       1  0.57002  0.0591      0.46522        0.698
##   47.80     38       1  0.55521  0.0594      0.45015        0.685
##   47.86     37       1  0.54041  0.0597      0.43519        0.671
##   50.43     36       1  0.52560  0.0599      0.42035        0.657
##   50.90     35       1  0.51080  0.0601      0.40561        0.643
##   52.14     34       1  0.49599  0.0602      0.39099        0.629
##   52.80     33       1  0.48119  0.0602      0.37647        0.615
##   52.86     32       1  0.46638  0.0602      0.36207        0.601
##   54.90     31       1  0.45158  0.0602      0.34777        0.586
##   55.92     30       1  0.43677  0.0601      0.33358        0.572
##   56.80     29       1  0.42197  0.0599      0.31950        0.557
##   58.02     28       1  0.40716  0.0597      0.30554        0.543
##   58.45     27       1  0.39236  0.0594      0.29168        0.528
##   59.50     26       1  0.37756  0.0590      0.27794        0.513
##   59.53     25       1  0.36275  0.0586      0.26431        0.498
##   63.25     24       1  0.34795  0.0581      0.25080        0.483
##   64.33     23       1  0.33314  0.0576      0.23740        0.467
##   64.37     22       1  0.31834  0.0570      0.22414        0.452
##   64.93     21       1  0.30354  0.0563      0.21100        0.437
##   65.55     20       1  0.28873  0.0556      0.19799        0.421
##   67.19     19       1  0.27393  0.0548      0.18511        0.405
##   68.10     18       1  0.25913  0.0539      0.17238        0.390
##   69.10     17       1  0.24432  0.0529      0.15980        0.374
##   70.65     16       1  0.22952  0.0519      0.14737        0.357
##   70.80     15       1  0.21472  0.0507      0.13511        0.341
##   74.53     13       1  0.19882  0.0496      0.12192        0.324
##   76.04     12       1  0.18292  0.0483      0.10897        0.307
##   82.29     10       1  0.16552  0.0471      0.09477        0.289
##   85.28      9       1  0.14811  0.0456      0.08099        0.271
##   86.43      8       1  0.13071  0.0439      0.06769        0.252
##   89.62      7       1  0.11331  0.0419      0.05492        0.234
##  105.17      6       1  0.09591  0.0395      0.04276        0.215
##  106.94      5       1  0.07853  0.0368      0.03133        0.197
##  109.21      4       1  0.06116  0.0337      0.02079        0.180
##  110.79      3       1  0.04382  0.0300      0.01143        0.168
##  119.21      2       1  0.02658  0.0262      0.00386        0.183
##  122.72      1       1  0.00978     Inf      0.00000        1.000
##
##                clinical_data$location=Right
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    101       1  0.99015 0.00985      0.97102        1.000
##    1.80     99       1  0.98020 0.01393      0.95326        1.000
```

```
##    3.64     97       1  0.97014 0.01707      0.93726        1.000
##    4.10     96       1  0.96009 0.01966      0.92233        0.999
##    4.24     95       1  0.95004 0.02189      0.90808        0.994
##    5.22     92       1  0.93977 0.02397      0.89394        0.988
##   12.10     87       1  0.92903 0.02602      0.87941        0.981
##   13.50     86       1  0.91829 0.02787      0.86526        0.975
##   15.00     82       1  0.90716 0.02970      0.85078        0.967
##   17.95     81       1  0.89603 0.03137      0.83660        0.960
##   18.18     79       1  0.88475 0.03296      0.82245        0.952
##   19.98     78       1  0.87348 0.03444      0.80852        0.944
##   20.44     77       1  0.86221 0.03582      0.79480        0.935
##   22.02     76       1  0.85094 0.03710      0.78125        0.927
##   22.25     75       1  0.83967 0.03831      0.76785        0.918
##   23.96     74       1  0.82840 0.03944      0.75460        0.909
##   24.19     73       1  0.81713 0.04050      0.74149        0.900
##   25.24     72       1  0.80586 0.04150      0.72849        0.891
##   26.26     71       1  0.79459 0.04244      0.71561        0.882
##   26.66     70       1  0.78332 0.04333      0.70283        0.873
##   26.82     69       1  0.77205 0.04417      0.69015        0.864
##   26.92     68       1  0.76078 0.04496      0.67756        0.854
##   27.15     67       1  0.74951 0.04571      0.66507        0.845
##   28.50     66       1  0.73824 0.04641      0.65265        0.835
##   28.63     65       1  0.72697 0.04707      0.64032        0.825
##   29.22     64       1  0.71570 0.04769      0.62807        0.816
##   29.60     63       1  0.70443 0.04828      0.61589        0.806
##   30.00     62       1  0.69315 0.04882      0.60378        0.796
##   31.06     61       1  0.68188 0.04933      0.59174        0.786
##   31.30     60       1  0.67061 0.04981      0.57976        0.776
##   31.36     59       1  0.65934 0.05025      0.56785        0.766
##   31.60     58       1  0.64807 0.05066      0.55601        0.755
##   33.69     56       1  0.63660 0.05107      0.54398        0.745
##   33.90     55       1  0.62513 0.05145      0.53201        0.735
##   36.20     53       1  0.61345 0.05182      0.51985        0.724
##   36.75     52       1  0.60176 0.05216      0.50775        0.713
##   38.07     49       1  0.58961 0.05253      0.49514        0.702
##   38.72     48       1  0.57745 0.05287      0.48260        0.691
##   39.25     47       1  0.56529 0.05316      0.47014        0.680
##   40.00     46       1  0.55314 0.05342      0.45775        0.668
##   40.40     44       1  0.54071 0.05368      0.44510        0.657
##   42.00     43       1  0.52828 0.05390      0.43253        0.645
##   42.90     42       1  0.51585 0.05408      0.42004        0.634
##   43.79     41       1  0.50342 0.05422      0.40762        0.622
##   45.30     40       1  0.49099 0.05432      0.39527        0.610
##   47.40     39       1  0.47856 0.05439      0.38300        0.598
##   49.11     38       1  0.46613 0.05441      0.37080        0.586
##   49.60     37       1  0.45370 0.05440      0.35868        0.574
##   49.84     36       1  0.44127 0.05435      0.34663        0.562
##   50.59     35       1  0.42884 0.05426      0.33465        0.550
##   52.24     34       1  0.41641 0.05414      0.32275        0.537
##   52.50     33       1  0.40398 0.05397      0.31092        0.525
##   55.13     32       1  0.39156 0.05377      0.29916        0.512
##   55.33     31       1  0.37913 0.05353      0.28748        0.500
##   55.90     30       1  0.36670 0.05324      0.27588        0.487
##   56.30     29       1  0.35427 0.05292      0.26435        0.475
```

```
##   56.50     28       1  0.34184 0.05255      0.25290        0.462
##   57.79     27       1  0.32941 0.05215      0.24154        0.449
##   57.80     26       1  0.31698 0.05170      0.23025        0.436
##   58.40     25       1  0.30455 0.05120      0.21905        0.423
##   59.07     24       1  0.29212 0.05066      0.20794        0.410
##   59.34     23       1  0.27969 0.05008      0.19692        0.397
##   59.50     22       1  0.26726 0.04944      0.18599        0.384
##   59.60     21       1  0.25484 0.04875      0.17515        0.371
##   59.96     20       1  0.24241 0.04801      0.16442        0.357
##   64.10     19       1  0.22998 0.04722      0.15379        0.344
##   64.50     18       1  0.21755 0.04637      0.14327        0.330
##   64.86     17       1  0.20512 0.04545      0.13286        0.317
##   65.88     16       1  0.19270 0.04447      0.12258        0.303
##   68.70     15       1  0.18027 0.04342      0.11243        0.289
##   72.09     14       1  0.16784 0.04230      0.10241        0.275
##   74.20     13       1  0.15541 0.04110      0.09255        0.261
##   76.07     12       1  0.14299 0.03981      0.08286        0.247
##   79.13     11       1  0.13056 0.03842      0.07334        0.232
##   80.25     10       1  0.11814 0.03693      0.06402        0.218
##   83.60      9       1  0.10571 0.03532      0.05493        0.203
##   84.70      8       1  0.09329 0.03357      0.04609        0.189
##   84.90      7       1  0.08087 0.03166      0.03755        0.174
##   88.99      5       1  0.06621 0.02985      0.02736        0.160
##   95.07      4       1  0.05157 0.02761      0.01806        0.147
##   99.51      3       1  0.03695 0.02488      0.00987        0.138
##  112.33      2       1  0.02241 0.02188      0.00331        0.152
##  142.55      1       1  0.00824     Inf      0.00000        1.000
```

```
autoplot(fhsurival1_location,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Cancer Stage

As expected, stage **A** is with the least death rate.

Kaplan-Meier non-parametric

```
kmsurvival1_stage <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                             ~ clinical_data$dukes_stage)
summary(kmsurvival1_stage)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$dukes_stage)
##
##                 clinical_data$dukes_stage=A
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    1.80     41       1   0.9756  0.0241      0.92952        1.000
##    3.64     40       1   0.9512  0.0336      0.88752        1.000
##   14.40     39       1   0.9268  0.0407      0.85045        1.000
##   16.47     37       1   0.9018  0.0467      0.81483        0.998
##   19.75     36       1   0.8767  0.0516      0.78113        0.984
##   20.02     35       1   0.8517  0.0559      0.74885        0.969
##   22.80     34       1   0.8266  0.0596      0.71767        0.952
##   23.96     33       1   0.8016  0.0629      0.68739        0.935
##   28.96     31       1   0.7757  0.0659      0.65669        0.916
```

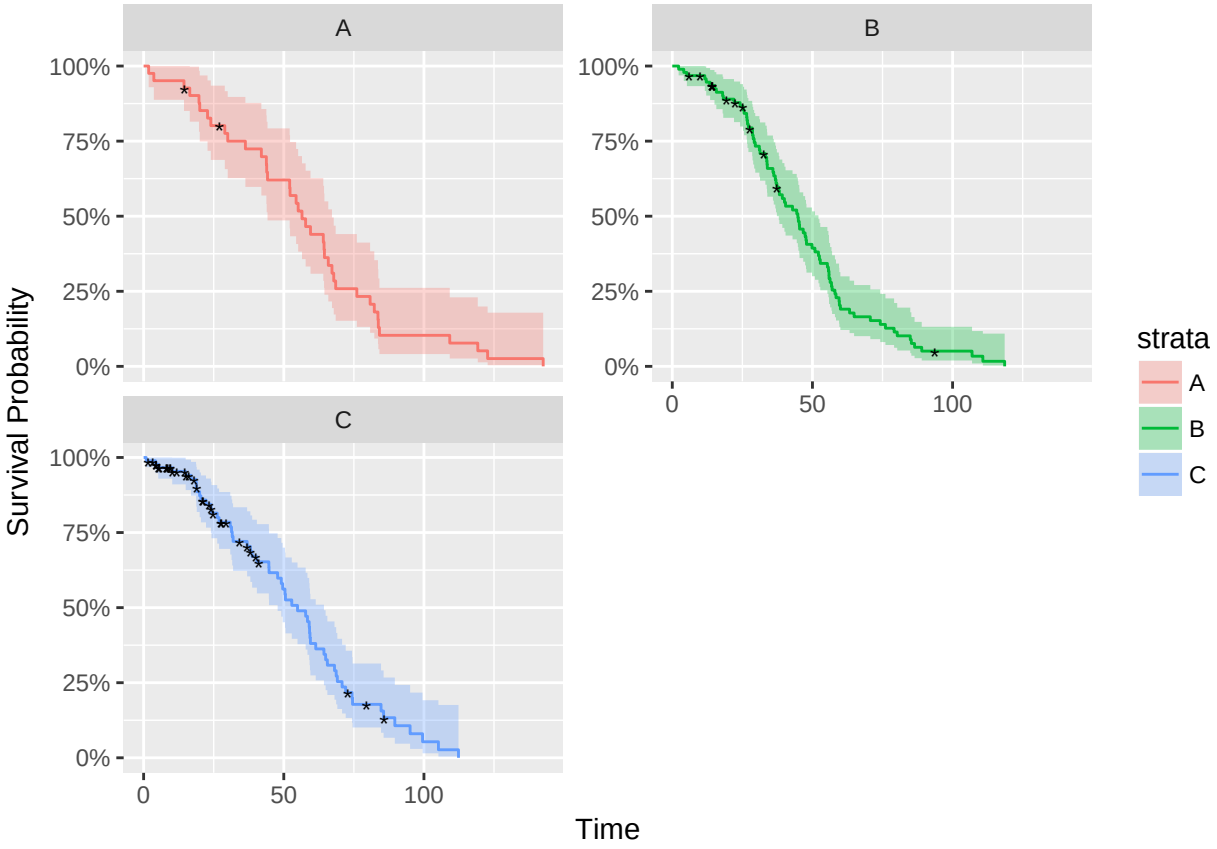
```
##   30.00     30       1   0.7499  0.0686      0.62675        0.897
##   36.30     29       1   0.7240  0.0710      0.59748        0.877
##   42.00     28       1   0.6982  0.0730      0.56881        0.857
##   43.79     27       1   0.6723  0.0747      0.54070        0.836
##   43.90     26       1   0.6464  0.0762      0.51310        0.814
##   44.20     25       1   0.6206  0.0774      0.48599        0.792
##   52.10     24       1   0.5947  0.0784      0.45934        0.770
##   52.24     23       1   0.5689  0.0791      0.43313        0.747
##   54.40     22       1   0.5430  0.0796      0.40735        0.724
##   55.13     21       1   0.5171  0.0799      0.38199        0.700
##   56.50     20       1   0.4913  0.0800      0.35704        0.676
##   57.79     19       1   0.4654  0.0799      0.33250        0.652
##   59.53     18       1   0.4396  0.0795      0.30837        0.627
##   64.10     17       1   0.4137  0.0789      0.28466        0.601
##   64.37     16       1   0.3879  0.0781      0.26137        0.576
##   64.50     15       1   0.3620  0.0771      0.23851        0.549
##   65.88     14       1   0.3361  0.0758      0.21610        0.523
##   67.19     13       1   0.3103  0.0742      0.19415        0.496
##   67.82     12       1   0.2844  0.0724      0.17270        0.468
##   68.51     11       1   0.2586  0.0703      0.15178        0.441
##   76.07     10       1   0.2327  0.0678      0.13142        0.412
##   80.80      9       1   0.2069  0.0651      0.11169        0.383
##   82.29      8       1   0.1810  0.0618      0.09265        0.354
##   83.60      7       1   0.1551  0.0582      0.07441        0.323
##   83.73      6       1   0.1293  0.0539      0.05710        0.293
##   84.13      5       1   0.1034  0.0489      0.04092        0.261
##  109.21      4       1   0.0776  0.0430      0.02618        0.230
##  119.21      3       1   0.0517  0.0356      0.01342        0.199
##  122.72      2       1   0.0259  0.0255      0.00374        0.179
##  142.55      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$dukes_stage=B
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    2.26     94       1   0.9894  0.0106      0.96884        1.000
##    4.10     93       1   0.9787  0.0149      0.94998        1.000
##    5.20     92       1   0.9681  0.0181      0.93320        1.000
##   11.60     89       1   0.9572  0.0209      0.91704        0.999
##   12.10     88       1   0.9463  0.0234      0.90165        0.993
##   13.50     87       1   0.9355  0.0255      0.88680        0.987
##   15.05     82       1   0.9240  0.0276      0.87147        0.980
##   15.71     81       1   0.9126  0.0295      0.85654        0.972
##   17.95     80       1   0.9012  0.0313      0.84193        0.965
##   18.18     79       1   0.8898  0.0329      0.82760        0.957
##   22.02     77       1   0.8783  0.0345      0.81327        0.948
##   24.19     74       1   0.8664  0.0360      0.79868        0.940
##   25.24     72       1   0.8544  0.0374      0.78406        0.931
##   25.61     71       1   0.8423  0.0388      0.76963        0.922
##   26.53     70       1   0.8303  0.0401      0.75538        0.913
##   26.66     69       1   0.8183  0.0412      0.74128        0.903
##   26.82     68       1   0.8062  0.0424      0.72734        0.894
##   27.15     67       1   0.7942  0.0434      0.71353        0.884
##   28.50     65       1   0.7820  0.0444      0.69958        0.874
##   28.63     64       1   0.7698  0.0454      0.68577        0.864
##   28.86     63       1   0.7575  0.0463      0.67207        0.854
```

```
##   29.22     62       1   0.7453  0.0471      0.65848        0.844
##   29.60     61       1   0.7331  0.0479      0.64499        0.833
##   31.06     60       1   0.7209  0.0486      0.63160        0.823
##   31.30     59       1   0.7087  0.0493      0.61831        0.812
##   33.20     57       1   0.6962  0.0500      0.60483        0.801
##   33.69     56       1   0.6838  0.0506      0.59144        0.791
##   33.80     55       1   0.6714  0.0512      0.57814        0.780
##   33.90     54       1   0.6589  0.0517      0.56493        0.769
##   35.90     53       1   0.6465  0.0522      0.55180        0.757
##   36.20     52       1   0.6341  0.0527      0.53876        0.746
##   36.75     51       1   0.6216  0.0531      0.52579        0.735
##   37.00     50       1   0.6092  0.0535      0.51290        0.724
##   37.31     49       1   0.5968  0.0538      0.50009        0.712
##   38.00     47       1   0.5841  0.0542      0.48703        0.700
##   38.20     46       1   0.5714  0.0544      0.47405        0.689
##   39.25     45       1   0.5587  0.0547      0.46114        0.677
##   40.00     44       1   0.5460  0.0549      0.44832        0.665
##   40.40     43       1   0.5333  0.0551      0.43556        0.653
##   42.90     42       1   0.5206  0.0552      0.42289        0.641
##   44.40     41       1   0.5079  0.0553      0.41029        0.629
##   44.80     40       1   0.4952  0.0554      0.39776        0.616
##   44.97     39       1   0.4825  0.0554      0.38530        0.604
##   45.30     38       1   0.4698  0.0554      0.37292        0.592
##   45.40     37       1   0.4571  0.0553      0.36061        0.579
##   46.71     36       1   0.4444  0.0552      0.34838        0.567
##   47.40     35       1   0.4317  0.0551      0.33622        0.554
##   47.70     34       1   0.4190  0.0549      0.32413        0.542
##   47.86     33       1   0.4063  0.0547      0.31212        0.529
##   49.84     32       1   0.3936  0.0544      0.30019        0.516
##   50.90     31       1   0.3809  0.0541      0.28833        0.503
##   52.14     30       1   0.3682  0.0538      0.27655        0.490
##   52.50     29       1   0.3555  0.0534      0.26484        0.477
##   52.80     28       1   0.3428  0.0530      0.25322        0.464
##   55.33     27       1   0.3301  0.0525      0.24168        0.451
##   55.70     26       1   0.3174  0.0520      0.23023        0.438
##   55.90     25       1   0.3047  0.0515      0.21886        0.424
##   55.92     24       1   0.2920  0.0509      0.20758        0.411
##   56.30     23       1   0.2793  0.0502      0.19639        0.397
##   56.80     22       1   0.2666  0.0495      0.18530        0.384
##   57.00     21       1   0.2539  0.0488      0.17431        0.370
##   58.02     20       1   0.2412  0.0479      0.16342        0.356
##   58.40     19       1   0.2286  0.0471      0.15265        0.342
##   59.50     18       1   0.2159  0.0461      0.14198        0.328
##   59.60     17       1   0.2032  0.0451      0.13144        0.314
##   59.96     16       1   0.1905  0.0441      0.12103        0.300
##   63.25     15       1   0.1778  0.0429      0.11075        0.285
##   64.86     14       1   0.1651  0.0417      0.10062        0.271
##   70.65     13       1   0.1524  0.0404      0.09065        0.256
##   74.20     12       1   0.1397  0.0389      0.08086        0.241
##   76.04     11       1   0.1270  0.0374      0.07126        0.226
##   79.13     10       1   0.1143  0.0358      0.06188        0.211
##   80.25      9       1   0.1016  0.0340      0.05274        0.196
##   84.90      8       1   0.0889  0.0320      0.04388        0.180
##   85.28      7       1   0.0762  0.0299      0.03535        0.164
```

```
##   86.43      6       1   0.0635  0.0274      0.02721        0.148
##   88.99      5       1   0.0508  0.0247      0.01957        0.132
##  106.94      3       1   0.0339  0.0215      0.00975        0.118
##  110.79      2       1   0.0169  0.0161      0.00263        0.109
##  118.58      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$dukes_stage=C
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92     91       1   0.9890  0.0109      0.96782        1.000
##    4.24     88       1   0.9778  0.0155      0.94778        1.000
##    5.22     85       1   0.9663  0.0191      0.92946        1.000
##   10.20     77       1   0.9537  0.0226      0.91036        0.999
##   15.00     73       1   0.9407  0.0258      0.89137        0.993
##   16.90     70       1   0.9272  0.0287      0.87256        0.985
##   18.70     68       1   0.9136  0.0314      0.85409        0.977
##   18.80     67       1   0.8999  0.0338      0.83617        0.969
##   18.96     65       1   0.8861  0.0360      0.81835        0.959
##   19.98     64       1   0.8723  0.0380      0.80092        0.950
##   20.44     63       1   0.8584  0.0398      0.78382        0.940
##   22.25     60       1   0.8441  0.0416      0.76631        0.930
##   24.00     58       1   0.8296  0.0434      0.74872        0.919
##   24.20     56       1   0.8147  0.0451      0.73101        0.908
##   26.26     54       1   0.7996  0.0467      0.71317        0.897
##   26.92     53       1   0.7846  0.0482      0.69557        0.885
##   30.90     49       1   0.7685  0.0498      0.67689        0.873
##   31.36     48       1   0.7525  0.0513      0.65847        0.860
##   31.60     47       1   0.7365  0.0526      0.64029        0.847
##   31.92     46       1   0.7205  0.0539      0.62233        0.834
##   36.92     44       1   0.7041  0.0551      0.60408        0.821
##   38.07     42       1   0.6874  0.0562      0.58552        0.807
##   38.72     40       1   0.6702  0.0574      0.56661        0.793
##   40.40     38       1   0.6526  0.0585      0.54733        0.778
##   44.67     36       1   0.6344  0.0597      0.52764        0.763
##   44.74     35       1   0.6163  0.0606      0.50820        0.747
##   47.80     34       1   0.5982  0.0615      0.48899        0.732
##   49.11     33       1   0.5800  0.0623      0.47000        0.716
##   49.60     32       1   0.5619  0.0629      0.45123        0.700
##   50.43     31       1   0.5438  0.0634      0.43267        0.683
##   50.59     30       1   0.5257  0.0638      0.41431        0.667
##   52.86     29       1   0.5075  0.0642      0.39614        0.650
##   54.90     28       1   0.4894  0.0644      0.37818        0.633
##   57.80     27       1   0.4713  0.0645      0.36040        0.616
##   58.45     26       1   0.4532  0.0645      0.34282        0.599
##   59.07     25       1   0.4350  0.0644      0.32543        0.582
##   59.20     24       1   0.4169  0.0642      0.30822        0.564
##   59.34     23       1   0.3988  0.0640      0.29121        0.546
##   59.50     22       1   0.3807  0.0636      0.27440        0.528
##   61.40     21       1   0.3625  0.0631      0.25778        0.510
##   64.33     20       1   0.3444  0.0625      0.24136        0.491
##   64.93     19       1   0.3263  0.0618      0.22515        0.473
##   65.55     18       1   0.3082  0.0609      0.20915        0.454
##   68.10     17       1   0.2900  0.0600      0.19337        0.435
##   68.70     16       1   0.2719  0.0589      0.17782        0.416
##   69.10     15       1   0.2538  0.0577      0.16252        0.396
```

```
##    70.80     14       1   0.2356  0.0564      0.14747        0.377
##    72.09     13       1   0.2175  0.0549      0.13269        0.357
##    74.36     11       1   0.1977  0.0533      0.11657        0.335
##    74.53     10       1   0.1780  0.0515      0.10091        0.314
##    84.70      8       1   0.1557  0.0497      0.08336        0.291
##    85.61      7       1   0.1335  0.0473      0.06666        0.267
##    89.62      5       1   0.1068  0.0447      0.04698        0.243
##    95.07      4       1   0.0801  0.0407      0.02955        0.217
##    99.51      3       1   0.0534  0.0348      0.01487        0.192
##   105.17      2       1   0.0267  0.0257      0.00405        0.176
##   112.33      1       1   0.0000     NaN           NA           NA
```

```
autoplot(kmsurvival1_stage,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_stage <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                             ~ clinical_data$dukes_stage, type="fleming-harrington")
summary(fhsurvival1_stage)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$dukes_stage, type = "fleming-harrington")
##
##                 clinical_data$dukes_stage=A
```

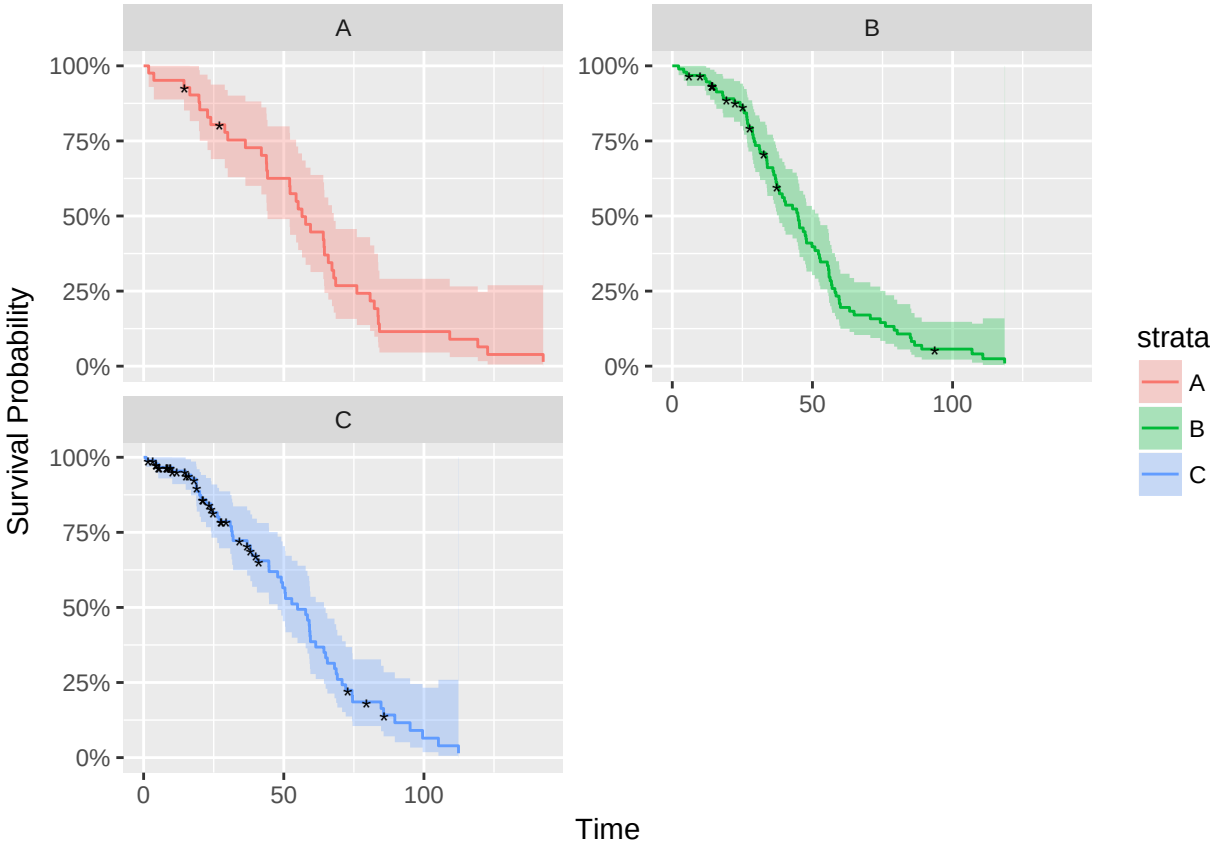
```
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    1.80     41       1   0.9759  0.0241      0.92980        1.000
##    3.64     40       1   0.9518  0.0337      0.88807        1.000
##   14.40     39       1   0.9277  0.0407      0.85126        1.000
##   16.47     37       1   0.9030  0.0467      0.81591        0.999
##   19.75     36       1   0.8782  0.0517      0.78248        0.986
##   20.02     35       1   0.8535  0.0560      0.75045        0.971
##   22.80     34       1   0.8288  0.0598      0.71952        0.955
##   23.96     33       1   0.8040  0.0630      0.68949        0.938
##   28.96     31       1   0.7785  0.0662      0.65905        0.920
##   30.00     30       1   0.7530  0.0689      0.62935        0.901
##   36.30     29       1   0.7275  0.0713      0.60033        0.882
##   42.00     28       1   0.7019  0.0734      0.57190        0.862
##   43.79     27       1   0.6764  0.0752      0.54402        0.841
##   43.90     26       1   0.6509  0.0767      0.51664        0.820
##   44.20     25       1   0.6254  0.0780      0.48974        0.799
##   52.10     24       1   0.5998  0.0791      0.46330        0.777
##   52.24     23       1   0.5743  0.0799      0.43729        0.754
##   54.40     22       1   0.5488  0.0805      0.41170        0.732
##   55.13     21       1   0.5233  0.0809      0.38652        0.708
##   56.50     20       1   0.4978  0.0811      0.36174        0.685
##   57.79     19       1   0.4722  0.0810      0.33737        0.661
##   59.53     18       1   0.4467  0.0808      0.31339        0.637
##   64.10     17       1   0.4212  0.0804      0.28981        0.612
##   64.37     16       1   0.3957  0.0797      0.26664        0.587
##   64.50     15       1   0.3702  0.0788      0.24389        0.562
##   65.88     14       1   0.3446  0.0777      0.22156        0.536
##   67.19     13       1   0.3191  0.0763      0.19969        0.510
##   67.82     12       1   0.2936  0.0747      0.17828        0.484
##   68.51     11       1   0.2681  0.0729      0.15737        0.457
##   76.07     10       1   0.2426  0.0707      0.13699        0.430
##   80.80      9       1   0.2171  0.0683      0.11720        0.402
##   82.29      8       1   0.1916  0.0655      0.09806        0.374
##   83.60      7       1   0.1661  0.0623      0.07964        0.346
##   83.73      6       1   0.1406  0.0586      0.06208        0.318
##   84.13      5       1   0.1151  0.0545      0.04553        0.291
##  109.21      4       1   0.0896  0.0497      0.03025        0.266
##  119.21      3       1   0.0642  0.0442      0.01666        0.248
##  122.72      2       1   0.0390  0.0384      0.00563        0.270
##  142.55      1       1   0.0143     Inf      0.00000        1.000
##
##                clinical_data$dukes_stage=B
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    2.26     94       1  0.98942  0.0106      0.96889        1.000
##    4.10     93       1  0.97884  0.0149      0.95009        1.000
##    5.20     92       1  0.96825  0.0181      0.93336        1.000
##   11.60     89       1  0.95744  0.0209      0.91726        0.999
##   12.10     88       1  0.94662  0.0234      0.90192        0.994
##   13.50     87       1  0.93580  0.0255      0.88713        0.987
##   15.05     82       1  0.92446  0.0276      0.87186        0.980
##   15.71     81       1  0.91311  0.0296      0.85699        0.973
##   17.95     80       1  0.90177  0.0313      0.84244        0.965
##   18.18     79       1  0.89043  0.0329      0.82816        0.957
##   22.02     77       1  0.87894  0.0345      0.81389        0.949
```

```
##   24.19     74       1  0.86714  0.0360      0.79937        0.941
##   25.24     72       1  0.85518  0.0375      0.78481        0.932
##   25.61     71       1  0.84322  0.0388      0.77044        0.923
##   26.53     70       1  0.83126  0.0401      0.75625        0.914
##   26.66     69       1  0.81930  0.0413      0.74222        0.904
##   26.82     68       1  0.80734  0.0424      0.72834        0.895
##   27.15     67       1  0.79538  0.0435      0.71459        0.885
##   28.50     65       1  0.78324  0.0445      0.70071        0.875
##   28.63     64       1  0.77109  0.0455      0.68696        0.866
##   28.86     63       1  0.75895  0.0464      0.67332        0.855
##   29.22     62       1  0.74681  0.0472      0.65979        0.845
##   29.60     61       1  0.73466  0.0480      0.64636        0.835
##   31.06     60       1  0.72252  0.0487      0.63303        0.825
##   31.30     59       1  0.71038  0.0494      0.61980        0.814
##   33.20     57       1  0.69802  0.0501      0.60638        0.804
##   33.69     56       1  0.68567  0.0508      0.59306        0.793
##   33.80     55       1  0.67332  0.0514      0.57982        0.782
##   33.90     54       1  0.66096  0.0519      0.56667        0.771
##   35.90     53       1  0.64861  0.0524      0.55360        0.760
##   36.20     52       1  0.63625  0.0529      0.54061        0.749
##   36.75     51       1  0.62390  0.0533      0.52770        0.738
##   37.00     50       1  0.61155  0.0537      0.51487        0.726
##   37.31     49       1  0.59919  0.0540      0.50211        0.715
##   38.00     47       1  0.58658  0.0544      0.48911        0.703
##   38.20     46       1  0.57396  0.0547      0.47619        0.692
##   39.25     45       1  0.56135  0.0550      0.46334        0.680
##   40.00     44       1  0.54874  0.0552      0.45057        0.668
##   40.40     43       1  0.53612  0.0554      0.43788        0.656
##   42.90     42       1  0.52351  0.0555      0.42526        0.644
##   44.40     41       1  0.51089  0.0556      0.41271        0.632
##   44.80     40       1  0.49828  0.0557      0.40024        0.620
##   44.97     39       1  0.48567  0.0557      0.38783        0.608
##   45.30     38       1  0.47305  0.0557      0.37550        0.596
##   45.40     37       1  0.46044  0.0557      0.36324        0.584
##   46.71     36       1  0.44782  0.0556      0.35106        0.571
##   47.40     35       1  0.43521  0.0555      0.33895        0.559
##   47.70     34       1  0.42260  0.0554      0.32691        0.546
##   47.86     33       1  0.40998  0.0552      0.31494        0.534
##   49.84     32       1  0.39737  0.0549      0.30305        0.521
##   50.90     31       1  0.38475  0.0547      0.29123        0.508
##   52.14     30       1  0.37214  0.0544      0.27949        0.496
##   52.50     29       1  0.35953  0.0540      0.26782        0.483
##   52.80     28       1  0.34691  0.0536      0.25624        0.470
##   55.33     27       1  0.33430  0.0532      0.24473        0.457
##   55.70     26       1  0.32169  0.0527      0.23331        0.444
##   55.90     25       1  0.30907  0.0522      0.22197        0.430
##   55.92     24       1  0.29646  0.0516      0.21072        0.417
##   56.30     23       1  0.28385  0.0510      0.19956        0.404
##   56.80     22       1  0.27123  0.0504      0.18849        0.390
##   57.00     21       1  0.25862  0.0496      0.17752        0.377
##   58.02     20       1  0.24601  0.0489      0.16665        0.363
##   58.40     19       1  0.23339  0.0481      0.15588        0.349
##   59.50     18       1  0.22078  0.0472      0.14522        0.336
##   59.60     17       1  0.20817  0.0462      0.13468        0.322
```

```
##   59.96     16       1  0.19556  0.0452      0.12426        0.308
##   63.25     15       1  0.18294  0.0442      0.11398        0.294
##   64.86     14       1  0.17033  0.0430      0.10383        0.279
##   70.65     13       1  0.15772  0.0418      0.09384        0.265
##   74.20     12       1  0.14511  0.0405      0.08401        0.251
##   76.04     11       1  0.13250  0.0390      0.07436        0.236
##   79.13     10       1  0.11989  0.0375      0.06492        0.221
##   80.25      9       1  0.10728  0.0359      0.05570        0.207
##   84.90      8       1  0.09468  0.0341      0.04674        0.192
##   85.28      7       1  0.08207  0.0322      0.03808        0.177
##   86.43      6       1  0.06947  0.0300      0.02978        0.162
##   88.99      5       1  0.05688  0.0277      0.02191        0.148
##  106.94      3       1  0.04076  0.0259      0.01174        0.142
##  110.79      2       1  0.02472  0.0235      0.00384        0.159
##  118.58      1       1  0.00909     Inf      0.00000        1.000
##
##                clinical_data$dukes_stage=C
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92     91       1   0.9891  0.0109      0.96788        1.000
##    4.24     88       1   0.9779  0.0155      0.94790        1.000
##    5.22     85       1   0.9665  0.0192      0.92964        1.000
##   10.20     77       1   0.9540  0.0226      0.91061        0.999
##   15.00     73       1   0.9410  0.0258      0.89171        0.993
##   16.90     70       1   0.9277  0.0288      0.87298        0.986
##   18.70     68       1   0.9141  0.0314      0.85459        0.978
##   18.80     67       1   0.9006  0.0338      0.83675        0.969
##   18.96     65       1   0.8868  0.0360      0.81902        0.960
##   19.98     64       1   0.8731  0.0380      0.80168        0.951
##   20.44     63       1   0.8593  0.0399      0.78466        0.941
##   22.25     60       1   0.8451  0.0417      0.76724        0.931
##   24.00     58       1   0.8307  0.0434      0.74974        0.920
##   24.20     56       1   0.8160  0.0451      0.73213        0.909
##   26.26     54       1   0.8010  0.0468      0.71438        0.898
##   26.92     53       1   0.7860  0.0483      0.69688        0.887
##   30.90     49       1   0.7702  0.0499      0.67831        0.874
##   31.36     48       1   0.7543  0.0514      0.66000        0.862
##   31.60     47       1   0.7384  0.0528      0.64192        0.849
##   31.92     46       1   0.7225  0.0540      0.62406        0.837
##   36.92     44       1   0.7063  0.0552      0.60592        0.823
##   38.07     42       1   0.6897  0.0564      0.58747        0.810
##   38.72     40       1   0.6726  0.0576      0.56868        0.796
##   40.40     38       1   0.6552  0.0588      0.54953        0.781
##   44.67     36       1   0.6372  0.0599      0.52997        0.766
##   44.74     35       1   0.6193  0.0609      0.51065        0.751
##   47.80     34       1   0.6013  0.0618      0.49156        0.736
##   49.11     33       1   0.5834  0.0626      0.47270        0.720
##   49.60     32       1   0.5654  0.0633      0.45404        0.704
##   50.43     31       1   0.5475  0.0639      0.43560        0.688
##   50.59     30       1   0.5295  0.0643      0.41735        0.672
##   52.86     29       1   0.5116  0.0647      0.39930        0.655
##   54.90     28       1   0.4936  0.0649      0.38143        0.639
##   57.80     27       1   0.4757  0.0651      0.36376        0.622
##   58.45     26       1   0.4577  0.0652      0.34628        0.605
##   59.07     25       1   0.4398  0.0651      0.32898        0.588
```

```
##    59.20     24       1   0.4218  0.0650       0.31187        0.571
##    59.34     23       1   0.4039  0.0648       0.29494        0.553
##    59.50     22       1   0.3859  0.0645       0.27821        0.535
##    61.40     21       1   0.3680  0.0640       0.26167        0.518
##    64.33     20       1   0.3500  0.0635       0.24532        0.499
##    64.93     19       1   0.3321  0.0629       0.22917        0.481
##    65.55     18       1   0.3142  0.0621       0.21323        0.463
##    68.10     17       1   0.2962  0.0613       0.19750        0.444
##    68.70     16       1   0.2783  0.0603       0.18199        0.425
##    69.10     15       1   0.2603  0.0592       0.16671        0.406
##    70.80     14       1   0.2424  0.0580       0.15167        0.387
##    72.09     13       1   0.2244  0.0566       0.13690        0.368
##    74.36     11       1   0.2049  0.0553       0.12081        0.348
##    74.53     10       1   0.1854  0.0537       0.10513        0.327
##    84.70      8       1   0.1636  0.0522       0.08759        0.306
##    85.61      7       1   0.1419  0.0502       0.07085        0.284
##    89.62      5       1   0.1161  0.0486       0.05110        0.264
##    95.07      4       1   0.0904  0.0460       0.03337        0.245
##    99.51      3       1   0.0648  0.0423       0.01805        0.233
##   105.17      2       1   0.0393  0.0378       0.00597        0.259
##   112.33      1       1   0.0145     Inf       0.00000        1.000
```

```
autoplot(fhsurvival1_stage,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Adjuvant Radiation Therapy

It seems that who had the thetapy had a better chance to live.

Kaplan-Meier non-parametric analysis

```
kmsurvival1_adjXRT <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$adjXRT)
summary(kmsurvival1_adjXRT)
```

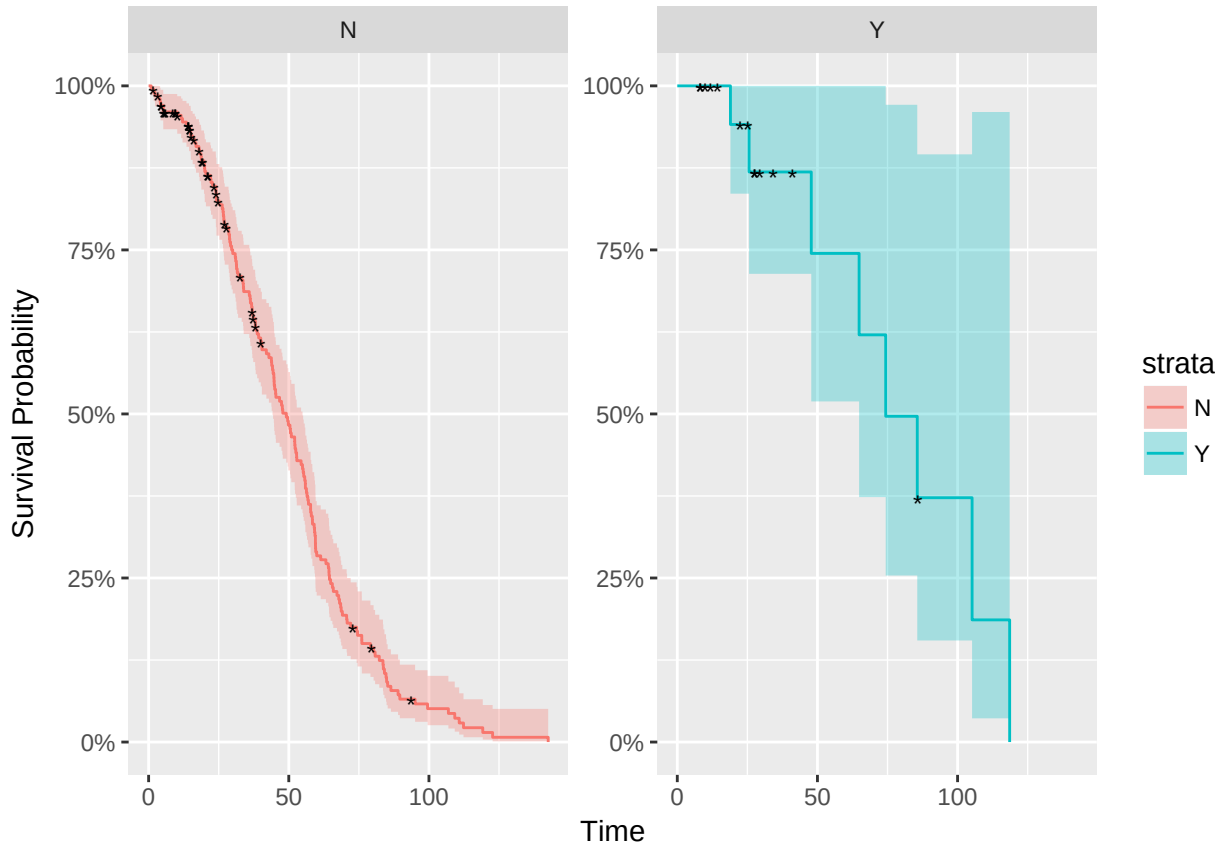
```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$adjXRT)
##
##                 clinical_data$adjXRT=N
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    204       1  0.99510 0.00489      0.98556       1.0000
##    1.80    202       1  0.99017 0.00692      0.97671       1.0000
##    2.26    201       1  0.98525 0.00846      0.96881       1.0000
##    3.64    199       1  0.98029 0.00976      0.96136       0.9996
##    4.10    198       1  0.97534 0.01089      0.95423       0.9969
##    4.24    197       1  0.97039 0.01191      0.94733       0.9940
##    5.20    194       1  0.96539 0.01285      0.94052       0.9909
##    5.22    193       1  0.96039 0.01373      0.93386       0.9877
##   10.20    186       1  0.95523 0.01459      0.92705       0.9843
##   11.60    184       1  0.95003 0.01541      0.92031       0.9807
##   12.10    183       1  0.94484 0.01617      0.91367       0.9771
##   13.50    182       1  0.93965 0.01690      0.90711       0.9734
##   14.40    178       1  0.93437 0.01761      0.90049       0.9695
##   15.00    175       1  0.92903 0.01830      0.89385       0.9656
##   15.05    174       1  0.92369 0.01896      0.88728       0.9616
##   15.71    172       1  0.91832 0.01959      0.88071       0.9575
##   16.47    170       1  0.91292 0.02021      0.87416       0.9534
##   16.90    169       1  0.90752 0.02080      0.86766       0.9492
##   17.95    168       1  0.90212 0.02136      0.86120       0.9450
##   18.18    166       1  0.89668 0.02192      0.85474       0.9407
##   18.70    165       1  0.89125 0.02245      0.84832       0.9363
##   18.80    164       1  0.88581 0.02296      0.84194       0.9320
##   19.75    161       1  0.88031 0.02347      0.83550       0.9275
##   19.98    160       1  0.87481 0.02396      0.82910       0.9230
##   20.02    159       1  0.86931 0.02443      0.82272       0.9185
##   20.44    158       1  0.86381 0.02489      0.81638       0.9140
##   22.02    155       1  0.85823 0.02534      0.80997       0.9094
##   22.25    154       1  0.85266 0.02578      0.80360       0.9047
##   22.80    153       1  0.84709 0.02621      0.79724       0.9000
##   23.96    151       1  0.84148 0.02663      0.79087       0.8953
##   24.00    150       1  0.83587 0.02704      0.78452       0.8906
##   24.19    148       1  0.83022 0.02744      0.77815       0.8858
##   24.20    147       1  0.82457 0.02783      0.77180       0.8810
##   25.24    145       1  0.81889 0.02821      0.76542       0.8761
##   26.26    144       1  0.81320 0.02858      0.75907       0.8712
##   26.53    143       1  0.80751 0.02894      0.75274       0.8663
##   26.66    142       1  0.80183 0.02929      0.74642       0.8613
##   26.82    141       1  0.79614 0.02963      0.74013       0.8564
```

```
##   26.92    140       1  0.79045 0.02996      0.73386       0.8514
##   27.15    138       1  0.78472 0.03028      0.72756       0.8464
##   28.50    136       1  0.77895 0.03061      0.72122       0.8413
##   28.63    135       1  0.77318 0.03092      0.71490       0.8362
##   28.86    134       1  0.76741 0.03122      0.70860       0.8311
##   28.96    133       1  0.76164 0.03152      0.70231       0.8260
##   29.22    132       1  0.75587 0.03180      0.69605       0.8208
##   29.60    131       1  0.75010 0.03208      0.68980       0.8157
##   30.00    130       1  0.74433 0.03235      0.68356       0.8105
##   30.90    129       1  0.73856 0.03261      0.67735       0.8053
##   31.06    128       1  0.73279 0.03286      0.67114       0.8001
##   31.30    127       1  0.72702 0.03310      0.66496       0.7949
##   31.36    126       1  0.72125 0.03334      0.65879       0.7896
##   31.60    125       1  0.71548 0.03357      0.65263       0.7844
##   31.92    124       1  0.70971 0.03379      0.64649       0.7791
##   33.20    122       1  0.70390 0.03401      0.64030       0.7738
##   33.69    121       1  0.69808 0.03422      0.63413       0.7685
##   33.80    120       1  0.69226 0.03443      0.62797       0.7631
##   33.90    119       1  0.68644 0.03463      0.62183       0.7578
##   35.90    118       1  0.68063 0.03482      0.61570       0.7524
##   36.20    117       1  0.67481 0.03500      0.60958       0.7470
##   36.30    116       1  0.66899 0.03518      0.60347       0.7416
##   36.75    115       1  0.66318 0.03535      0.59738       0.7362
##   36.92    114       1  0.65736 0.03552      0.59130       0.7308
##   37.00    112       1  0.65149 0.03568      0.58518       0.7253
##   37.31    111       1  0.64562 0.03584      0.57906       0.7198
##   38.00    109       1  0.63970 0.03600      0.57289       0.7143
##   38.07    108       1  0.63377 0.03615      0.56674       0.7087
##   38.20    106       1  0.62779 0.03630      0.56053       0.7031
##   38.72    105       1  0.62182 0.03644      0.55434       0.6975
##   39.25    104       1  0.61584 0.03658      0.54816       0.6919
##   40.00    103       1  0.60986 0.03671      0.54199       0.6862
##   40.40    101       2  0.59778 0.03696      0.52955       0.6748
##   42.00     99       1  0.59174 0.03708      0.52336       0.6691
##   42.90     98       1  0.58570 0.03719      0.51717       0.6633
##   43.79     97       1  0.57967 0.03729      0.51100       0.6576
##   43.90     96       1  0.57363 0.03739      0.50483       0.6518
##   44.20     95       1  0.56759 0.03748      0.49869       0.6460
##   44.40     94       1  0.56155 0.03756      0.49255       0.6402
##   44.67     93       1  0.55551 0.03764      0.48642       0.6344
##   44.74     92       1  0.54948 0.03771      0.48031       0.6286
##   44.80     91       1  0.54344 0.03778      0.47421       0.6228
##   44.97     90       1  0.53740 0.03784      0.46812       0.6169
##   45.30     89       1  0.53136 0.03789      0.46205       0.6111
##   45.40     88       1  0.52532 0.03794      0.45598       0.6052
##   46.71     87       1  0.51928 0.03798      0.44993       0.5993
##   47.40     86       1  0.51325 0.03802      0.44389       0.5934
##   47.70     85       1  0.50721 0.03805      0.43786       0.5875
##   47.86     84       1  0.50117 0.03807      0.43184       0.5816
##   49.11     83       1  0.49513 0.03809      0.42584       0.5757
##   49.60     82       1  0.48909 0.03810      0.41984       0.5698
##   49.84     81       1  0.48306 0.03810      0.41386       0.5638
##   50.43     80       1  0.47702 0.03810      0.40789       0.5579
##   50.59     79       1  0.47098 0.03810      0.40193       0.5519
```

```
##   50.90     78       1  0.46494 0.03808      0.39598       0.5459
##   52.10     77       1  0.45890 0.03806      0.39005       0.5399
##   52.14     76       1  0.45286 0.03804      0.38412       0.5339
##   52.24     75       1  0.44683 0.03801      0.37821       0.5279
##   52.50     74       1  0.44079 0.03797      0.37231       0.5219
##   52.80     73       1  0.43475 0.03793      0.36642       0.5158
##   52.86     72       1  0.42871 0.03788      0.36054       0.5098
##   54.40     71       1  0.42267 0.03782      0.35468       0.5037
##   54.90     70       1  0.41664 0.03776      0.34882       0.4976
##   55.13     69       1  0.41060 0.03769      0.34298       0.4915
##   55.33     68       1  0.40456 0.03762      0.33715       0.4854
##   55.70     67       1  0.39852 0.03754      0.33134       0.4793
##   55.90     66       1  0.39248 0.03745      0.32553       0.4732
##   55.92     65       1  0.38644 0.03736      0.31974       0.4671
##   56.30     64       1  0.38041 0.03726      0.31396       0.4609
##   56.50     63       1  0.37437 0.03716      0.30819       0.4548
##   56.80     62       1  0.36833 0.03705      0.30243       0.4486
##   57.00     61       1  0.36229 0.03693      0.29669       0.4424
##   57.79     60       1  0.35625 0.03680      0.29096       0.4362
##   57.80     59       1  0.35021 0.03667      0.28524       0.4300
##   58.02     58       1  0.34418 0.03653      0.27953       0.4238
##   58.40     57       1  0.33814 0.03639      0.27384       0.4175
##   58.45     56       1  0.33210 0.03623      0.26816       0.4113
##   59.07     55       1  0.32606 0.03607      0.26250       0.4050
##   59.20     54       1  0.32002 0.03591      0.25685       0.3987
##   59.34     53       1  0.31399 0.03573      0.25121       0.3925
##   59.50     52       2  0.30191 0.03537      0.23997       0.3798
##   59.53     50       1  0.29587 0.03517      0.23438       0.3735
##   59.60     49       1  0.28983 0.03497      0.22880       0.3671
##   59.96     48       1  0.28379 0.03476      0.22323       0.3608
##   61.40     47       1  0.27776 0.03454      0.21768       0.3544
##   63.25     46       1  0.27172 0.03431      0.21215       0.3480
##   64.10     45       1  0.26568 0.03407      0.20663       0.3416
##   64.33     44       1  0.25964 0.03383      0.20112       0.3352
##   64.37     43       1  0.25360 0.03358      0.19564       0.3287
##   64.50     42       1  0.24757 0.03332      0.19017       0.3223
##   64.93     41       1  0.24153 0.03305      0.18471       0.3158
##   65.55     40       1  0.23549 0.03277      0.17928       0.3093
##   65.88     39       1  0.22945 0.03248      0.17386       0.3028
##   67.19     38       1  0.22341 0.03218      0.16846       0.2963
##   67.82     37       1  0.21737 0.03187      0.16308       0.2897
##   68.10     36       1  0.21134 0.03155      0.15772       0.2832
##   68.51     35       1  0.20530 0.03123      0.15238       0.2766
##   68.70     34       1  0.19926 0.03089      0.14706       0.2700
##   69.10     33       1  0.19322 0.03053      0.14176       0.2634
##   70.65     32       1  0.18718 0.03017      0.13648       0.2567
##   70.80     31       1  0.18115 0.02980      0.13123       0.2501
##   72.09     30       1  0.17511 0.02941      0.12599       0.2434
##   74.20     28       1  0.16885 0.02902      0.12057       0.2365
##   74.53     27       1  0.16260 0.02861      0.11518       0.2295
##   76.04     26       1  0.15635 0.02818      0.10981       0.2226
##   76.07     25       1  0.15009 0.02774      0.10448       0.2156
##   79.13     24       1  0.14384 0.02728      0.09918       0.2086
##   80.25     22       1  0.13730 0.02681      0.09364       0.2013
```

```
##   80.80     21       1  0.13076 0.02632      0.08814       0.1940
##   82.29     20       1  0.12422 0.02580      0.08268       0.1866
##   83.60     19       1  0.11769 0.02526      0.07727       0.1792
##   83.73     18       1  0.11115 0.02469      0.07192       0.1718
##   84.13     17       1  0.10461 0.02409      0.06662       0.1643
##   84.70     16       1  0.09807 0.02345      0.06138       0.1567
##   84.90     15       1  0.09153 0.02278      0.05620       0.1491
##   85.28     14       1  0.08500 0.02207      0.05109       0.1414
##   86.43     13       1  0.07846 0.02132      0.04606       0.1336
##   88.99     12       1  0.07192 0.02052      0.04111       0.1258
##   89.62     11       1  0.06538 0.01967      0.03625       0.1179
##   95.07      9       1  0.05812 0.01878      0.03085       0.1095
##   99.51      8       1  0.05085 0.01778      0.02563       0.1009
##  106.94      7       1  0.04359 0.01666      0.02061       0.0922
##  109.21      6       1  0.03632 0.01538      0.01584       0.0833
##  110.79      5       1  0.02906 0.01392      0.01137       0.0743
##  112.33      4       1  0.02179 0.01219      0.00728       0.0652
##  119.21      3       1  0.01453 0.01006      0.00374       0.0564
##  122.72      2       1  0.00726 0.00719      0.00104       0.0505
##  142.55      1       1  0.00000     NaN          NA           NA
##
##                clinical_data$adjXRT=Y
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   19.0     17       1    0.941  0.0571       0.8357        1.000
##   25.6     13       1    0.869  0.0873       0.7135        1.000
##   47.8      7       1    0.745  0.1371       0.5191        1.000
##   64.9      6       1    0.621  0.1609       0.3733        1.000
##   74.4      5       1    0.496  0.1700       0.2538        0.971
##   85.6      4       1    0.372  0.1667       0.1548        0.896
##  105.2      2       1    0.186  0.1558       0.0361        0.960
##  118.6      1       1    0.000     NaN          NA           NA
```

```
autoplot(kmsurvival1_adjXRT,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_adjXRT <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$adjXRT, type="fleming-harrington")
summary(fhsurvival1_adjXRT)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$adjXRT, type = "fleming-harrington")
##
##                 clinical_data$adjXRT=N
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    204       1  0.99511 0.00489      0.98557       1.0000
##    1.80    202       1  0.99020 0.00692      0.97673       1.0000
##    2.26    201       1  0.98528 0.00846      0.96885       1.0000
##    3.64    199       1  0.98034 0.00976      0.96141       0.9997
##    4.10    198       1  0.97540 0.01089      0.95429       0.9970
##    4.24    197       1  0.97047 0.01191      0.94740       0.9941
##    5.20    194       1  0.96548 0.01285      0.94061       0.9910
##    5.22    193       1  0.96049 0.01373      0.93395       0.9878
##   10.20    186       1  0.95534 0.01459      0.92716       0.9844
##   11.60    184       1  0.95016 0.01541      0.92043       0.9808
##   12.10    183       1  0.94498 0.01618      0.91380       0.9772
##   13.50    182       1  0.93980 0.01690      0.90725       0.9735
##   14.40    178       1  0.93454 0.01761      0.90065       0.9697
##   15.00    175       1  0.92921 0.01830      0.89402       0.9658
```

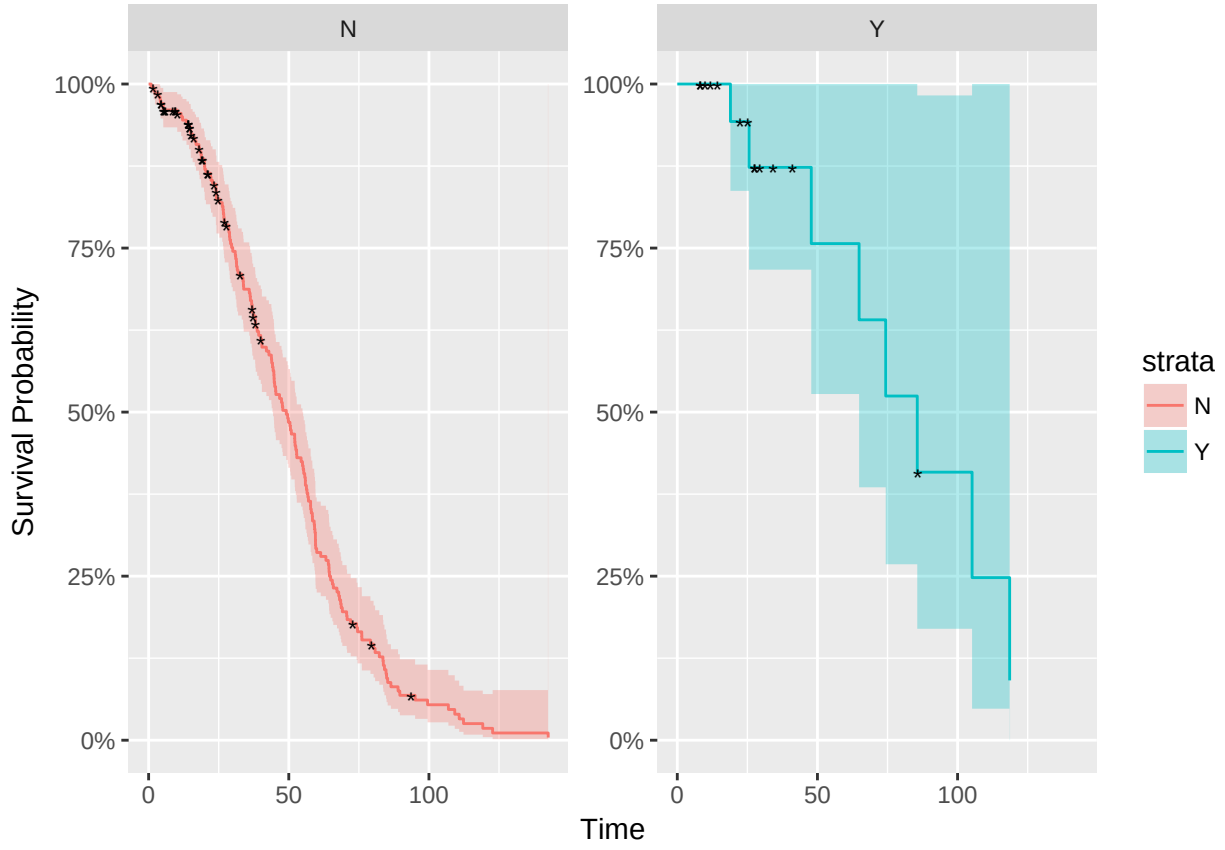
```
##   15.05    174       1  0.92389 0.01896      0.88746       0.9618
##   15.71    172       1  0.91853 0.01960      0.88091       0.9578
##   16.47    170       1  0.91314 0.02021      0.87437       0.9536
##   16.90    169       1  0.90776 0.02080      0.86788       0.9495
##   17.95    168       1  0.90237 0.02137      0.86144       0.9452
##   18.18    166       1  0.89695 0.02192      0.85500       0.9410
##   18.70    165       1  0.89153 0.02245      0.84859       0.9366
##   18.80    164       1  0.88611 0.02297      0.84222       0.9323
##   19.75    161       1  0.88062 0.02347      0.83580       0.9279
##   19.98    160       1  0.87514 0.02396      0.82941       0.9234
##   20.02    159       1  0.86965 0.02444      0.82305       0.9189
##   20.44    158       1  0.86416 0.02490      0.81672       0.9144
##   22.02    155       1  0.85861 0.02535      0.81033       0.9098
##   22.25    154       1  0.85305 0.02579      0.80396       0.9051
##   22.80    153       1  0.84749 0.02622      0.79763       0.9005
##   23.96    151       1  0.84190 0.02664      0.79127       0.8958
##   24.00    150       1  0.83630 0.02705      0.78493       0.8910
##   24.19    148       1  0.83067 0.02745      0.77857       0.8863
##   24.20    147       1  0.82504 0.02784      0.77224       0.8815
##   25.24    145       1  0.81937 0.02823      0.76588       0.8766
##   26.26    144       1  0.81370 0.02860      0.75954       0.8717
##   26.53    143       1  0.80803 0.02896      0.75322       0.8668
##   26.66    142       1  0.80236 0.02931      0.74692       0.8619
##   26.82    141       1  0.79669 0.02965      0.74064       0.8570
##   26.92    140       1  0.79102 0.02998      0.73439       0.8520
##   27.15    138       1  0.78531 0.03031      0.72810       0.8470
##   28.50    136       1  0.77955 0.03063      0.72177       0.8420
##   28.63    135       1  0.77380 0.03094      0.71547       0.8369
##   28.86    134       1  0.76805 0.03125      0.70918       0.8318
##   28.96    133       1  0.76229 0.03154      0.70291       0.8267
##   29.22    132       1  0.75654 0.03183      0.69666       0.8216
##   29.60    131       1  0.75079 0.03211      0.69043       0.8164
##   30.00    130       1  0.74504 0.03238      0.68421       0.8113
##   30.90    129       1  0.73928 0.03264      0.67800       0.8061
##   31.06    128       1  0.73353 0.03289      0.67182       0.8009
##   31.30    127       1  0.72778 0.03314      0.66565       0.7957
##   31.36    126       1  0.72202 0.03337      0.65949       0.7905
##   31.60    125       1  0.71627 0.03360      0.65335       0.7853
##   31.92    124       1  0.71052 0.03383      0.64722       0.7800
##   33.20    122       1  0.70472 0.03405      0.64105       0.7747
##   33.69    121       1  0.69892 0.03426      0.63489       0.7694
##   33.80    120       1  0.69312 0.03447      0.62875       0.7641
##   33.90    119       1  0.68732 0.03467      0.62262       0.7587
##   35.90    118       1  0.68152 0.03486      0.61650       0.7534
##   36.20    117       1  0.67572 0.03505      0.61040       0.7480
##   36.30    116       1  0.66992 0.03523      0.60431       0.7426
##   36.75    115       1  0.66412 0.03540      0.59823       0.7373
##   36.92    114       1  0.65832 0.03557      0.59217       0.7319
##   37.00    112       1  0.65246 0.03574      0.58605       0.7264
##   37.31    111       1  0.64661 0.03590      0.57995       0.7209
##   38.00    109       1  0.64071 0.03605      0.57380       0.7154
##   38.07    108       1  0.63480 0.03621      0.56766       0.7099
##   38.20    106       1  0.62884 0.03636      0.56147       0.7043
##   38.72    105       1  0.62288 0.03650      0.55529       0.6987
```

```
##   39.25    104       1  0.61692 0.03664      0.54912       0.6931
##   40.00    103       1  0.61096 0.03678      0.54297       0.6875
##   40.40    101       2  0.59898 0.03704      0.53062       0.6762
##   42.00     99       1  0.59296 0.03715      0.52443       0.6704
##   42.90     98       1  0.58694 0.03727      0.51826       0.6647
##   43.79     97       1  0.58092 0.03737      0.51210       0.6590
##   43.90     96       1  0.57490 0.03747      0.50596       0.6532
##   44.20     95       1  0.56888 0.03757      0.49982       0.6475
##   44.40     94       1  0.56286 0.03765      0.49370       0.6417
##   44.67     93       1  0.55684 0.03773      0.48759       0.6359
##   44.74     92       1  0.55082 0.03781      0.48149       0.6301
##   44.80     91       1  0.54480 0.03788      0.47540       0.6243
##   44.97     90       1  0.53878 0.03794      0.46933       0.6185
##   45.30     89       1  0.53276 0.03799      0.46327       0.6127
##   45.40     88       1  0.52674 0.03804      0.45722       0.6068
##   46.71     87       1  0.52072 0.03809      0.45118       0.6010
##   47.40     86       1  0.51470 0.03813      0.44515       0.5951
##   47.70     85       1  0.50868 0.03816      0.43913       0.5892
##   47.86     84       1  0.50266 0.03818      0.43313       0.5834
##   49.11     83       1  0.49664 0.03820      0.42714       0.5775
##   49.60     82       1  0.49062 0.03822      0.42116       0.5715
##   49.84     81       1  0.48460 0.03823      0.41519       0.5656
##   50.43     80       1  0.47858 0.03823      0.40923       0.5597
##   50.59     79       1  0.47256 0.03822      0.40328       0.5537
##   50.90     78       1  0.46654 0.03821      0.39735       0.5478
##   52.10     77       1  0.46052 0.03820      0.39143       0.5418
##   52.14     76       1  0.45450 0.03818      0.38551       0.5358
##   52.24     75       1  0.44848 0.03815      0.37961       0.5299
##   52.50     74       1  0.44246 0.03812      0.37373       0.5238
##   52.80     73       1  0.43644 0.03808      0.36785       0.5178
##   52.86     72       1  0.43043 0.03803      0.36198       0.5118
##   54.40     71       1  0.42441 0.03798      0.35613       0.5058
##   54.90     70       1  0.41839 0.03792      0.35029       0.4997
##   55.13     69       1  0.41237 0.03786      0.34446       0.4937
##   55.33     68       1  0.40635 0.03779      0.33864       0.4876
##   55.70     67       1  0.40033 0.03771      0.33284       0.4815
##   55.90     66       1  0.39431 0.03763      0.32704       0.4754
##   55.92     65       1  0.38829 0.03754      0.32126       0.4693
##   56.30     64       1  0.38227 0.03744      0.31549       0.4632
##   56.50     63       1  0.37625 0.03734      0.30973       0.4570
##   56.80     62       1  0.37023 0.03724      0.30399       0.4509
##   57.00     61       1  0.36421 0.03712      0.29826       0.4447
##   57.79     60       1  0.35819 0.03700      0.29254       0.4386
##   57.80     59       1  0.35217 0.03687      0.28683       0.4324
##   58.02     58       1  0.34615 0.03674      0.28113       0.4262
##   58.40     57       1  0.34013 0.03660      0.27545       0.4200
##   58.45     56       1  0.33411 0.03645      0.26978       0.4138
##   59.07     55       1  0.32809 0.03630      0.26413       0.4075
##   59.20     54       1  0.32207 0.03614      0.25849       0.4013
##   59.34     53       1  0.31605 0.03597      0.25286       0.3950
##   59.50     52       2  0.30412 0.03563      0.24173       0.3826
##   59.53     50       1  0.29810 0.03544      0.23615       0.3763
##   59.60     49       1  0.29208 0.03524      0.23057       0.3700
##   59.96     48       1  0.28606 0.03503      0.22501       0.3637
```

```
##   61.40     47       1  0.28004 0.03482      0.21947       0.3573
##   63.25     46       1  0.27401 0.03460      0.21394       0.3510
##   64.10     45       1  0.26799 0.03437      0.20843       0.3446
##   64.33     44       1  0.26197 0.03413      0.20293       0.3382
##   64.37     43       1  0.25595 0.03389      0.19744       0.3318
##   64.50     42       1  0.24993 0.03364      0.19198       0.3254
##   64.93     41       1  0.24390 0.03337      0.18653       0.3189
##   65.55     40       1  0.23788 0.03310      0.18110       0.3125
##   65.88     39       1  0.23186 0.03282      0.17568       0.3060
##   67.19     38       1  0.22584 0.03253      0.17029       0.2995
##   67.82     37       1  0.21982 0.03223      0.16491       0.2930
##   68.10     36       1  0.21379 0.03192      0.15955       0.2865
##   68.51     35       1  0.20777 0.03160      0.15421       0.2799
##   68.70     34       1  0.20175 0.03127      0.14889       0.2734
##   69.10     33       1  0.19573 0.03093      0.14360       0.2668
##   70.65     32       1  0.18971 0.03058      0.13832       0.2602
##   70.80     31       1  0.18368 0.03021      0.13306       0.2536
##   72.09     30       1  0.17766 0.02984      0.12783       0.2469
##   74.20     28       1  0.17143 0.02946      0.12241       0.2401
##   74.53     27       1  0.16520 0.02906      0.11702       0.2332
##   76.04     26       1  0.15896 0.02865      0.11165       0.2263
##   76.07     25       1  0.15273 0.02823      0.10632       0.2194
##   79.13     24       1  0.14650 0.02778      0.10102       0.2125
##   80.25     22       1  0.13999 0.02734      0.09547       0.2053
##   80.80     21       1  0.13348 0.02687      0.08997       0.1980
##   82.29     20       1  0.12697 0.02637      0.08451       0.1908
##   83.60     19       1  0.12046 0.02585      0.07909       0.1835
##   83.73     18       1  0.11395 0.02531      0.07373       0.1761
##   84.13     17       1  0.10744 0.02474      0.06842       0.1687
##   84.70     16       1  0.10093 0.02413      0.06316       0.1613
##   84.90     15       1  0.09442 0.02350      0.05797       0.1538
##   85.28     14       1  0.08791 0.02283      0.05284       0.1462
##   86.43     13       1  0.08140 0.02212      0.04779       0.1387
##   88.99     12       1  0.07489 0.02137      0.04281       0.1310
##   89.62     11       1  0.06839 0.02057      0.03792       0.1233
##   95.07      9       1  0.06119 0.01977      0.03248       0.1153
##   99.51      8       1  0.05400 0.01888      0.02721       0.1072
##  106.94      7       1  0.04681 0.01789      0.02213       0.0990
##  109.21      6       1  0.03963 0.01678      0.01728       0.0909
##  110.79      5       1  0.03244 0.01554      0.01269       0.0830
##  112.33      4       1  0.02527 0.01413      0.00844       0.0756
##  119.21      3       1  0.01811 0.01254      0.00466       0.0703
##  122.72      2       1  0.01098 0.01087      0.00158       0.0764
##  142.55      1       1  0.00404     Inf      0.00000       1.0000
##
##                clinical_data$adjXRT=Y
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   19.0     17       1   0.9429  0.0572        0.837        1.000
##   25.6     13       1   0.8731  0.0877        0.717        1.000
##   47.8      7       1   0.7568  0.1393        0.528        1.000
##   64.9      6       1   0.6407  0.1661        0.385        1.000
##   74.4      5       1   0.5245  0.1796        0.268        1.000
##   85.6      4       1   0.4085  0.1829        0.170        0.983
##  105.2      2       1   0.2478  0.2074        0.048        1.000
```

```
##  118.6      1       1   0.0911      Inf        0.000        1.000
```

```
autoplot(fhsurvival1_adjXRT,
         censor.shape = '*', facets = TRUE, ncol = 2,xlab="Time",
         ylab="Survival Probability")
```



Adjuvant Chemotherapy Analysis

Also the chemo therapy helps but not as much as radiation therapy.

Kaplan-Meier non-parametric analysis

```
kmsurvival1_adjCTX <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$adjCTX)
summary(kmsurvival1_adjCTX)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$adjCTX)
##
##                 clinical_data$adjCTX=N
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    139       1   0.9928 0.00717      0.97886       1.0000
##    1.80    138       1   0.9856 0.01010      0.96601       1.0000
##    2.26    137       1   0.9784 0.01233      0.95456       1.0000
##    3.64    135       1   0.9712 0.01421      0.94372       0.9994
```

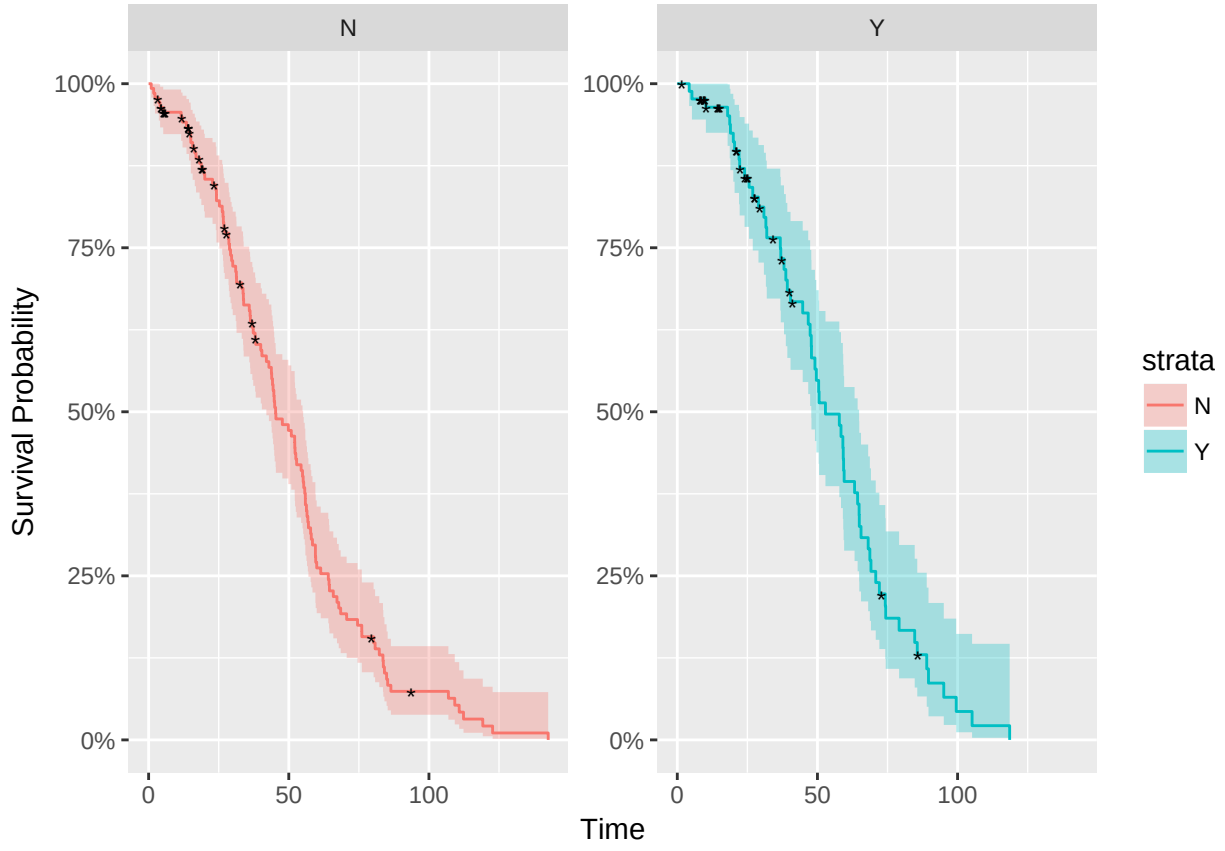
```
##    4.10    134       1   0.9639 0.01584      0.93337       0.9955
##    5.20    131       1   0.9566 0.01735      0.92316       0.9912
##   11.60    127       1   0.9490 0.01877      0.91294       0.9865
##   12.10    125       1   0.9414 0.02010      0.90286       0.9817
##   13.50    124       1   0.9338 0.02132      0.89298       0.9766
##   14.40    120       1   0.9261 0.02252      0.88296       0.9713
##   15.00    118       1   0.9182 0.02366      0.87300       0.9658
##   15.05    117       1   0.9104 0.02472      0.86318       0.9601
##   15.71    116       1   0.9025 0.02573      0.85348       0.9544
##   16.47    114       1   0.8946 0.02669      0.84379       0.9485
##   16.90    113       1   0.8867 0.02760      0.83420       0.9425
##   18.18    111       1   0.8787 0.02849      0.82460       0.9363
##   18.80    110       1   0.8707 0.02933      0.81509       0.9301
##   19.75    107       1   0.8626 0.03016      0.80544       0.9238
##   20.02    106       1   0.8544 0.03095      0.79587       0.9173
##   22.80    105       1   0.8463 0.03171      0.78637       0.9108
##   23.96    103       1   0.8381 0.03245      0.77683       0.9042
##   24.19    102       1   0.8299 0.03316      0.76736       0.8975
##   24.20    101       1   0.8216 0.03383      0.75795       0.8907
##   25.24    100       1   0.8134 0.03448      0.74859       0.8839
##   26.26     99       1   0.8052 0.03509      0.73929       0.8770
##   26.53     98       1   0.7970 0.03568      0.73004       0.8701
##   26.66     97       1   0.7888 0.03625      0.72084       0.8631
##   26.82     96       1   0.7806 0.03679      0.71169       0.8561
##   27.15     94       1   0.7723 0.03733      0.70247       0.8490
##   28.50     92       1   0.7639 0.03785      0.69317       0.8418
##   28.63     91       1   0.7555 0.03835      0.68392       0.8345
##   28.86     90       1   0.7471 0.03884      0.67471       0.8272
##   29.22     89       1   0.7387 0.03930      0.66555       0.8199
##   29.60     88       1   0.7303 0.03974      0.65642       0.8125
##   30.00     87       1   0.7219 0.04016      0.64733       0.8051
##   31.06     86       1   0.7135 0.04056      0.63828       0.7976
##   31.30     85       1   0.7051 0.04094      0.62927       0.7901
##   31.36     84       1   0.6967 0.04130      0.62029       0.7826
##   33.20     82       1   0.6882 0.04167      0.61122       0.7749
##   33.69     81       1   0.6797 0.04201      0.60218       0.7673
##   33.80     80       1   0.6712 0.04233      0.59318       0.7595
##   33.90     79       1   0.6627 0.04264      0.58421       0.7518
##   35.90     78       1   0.6542 0.04293      0.57527       0.7440
##   36.20     77       1   0.6457 0.04321      0.56637       0.7362
##   36.30     76       1   0.6372 0.04347      0.55750       0.7284
##   37.00     74       1   0.6286 0.04372      0.54851       0.7204
##   37.31     73       1   0.6200 0.04397      0.53957       0.7125
##   38.00     72       1   0.6114 0.04419      0.53065       0.7045
##   38.20     70       1   0.6027 0.04441      0.52162       0.6963
##   40.00     69       1   0.5939 0.04462      0.51262       0.6882
##   40.40     68       1   0.5852 0.04481      0.50365       0.6800
##   42.00     67       1   0.5765 0.04499      0.49471       0.6717
##   42.90     66       1   0.5677 0.04514      0.48580       0.6635
##   43.79     65       1   0.5590 0.04529      0.47693       0.6552
##   43.90     64       1   0.5503 0.04541      0.46808       0.6469
##   44.20     63       1   0.5415 0.04552      0.45927       0.6385
##   44.40     62       1   0.5328 0.04562      0.45048       0.6302
##   44.67     61       1   0.5241 0.04570      0.44173       0.6217
```

```
##   44.80     60       1   0.5153 0.04577      0.43300       0.6133
##   44.97     59       1   0.5066 0.04582      0.42430       0.6048
##   45.30     58       1   0.4979 0.04585      0.41564       0.5963
##   45.40     57       1   0.4891 0.04587      0.40700       0.5878
##   47.70     56       1   0.4804 0.04588      0.39839       0.5793
##   49.84     55       1   0.4717 0.04587      0.38981       0.5707
##   50.90     54       1   0.4629 0.04584      0.38126       0.5621
##   52.10     53       1   0.4542 0.04580      0.37273       0.5534
##   52.14     52       1   0.4455 0.04575      0.36424       0.5448
##   52.24     51       1   0.4367 0.04567      0.35578       0.5361
##   52.50     50       1   0.4280 0.04559      0.34734       0.5273
##   52.80     49       1   0.4192 0.04549      0.33894       0.5186
##   54.40     48       1   0.4105 0.04537      0.33056       0.5098
##   54.90     47       1   0.4018 0.04524      0.32222       0.5010
##   55.13     46       1   0.3930 0.04509      0.31390       0.4921
##   55.33     45       1   0.3843 0.04493      0.30562       0.4833
##   55.70     44       1   0.3756 0.04475      0.29736       0.4744
##   55.90     43       1   0.3668 0.04455      0.28914       0.4654
##   55.92     42       1   0.3581 0.04434      0.28095       0.4565
##   56.30     41       1   0.3494 0.04411      0.27279       0.4475
##   56.50     40       1   0.3406 0.04386      0.26466       0.4384
##   56.80     39       1   0.3319 0.04360      0.25657       0.4294
##   57.00     38       1   0.3232 0.04332      0.24851       0.4203
##   57.79     37       1   0.3144 0.04302      0.24048       0.4111
##   58.02     36       1   0.3057 0.04270      0.23249       0.4020
##   58.45     35       1   0.2970 0.04236      0.22453       0.3928
##   59.50     34       2   0.2795 0.04163      0.20873       0.3743
##   59.60     32       1   0.2708 0.04124      0.20089       0.3650
##   59.96     31       1   0.2620 0.04082      0.19308       0.3556
##   61.40     30       1   0.2533 0.04039      0.18532       0.3462
##   64.10     29       1   0.2446 0.03993      0.17759       0.3368
##   64.37     28       1   0.2358 0.03944      0.16991       0.3273
##   64.50     27       1   0.2271 0.03894      0.16228       0.3178
##   65.88     26       1   0.2184 0.03841      0.15469       0.3082
##   67.19     25       1   0.2096 0.03785      0.14714       0.2986
##   67.82     24       1   0.2009 0.03727      0.13965       0.2890
##   68.51     23       1   0.1922 0.03666      0.13221       0.2793
##   70.65     22       1   0.1834 0.03602      0.12483       0.2695
##   74.53     21       1   0.1747 0.03534      0.11750       0.2597
##   76.04     20       1   0.1660 0.03464      0.11023       0.2498
##   76.07     19       1   0.1572 0.03390      0.10303       0.2399
##   80.25     17       1   0.1480 0.03314      0.09539       0.2295
##   80.80     16       1   0.1387 0.03234      0.08785       0.2191
##   82.29     15       1   0.1295 0.03148      0.08040       0.2085
##   83.60     14       1   0.1202 0.03056      0.07306       0.1978
##   83.73     13       1   0.1110 0.02957      0.06583       0.1871
##   84.13     12       1   0.1017 0.02852      0.05873       0.1762
##   84.90     11       1   0.0925 0.02738      0.05176       0.1652
##   85.28     10       1   0.0832 0.02616      0.04495       0.1541
##   86.43      9       1   0.0740 0.02483      0.03832       0.1428
##  106.94      7       1   0.0634 0.02343      0.03074       0.1308
##  109.21      6       1   0.0528 0.02178      0.02356       0.1185
##  110.79      5       1   0.0423 0.01982      0.01687       0.1060
##  112.33      4       1   0.0317 0.01746      0.01078       0.0933
```

```
##  119.21      3       1   0.0211 0.01449      0.00552       0.0810
##  122.72      2       1   0.0106 0.01041      0.00153       0.0728
##  142.55      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$adjCTX=Y
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    4.24     86       1   0.9884  0.0116       0.9660        1.000
##    5.22     85       1   0.9767  0.0163       0.9454        1.000
##   10.20     78       1   0.9642  0.0203       0.9252        1.000
##   17.95     73       1   0.9510  0.0239       0.9052        0.999
##   18.70     72       1   0.9378  0.0270       0.8863        0.992
##   18.96     71       1   0.9246  0.0297       0.8682        0.985
##   19.98     70       1   0.9114  0.0321       0.8507        0.976
##   20.44     69       1   0.8982  0.0342       0.8336        0.968
##   22.02     66       1   0.8846  0.0363       0.8162        0.959
##   22.25     65       1   0.8710  0.0382       0.7992        0.949
##   24.00     62       1   0.8569  0.0401       0.7818        0.939
##   25.61     58       1   0.8421  0.0420       0.7637        0.929
##   26.92     57       1   0.8274  0.0438       0.7458        0.918
##   28.96     54       1   0.8120  0.0456       0.7274        0.907
##   30.90     52       1   0.7964  0.0473       0.7089        0.895
##   31.60     51       1   0.7808  0.0489       0.6906        0.883
##   31.92     50       1   0.7652  0.0504       0.6726        0.871
##   36.75     48       1   0.7493  0.0518       0.6544        0.858
##   36.92     47       1   0.7333  0.0531       0.6363        0.845
##   38.07     45       1   0.7170  0.0543       0.6181        0.832
##   38.72     44       1   0.7007  0.0555       0.6000        0.818
##   39.25     43       1   0.6844  0.0565       0.5821        0.805
##   40.40     41       1   0.6677  0.0576       0.5639        0.791
##   44.74     39       1   0.6506  0.0586       0.5453        0.776
##   46.71     38       1   0.6335  0.0595       0.5270        0.762
##   47.40     37       1   0.6164  0.0603       0.5088        0.747
##   47.80     36       1   0.5992  0.0610       0.4908        0.732
##   47.86     35       1   0.5821  0.0616       0.4731        0.716
##   49.11     34       1   0.5650  0.0621       0.4554        0.701
##   49.60     33       1   0.5479  0.0626       0.4380        0.685
##   50.43     32       1   0.5308  0.0629       0.4207        0.670
##   50.59     31       1   0.5136  0.0632       0.4036        0.654
##   52.86     30       1   0.4965  0.0633       0.3867        0.638
##   57.80     29       1   0.4794  0.0634       0.3699        0.621
##   58.40     28       1   0.4623  0.0634       0.3533        0.605
##   59.07     27       1   0.4452  0.0634       0.3368        0.588
##   59.20     26       1   0.4280  0.0632       0.3205        0.572
##   59.34     25       1   0.4109  0.0629       0.3044        0.555
##   59.53     24       1   0.3938  0.0626       0.2884        0.538
##   63.25     23       1   0.3767  0.0622       0.2726        0.521
##   64.33     22       1   0.3595  0.0617       0.2569        0.503
##   64.86     21       1   0.3424  0.0611       0.2414        0.486
##   64.93     20       1   0.3253  0.0604       0.2261        0.468
##   65.55     19       1   0.3082  0.0596       0.2110        0.450
##   68.10     18       1   0.2911  0.0587       0.1961        0.432
##   68.70     17       1   0.2739  0.0577       0.1813        0.414
##   69.10     16       1   0.2568  0.0565       0.1668        0.395
##   70.80     15       1   0.2397  0.0553       0.1525        0.377
```

```
##    72.09     14       1   0.2226  0.0539        0.1384        0.358
##    74.20     12       1   0.2040  0.0525        0.1232        0.338
##    74.36     11       1   0.1855  0.0509        0.1083        0.318
##    79.13     10       1   0.1669  0.0491        0.0938        0.297
##    84.70      9       1   0.1484  0.0470        0.0797        0.276
##    85.61      8       1   0.1298  0.0446        0.0662        0.255
##    88.99      6       1   0.1082  0.0421        0.0504        0.232
##    89.62      5       1   0.0866  0.0389        0.0359        0.209
##    95.07      4       1   0.0649  0.0347        0.0228        0.185
##    99.51      3       1   0.0433  0.0291        0.0116        0.162
##   105.17      2       1   0.0216  0.0211        0.0032        0.146
##   118.58      1       1   0.0000     NaN            NA           NA
```

```
autoplot(kmsurvival1_adjCTX,
         censor.shape = '*', facets = TRUE, ncol = 2,xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_adjCTX <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                              ~ clinical_data$adjCTX, type="fleming-harrington")
summary(fhsurvival1_adjCTX)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$adjCTX, type = "fleming-harrington")
##
```

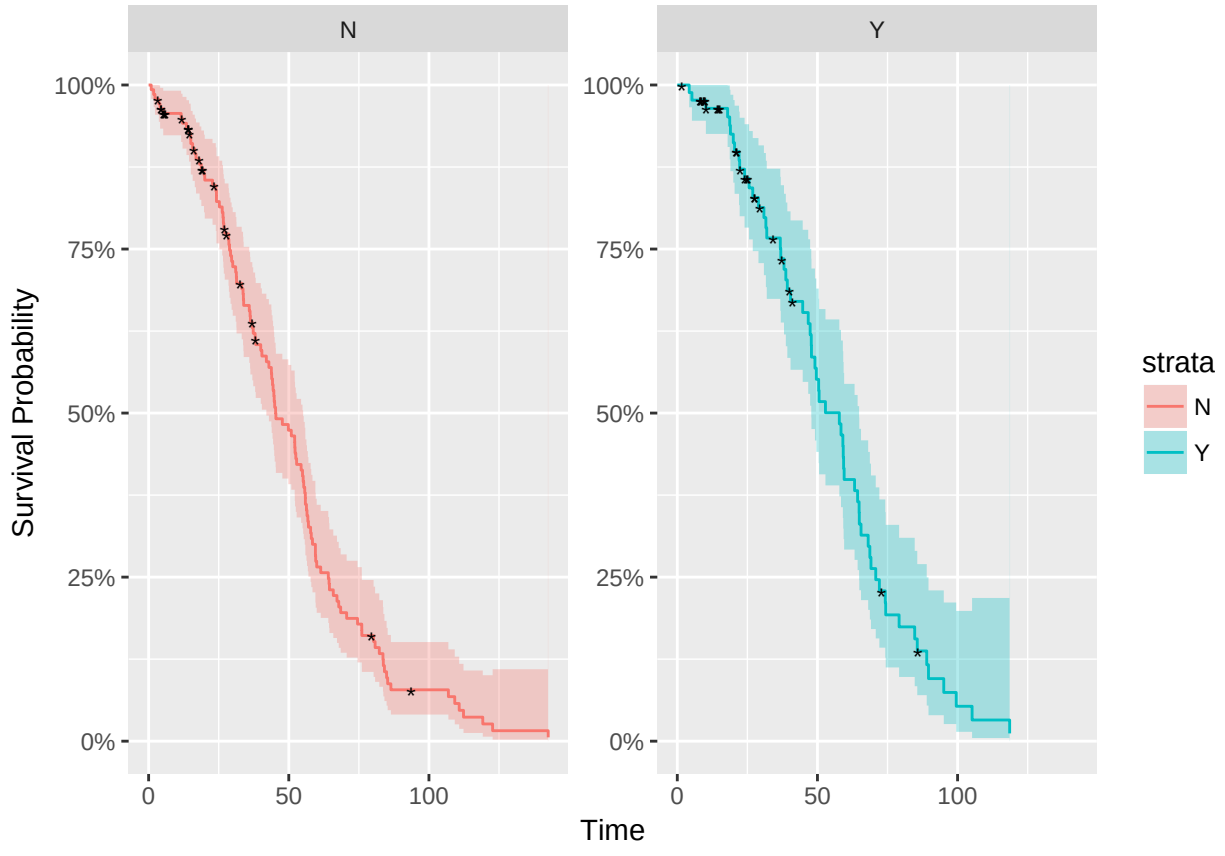
```
##                clinical_data$adjCTX=N
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92    139       1  0.99283 0.00717      0.97888        1.000
##    1.80    138       1  0.98566 0.01010      0.96606        1.000
##    2.26    137       1  0.97849 0.01233      0.95463        1.000
##    3.64    135       1  0.97127 0.01421      0.94382        1.000
##    4.10    134       1  0.96405 0.01584      0.93349        0.996
##    5.20    131       1  0.95672 0.01735      0.92332        0.991
##   11.60    127       1  0.94922 0.01878      0.91312        0.987
##   12.10    125       1  0.94165 0.02010      0.90306        0.982
##   13.50    124       1  0.93409 0.02133      0.89321        0.977
##   14.40    120       1  0.92634 0.02253      0.88322        0.972
##   15.00    118       1  0.91852 0.02367      0.87329        0.966
##   15.05    117       1  0.91070 0.02473      0.86350        0.960
##   15.71    116       1  0.90289 0.02574      0.85383        0.955
##   16.47    114       1  0.89500 0.02670      0.84417        0.949
##   16.90    113       1  0.88712 0.02762      0.83461        0.943
##   18.18    111       1  0.87916 0.02850      0.82504        0.937
##   18.80    110       1  0.87120 0.02934      0.81555        0.931
##   19.75    107       1  0.86310 0.03018      0.80593        0.924
##   20.02    106       1  0.85500 0.03097      0.79639        0.918
##   22.80    105       1  0.84689 0.03173      0.78692        0.911
##   23.96    103       1  0.83871 0.03247      0.77742        0.905
##   24.19    102       1  0.83053 0.03318      0.76797        0.898
##   24.20    101       1  0.82234 0.03386      0.75859        0.891
##   25.24    100       1  0.81416 0.03451      0.74926        0.885
##   26.26     99       1  0.80598 0.03513      0.73999        0.878
##   26.53     98       1  0.79780 0.03572      0.73077        0.871
##   26.66     97       1  0.78961 0.03629      0.72160        0.864
##   26.82     96       1  0.78143 0.03683      0.71248        0.857
##   27.15     94       1  0.77316 0.03737      0.70328        0.850
##   28.50     92       1  0.76480 0.03790      0.69402        0.843
##   28.63     91       1  0.75645 0.03840      0.68480        0.836
##   28.86     90       1  0.74809 0.03889      0.67562        0.828
##   29.22     89       1  0.73973 0.03935      0.66648        0.821
##   29.60     88       1  0.73137 0.03980      0.65739        0.814
##   30.00     87       1  0.72301 0.04022      0.64833        0.806
##   31.06     86       1  0.71465 0.04062      0.63931        0.799
##   31.30     85       1  0.70630 0.04101      0.63032        0.791
##   31.36     84       1  0.69794 0.04138      0.62137        0.784
##   33.20     82       1  0.68948 0.04174      0.61233        0.776
##   33.69     81       1  0.68102 0.04209      0.60333        0.769
##   33.80     80       1  0.67256 0.04242      0.59435        0.761
##   33.90     79       1  0.66410 0.04273      0.58541        0.753
##   35.90     78       1  0.65564 0.04303      0.57651        0.746
##   36.20     77       1  0.64718 0.04330      0.56763        0.738
##   36.30     76       1  0.63872 0.04357      0.55879        0.730
##   37.00     74       1  0.63015 0.04383      0.54984        0.722
##   37.31     73       1  0.62157 0.04408      0.54092        0.714
##   38.00     72       1  0.61300 0.04431      0.53203        0.706
##   38.20     70       1  0.60430 0.04453      0.52303        0.698
##   40.00     69       1  0.59561 0.04475      0.51406        0.690
##   40.40     68       1  0.58691 0.04494      0.50512        0.682
##   42.00     67       1  0.57822 0.04512      0.49621        0.674
```

```
##   42.90     66       1  0.56952 0.04529      0.48734        0.666
##   43.79     65       1  0.56083 0.04543      0.47849        0.657
##   43.90     64       1  0.55213 0.04557      0.46967        0.649
##   44.20     63       1  0.54344 0.04568      0.46089        0.641
##   44.40     62       1  0.53475 0.04579      0.45213        0.632
##   44.67     61       1  0.52605 0.04587      0.44340        0.624
##   44.80     60       1  0.51736 0.04595      0.43470        0.616
##   44.97     59       1  0.50866 0.04600      0.42603        0.607
##   45.30     58       1  0.49997 0.04605      0.41739        0.599
##   45.40     57       1  0.49127 0.04607      0.40878        0.590
##   47.70     56       1  0.48258 0.04609      0.40020        0.582
##   49.84     55       1  0.47388 0.04608      0.39165        0.573
##   50.90     54       1  0.46519 0.04607      0.38312        0.565
##   52.10     53       1  0.45649 0.04603      0.37463        0.556
##   52.14     52       1  0.44780 0.04599      0.36616        0.548
##   52.24     51       1  0.43910 0.04592      0.35772        0.539
##   52.50     50       1  0.43041 0.04585      0.34931        0.530
##   52.80     49       1  0.42171 0.04575      0.34093        0.522
##   54.40     48       1  0.41302 0.04565      0.33258        0.513
##   54.90     47       1  0.40432 0.04552      0.32426        0.504
##   55.13     46       1  0.39563 0.04539      0.31596        0.495
##   55.33     45       1  0.38693 0.04523      0.30770        0.487
##   55.70     44       1  0.37824 0.04506      0.29947        0.478
##   55.90     43       1  0.36954 0.04488      0.29127        0.469
##   55.92     42       1  0.36085 0.04468      0.28310        0.460
##   56.30     41       1  0.35215 0.04446      0.27496        0.451
##   56.50     40       1  0.34346 0.04422      0.26685        0.442
##   56.80     39       1  0.33476 0.04397      0.25878        0.433
##   57.00     38       1  0.32607 0.04370      0.25074        0.424
##   57.79     37       1  0.31738 0.04342      0.24273        0.415
##   58.02     36       1  0.30868 0.04312      0.23476        0.406
##   58.45     35       1  0.29999 0.04279      0.22682        0.397
##   59.50     34       2  0.28285 0.04213      0.21123        0.379
##   59.60     32       1  0.27415 0.04175      0.20340        0.370
##   59.96     31       1  0.26544 0.04135      0.19560        0.360
##   61.40     30       1  0.25674 0.04093      0.18784        0.351
##   64.10     29       1  0.24804 0.04049      0.18012        0.342
##   64.37     28       1  0.23934 0.04003      0.17244        0.332
##   64.50     27       1  0.23064 0.03955      0.16481        0.323
##   65.88     26       1  0.22193 0.03904      0.15722        0.313
##   67.19     25       1  0.21323 0.03850      0.14968        0.304
##   67.82     24       1  0.20453 0.03794      0.14218        0.294
##   68.51     23       1  0.19583 0.03736      0.13474        0.285
##   70.65     22       1  0.18712 0.03674      0.12735        0.275
##   74.53     21       1  0.17842 0.03610      0.12001        0.265
##   76.04     20       1  0.16972 0.03543      0.11274        0.256
##   76.07     19       1  0.16102 0.03472      0.10552        0.246
##   80.25     17       1  0.15182 0.03401      0.09788        0.235
##   80.80     16       1  0.14262 0.03325      0.09032        0.225
##   82.29     15       1  0.13342 0.03244      0.08285        0.215
##   83.60     14       1  0.12423 0.03157      0.07549        0.204
##   83.73     13       1  0.11503 0.03065      0.06823        0.194
##   84.13     12       1  0.10583 0.02967      0.06110        0.183
##   84.90     11       1  0.09664 0.02861      0.05409        0.173
```

```
##   85.28     10       1  0.08744 0.02748      0.04723        0.162
##   86.43      9       1  0.07824 0.02626      0.04053        0.151
##  106.94      7       1  0.06783 0.02506      0.03288        0.140
##  109.21      6       1  0.05742 0.02366      0.02560        0.129
##  110.79      5       1  0.04701 0.02204      0.01875        0.118
##  112.33      4       1  0.03661 0.02016      0.01244        0.108
##  119.21      3       1  0.02623 0.01798      0.00685        0.101
##  122.72      2       1  0.01591 0.01567      0.00231        0.110
##  142.55      1       1  0.00585     Inf      0.00000        1.000
##
##                clinical_data$adjCTX=Y
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    4.24     86       1   0.9884  0.0116      0.96604        1.000
##    5.22     85       1   0.9769  0.0163      0.94554        1.000
##   10.20     78       1   0.9644  0.0203      0.92544        1.000
##   17.95     73       1   0.9513  0.0239      0.90552        0.999
##   18.70     72       1   0.9382  0.0270      0.88671        0.993
##   18.96     71       1   0.9251  0.0297      0.86866        0.985
##   19.98     70       1   0.9119  0.0321      0.85119        0.977
##   20.44     69       1   0.8988  0.0342      0.83417        0.968
##   22.02     66       1   0.8853  0.0363      0.81690        0.959
##   22.25     65       1   0.8718  0.0382      0.79998        0.950
##   24.00     62       1   0.8578  0.0401      0.78269        0.940
##   25.61     58       1   0.8432  0.0421      0.76461        0.930
##   26.92     57       1   0.8285  0.0439      0.74684        0.919
##   28.96     54       1   0.8133  0.0457      0.72855        0.908
##   30.90     52       1   0.7978  0.0474      0.71012        0.896
##   31.60     51       1   0.7823  0.0490      0.69196        0.885
##   31.92     50       1   0.7668  0.0505      0.67405        0.872
##   36.75     48       1   0.7510  0.0519      0.65591        0.860
##   36.92     47       1   0.7352  0.0532      0.63800        0.847
##   38.07     45       1   0.7191  0.0545      0.61982        0.834
##   38.72     44       1   0.7029  0.0557      0.60186        0.821
##   39.25     43       1   0.6867  0.0567      0.58409        0.807
##   40.40     41       1   0.6702  0.0578      0.56600        0.794
##   44.74     39       1   0.6532  0.0588      0.54755        0.779
##   46.71     38       1   0.6363  0.0598      0.52930        0.765
##   47.40     37       1   0.6193  0.0606      0.51125        0.750
##   47.80     36       1   0.6023  0.0613      0.49338        0.735
##   47.86     35       1   0.5854  0.0620      0.47570        0.720
##   49.11     34       1   0.5684  0.0625      0.45819        0.705
##   49.60     33       1   0.5514  0.0630      0.44084        0.690
##   50.43     32       1   0.5345  0.0634      0.42367        0.674
##   50.59     31       1   0.5175  0.0636      0.40666        0.659
##   52.86     30       1   0.5005  0.0639      0.38980        0.643
##   57.80     29       1   0.4836  0.0640      0.37311        0.627
##   58.40     28       1   0.4666  0.0640      0.35657        0.611
##   59.07     27       1   0.4496  0.0640      0.34019        0.594
##   59.20     26       1   0.4327  0.0639      0.32397        0.578
##   59.34     25       1   0.4157  0.0637      0.30791        0.561
##   59.53     24       1   0.3987  0.0634      0.29200        0.545
##   63.25     23       1   0.3818  0.0630      0.27625        0.528
##   64.33     22       1   0.3648  0.0626      0.26067        0.511
##   64.86     21       1   0.3479  0.0620      0.24526        0.493
```

```
##    64.93     20       1   0.3309  0.0614       0.23001        0.476
##    65.55     19       1   0.3139  0.0607       0.21494        0.458
##    68.10     18       1   0.2970  0.0598       0.20005        0.441
##    68.70     17       1   0.2800  0.0589       0.18536        0.423
##    69.10     16       1   0.2630  0.0579       0.17085        0.405
##    70.80     15       1   0.2461  0.0568       0.15656        0.387
##    72.09     14       1   0.2291  0.0555       0.14249        0.368
##    74.20     12       1   0.2108  0.0543       0.12726        0.349
##    74.36     11       1   0.1925  0.0528       0.11237        0.330
##    79.13     10       1   0.1742  0.0512       0.09786        0.310
##    84.70      9       1   0.1558  0.0494       0.08375        0.290
##    85.61      8       1   0.1375  0.0473       0.07010        0.270
##    88.99      6       1   0.1164  0.0453       0.05428        0.250
##    89.62      5       1   0.0953  0.0428       0.03953        0.230
##    95.07      4       1   0.0742  0.0396       0.02608        0.211
##    99.51      3       1   0.0532  0.0357       0.01425        0.199
##   105.17      2       1   0.0323  0.0315       0.00477        0.218
##   118.58      1       1   0.0119     Inf       0.00000        1.000
```

```
autoplot(fhsurvival1_adjCTX,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Age

- People older than 80 are collapsing so fast.

- People between 20 and 40 death rate are normal butwith a huge amount of events at each time
- People between 60 and 80 are the strongest group.

Create age groups

```
clinical_data$age_groups <- ifelse(clinical_data$age_diag >= 20 &
                                     clinical_data$age_diag < 40, "20-40",
                                   ifelse(clinical_data$age_diag >= 40 &
                                            clinical_data$age_diag < 60, "40-60",
                                          ifelse(clinical_data$age_diag >= 60 &
                                                   clinical_data$age_diag < 80, "60-80",
                                                 "> 80")))
## Convert it to factor
clinical_data$age_groups <- factor(clinical_data$age_groups)
## Perform the estimations using Kaplan-Meier non-parametric
kmsurvival1_age <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
                             clinical_data$age_groups)
summary(kmsurvival1_age)
```

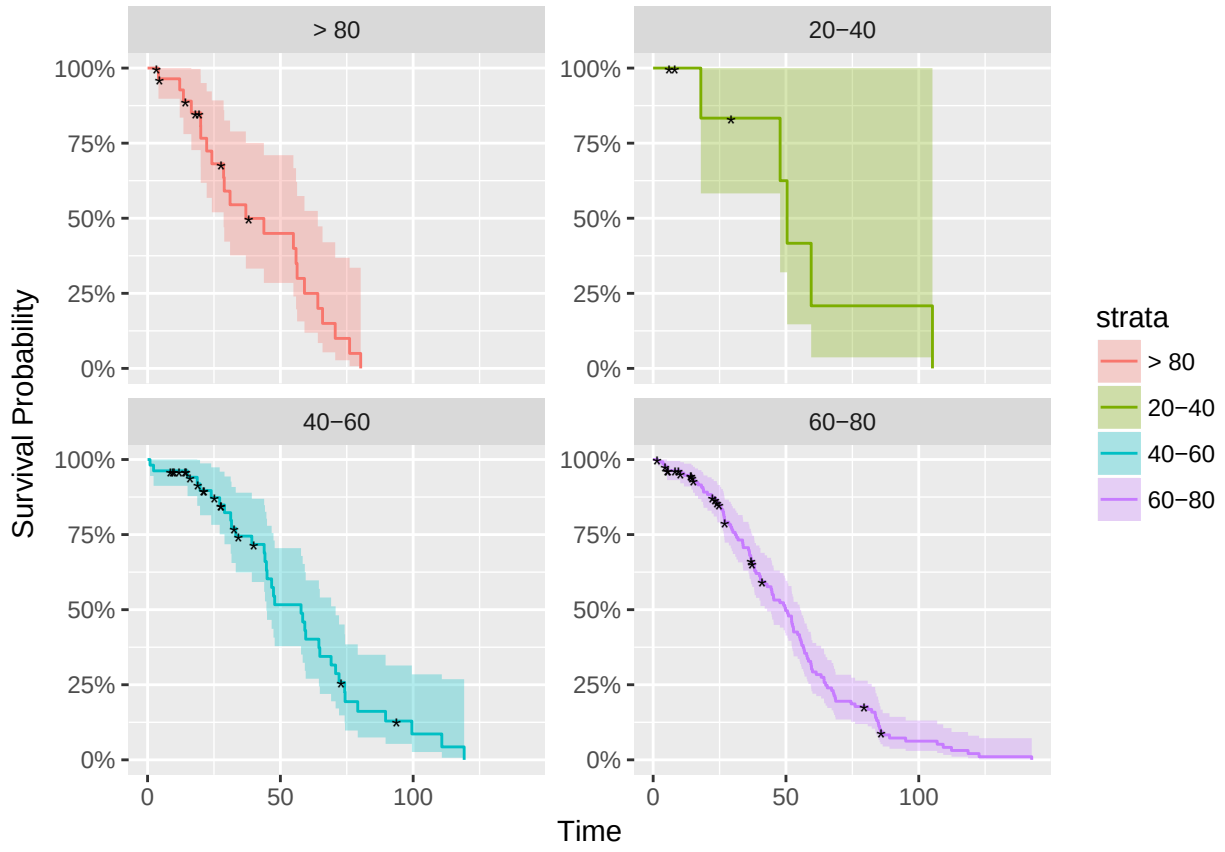
```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$age_groups)
##
##                 clinical_data$age_groups=> 80
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   4.1     28       1   0.9643  0.0351      0.89794        1.000
##  12.1     26       1   0.9272  0.0496      0.83491        1.000
##  13.5     25       1   0.8901  0.0599      0.78013        1.000
##  16.5     23       1   0.8514  0.0687      0.72693        0.997
##  20.0     20       1   0.8088  0.0773      0.67066        0.975
##  20.0     19       1   0.7663  0.0841      0.61788        0.950
##  22.2     18       1   0.7237  0.0896      0.56777        0.922
##  24.2     17       1   0.6811  0.0939      0.51986        0.892
##  28.6     15       1   0.6357  0.0980      0.46994        0.860
##  28.9     14       1   0.5903  0.1010      0.42216        0.825
##  31.1     13       1   0.5449  0.1029      0.37632        0.789
##  37.0     12       1   0.4995  0.1039      0.33229        0.751
##  43.8     10       1   0.4495  0.1048      0.28465        0.710
##  54.9      9       1   0.3996  0.1044      0.23947        0.667
##  55.9      8       1   0.3496  0.1026      0.19672        0.621
##  56.3      7       1   0.2997  0.0994      0.15649        0.574
##  59.1      6       1   0.2497  0.0945      0.11894        0.524
##  64.1      5       1   0.1998  0.0878      0.08441        0.473
##  65.9      4       1   0.1498  0.0788      0.05346        0.420
##  70.7      3       1   0.0999  0.0665      0.02709        0.368
##  76.1      2       1   0.0499  0.0485      0.00744        0.335
##  80.2      1       1   0.0000     NaN           NA           NA
##
##                 clinical_data$age_groups=20-40
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   17.9      6       1    0.833   0.152       0.5827            1
##   47.8      4       1    0.625   0.213       0.3200            1
##   50.4      3       1    0.417   0.222       0.1468            1
##   59.5      2       1    0.208   0.184       0.0368            1
```

```
##  105.2      1       1    0.000     NaN           NA           NA
##
##                clinical_data$age_groups=40-60
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92     53       1   0.9811  0.0187       0.9452        1.000
##    2.26     52       1   0.9623  0.0262       0.9123        1.000
##   15.05     45       1   0.9409  0.0332       0.8780        1.000
##   18.70     43       1   0.9190  0.0390       0.8457        0.999
##   19.75     41       1   0.8966  0.0440       0.8144        0.987
##   23.96     38       1   0.8730  0.0488       0.7825        0.974
##   27.15     36       1   0.8487  0.0531       0.7508        0.959
##   28.96     33       1   0.8230  0.0574       0.7179        0.944
##   31.30     32       1   0.7973  0.0611       0.6861        0.926
##   31.60     31       1   0.7716  0.0643       0.6553        0.908
##   33.20     29       1   0.7450  0.0674       0.6240        0.889
##   39.25     27       1   0.7174  0.0703       0.5920        0.869
##   43.90     25       1   0.6887  0.0731       0.5593        0.848
##   44.20     24       1   0.6600  0.0755       0.5275        0.826
##   44.74     23       1   0.6313  0.0775       0.4964        0.803
##   44.97     22       1   0.6026  0.0791       0.4659        0.779
##   46.71     21       1   0.5739  0.0803       0.4362        0.755
##   47.40     20       1   0.5452  0.0813       0.4071        0.730
##   47.86     19       1   0.5165  0.0819       0.3785        0.705
##   57.79     18       1   0.4878  0.0822       0.3506        0.679
##   58.40     17       1   0.4591  0.0823       0.3232        0.652
##   59.20     16       1   0.4304  0.0820       0.2963        0.625
##   59.53     15       1   0.4017  0.0814       0.2701        0.598
##   64.50     14       1   0.3730  0.0805       0.2444        0.569
##   64.86     13       1   0.3443  0.0792       0.2194        0.541
##   69.10     12       1   0.3156  0.0776       0.1949        0.511
##   70.80     11       1   0.2870  0.0757       0.1711        0.481
##   72.09     10       1   0.2583  0.0734       0.1480        0.451
##   74.20      8       1   0.2260  0.0709       0.1221        0.418
##   74.36      7       1   0.1937  0.0678       0.0976        0.384
##   79.13      6       1   0.1614  0.0637       0.0745        0.350
##   89.62      5       1   0.1291  0.0586       0.0531        0.314
##   99.51      3       1   0.0861  0.0525       0.0260        0.285
##  110.79      2       1   0.0430  0.0402       0.0069        0.268
##  119.21      1       1   0.0000     NaN           NA           NA
##
##                clinical_data$age_groups=60-80
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    1.80    135       1   0.9926 0.00738      0.97823       1.0000
##    3.64    134       1   0.9852 0.01040      0.96502       1.0000
##    4.24    133       1   0.9778 0.01269      0.95323       1.0000
##    5.20    131       1   0.9703 0.01462      0.94208       0.9994
##    5.22    130       1   0.9628 0.01630      0.93142       0.9953
##   10.20    125       1   0.9551 0.01790      0.92070       0.9909
##   11.60    123       1   0.9474 0.01937      0.91018       0.9861
##   14.40    120       1   0.9395 0.02075      0.89968       0.9811
##   15.00    118       1   0.9315 0.02205      0.88929       0.9758
##   15.71    116       1   0.9235 0.02328      0.87898       0.9703
##   16.90    115       1   0.9155 0.02442      0.86883       0.9646
##   18.18    114       1   0.9074 0.02549      0.85882       0.9588
```

```
##   18.80    113       1   0.8994 0.02650      0.84893       0.9529
##   18.96    112       1   0.8914 0.02745      0.83916       0.9468
##   20.44    111       1   0.8833 0.02836      0.82948       0.9407
##   22.02    110       1   0.8753 0.02921      0.81989       0.9345
##   22.80    107       1   0.8671 0.03006      0.81016       0.9281
##   24.00    105       1   0.8589 0.03089      0.80041       0.9216
##   24.19    103       1   0.8505 0.03170      0.79062       0.9150
##   25.24    101       1   0.8421 0.03248      0.78080       0.9082
##   25.61    100       1   0.8337 0.03323      0.77104       0.9014
##   26.26     99       1   0.8253 0.03395      0.76135       0.8946
##   26.53     98       1   0.8169 0.03463      0.75172       0.8876
##   26.66     97       1   0.8084 0.03528      0.74216       0.8806
##   26.82     96       1   0.8000 0.03590      0.73264       0.8736
##   26.92     95       1   0.7916 0.03650      0.72318       0.8665
##   28.50     93       1   0.7831 0.03709      0.71366       0.8592
##   29.22     92       1   0.7746 0.03765      0.70418       0.8520
##   29.60     91       1   0.7661 0.03818      0.69475       0.8447
##   30.00     90       1   0.7575 0.03870      0.68537       0.8373
##   30.90     89       1   0.7490 0.03919      0.67603       0.8299
##   31.36     88       1   0.7405 0.03966      0.66673       0.8225
##   31.92     87       1   0.7320 0.04010      0.65748       0.8150
##   33.69     86       1   0.7235 0.04053      0.64826       0.8075
##   33.80     85       1   0.7150 0.04094      0.63908       0.7999
##   33.90     84       1   0.7065 0.04133      0.62994       0.7923
##   35.90     83       1   0.6980 0.04169      0.62084       0.7847
##   36.20     82       1   0.6894 0.04205      0.61177       0.7770
##   36.30     81       1   0.6809 0.04238      0.60274       0.7693
##   36.75     80       1   0.6724 0.04270      0.59374       0.7615
##   36.92     79       1   0.6639 0.04300      0.58477       0.7538
##   37.31     77       1   0.6553 0.04329      0.57570       0.7459
##   38.00     75       1   0.6466 0.04359      0.56652       0.7379
##   38.07     74       1   0.6378 0.04387      0.55738       0.7299
##   38.20     73       1   0.6291 0.04413      0.54827       0.7218
##   38.72     72       1   0.6203 0.04437      0.53920       0.7137
##   40.00     71       1   0.6116 0.04460      0.53015       0.7056
##   40.40     70       2   0.5941 0.04500      0.51216       0.6892
##   42.00     67       1   0.5853 0.04520      0.50306       0.6809
##   42.90     66       1   0.5764 0.04537      0.49398       0.6726
##   44.40     65       1   0.5675 0.04553      0.48495       0.6642
##   44.67     64       1   0.5587 0.04568      0.47594       0.6558
##   44.80     63       1   0.5498 0.04580      0.46696       0.6473
##   45.30     62       1   0.5409 0.04592      0.45802       0.6388
##   45.40     61       1   0.5321 0.04601      0.44910       0.6303
##   47.70     60       1   0.5232 0.04609      0.44022       0.6218
##   49.11     59       1   0.5143 0.04616      0.43137       0.6132
##   49.60     58       1   0.5055 0.04620      0.42254       0.6046
##   49.84     57       1   0.4966 0.04624      0.41375       0.5960
##   50.59     56       1   0.4877 0.04625      0.40499       0.5873
##   50.90     55       1   0.4789 0.04625      0.39626       0.5787
##   52.10     54       1   0.4700 0.04624      0.38756       0.5699
##   52.14     53       1   0.4611 0.04621      0.37888       0.5612
##   52.24     52       1   0.4522 0.04616      0.37024       0.5524
##   52.50     51       1   0.4434 0.04610      0.36163       0.5436
##   52.80     50       1   0.4345 0.04603      0.35305       0.5348
```

```
##   52.86     49       1   0.4256 0.04593      0.34450       0.5259
##   54.40     48       1   0.4168 0.04582      0.33598       0.5170
##   55.13     47       1   0.4079 0.04570      0.32749       0.5081
##   55.33     46       1   0.3990 0.04556      0.31904       0.4991
##   55.70     45       1   0.3902 0.04540      0.31061       0.4901
##   55.92     44       1   0.3813 0.04523      0.30221       0.4811
##   56.50     43       1   0.3724 0.04504      0.29385       0.4720
##   56.80     42       1   0.3636 0.04483      0.28552       0.4630
##   57.00     41       1   0.3547 0.04460      0.27722       0.4538
##   57.80     40       1   0.3458 0.04436      0.26896       0.4447
##   58.02     39       1   0.3370 0.04410      0.26073       0.4355
##   58.45     38       1   0.3281 0.04382      0.25253       0.4263
##   59.34     37       1   0.3192 0.04353      0.24437       0.4170
##   59.50     36       1   0.3104 0.04321      0.23625       0.4077
##   59.60     35       1   0.3015 0.04288      0.22816       0.3984
##   59.96     34       1   0.2926 0.04252      0.22011       0.3891
##   61.40     33       1   0.2838 0.04215      0.21209       0.3797
##   63.25     32       1   0.2749 0.04175      0.20412       0.3702
##   64.33     31       1   0.2660 0.04134      0.19618       0.3607
##   64.37     30       1   0.2572 0.04090      0.18829       0.3512
##   64.93     29       1   0.2483 0.04044      0.18044       0.3417
##   65.55     28       1   0.2394 0.03996      0.17263       0.3321
##   67.19     27       1   0.2306 0.03945      0.16487       0.3224
##   67.82     26       1   0.2217 0.03891      0.15716       0.3127
##   68.10     25       1   0.2128 0.03835      0.14949       0.3030
##   68.51     24       1   0.2040 0.03777      0.14188       0.2932
##   68.70     23       1   0.1951 0.03715      0.13432       0.2834
##   74.53     22       1   0.1862 0.03651      0.12681       0.2735
##   76.04     21       1   0.1774 0.03583      0.11936       0.2635
##   80.80     19       1   0.1680 0.03514      0.11152       0.2531
##   82.29     18       1   0.1587 0.03440      0.10375       0.2427
##   83.60     17       1   0.1493 0.03362      0.09607       0.2322
##   83.73     16       1   0.1400 0.03279      0.08848       0.2216
##   84.13     15       1   0.1307 0.03191      0.08098       0.2109
##   84.70     14       1   0.1213 0.03096      0.07359       0.2001
##   84.90     13       1   0.1120 0.02995      0.06632       0.1892
##   85.28     12       1   0.1027 0.02888      0.05917       0.1782
##   85.61     11       1   0.0933 0.02772      0.05216       0.1671
##   86.43      9       1   0.0830 0.02651      0.04436       0.1552
##   88.99      8       1   0.0726 0.02514      0.03683       0.1431
##   95.07      7       1   0.0622 0.02359      0.02960       0.1308
##  106.94      6       1   0.0519 0.02182      0.02273       0.1183
##  109.21      5       1   0.0415 0.01977      0.01630       0.1056
##  112.33      4       1   0.0311 0.01734      0.01044       0.0927
##  118.58      3       1   0.0207 0.01433      0.00536       0.0803
##  122.72      2       1   0.0104 0.01025      0.00149       0.0720
##  142.55      1       1   0.0000     NaN           NA           NA
```

```
autoplot(kmsurvival1_age,
         censor.shape = '*', facets = TRUE, ncol = 2,xlab="Time",
         ylab="Survival Probability")
```



Fleming-Harrington non-parametric analysis

```
fhsurvival1_age <- survfit(Surv(clinical_data$dfs_time, clinical_data$dfs_event)
                           ~ clinical_data$age_groups, type="fleming-harrington")
summary(fhsurvival1_age)
```

```
## Call: survfit(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     clinical_data$age_groups, type = "fleming-harrington")
##
##                 clinical_data$age_groups=> 80
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   4.1     28       1   0.9649  0.0351       0.8985        1.000
##  12.1     26       1   0.9285  0.0497       0.8361        1.000
##  13.5     25       1   0.8921  0.0600       0.7819        1.000
##  16.5     23       1   0.8541  0.0689       0.7293        1.000
##  20.0     20       1   0.8125  0.0777       0.6737        0.980
##  20.0     19       1   0.7708  0.0847       0.6216        0.956
##  22.2     18       1   0.7292  0.0903       0.5721        0.929
##  24.2     17       1   0.6875  0.0948       0.5247        0.901
##  28.6     15       1   0.6432  0.0992       0.4755        0.870
##  28.9     14       1   0.5988  0.1024       0.4283        0.837
##  31.1     13       1   0.5545  0.1047       0.3829        0.803
##  37.0     12       1   0.5102  0.1061       0.3394        0.767
##  43.8     10       1   0.4616  0.1076       0.2923        0.729
##  54.9      9       1   0.4131  0.1079       0.2475        0.689
```

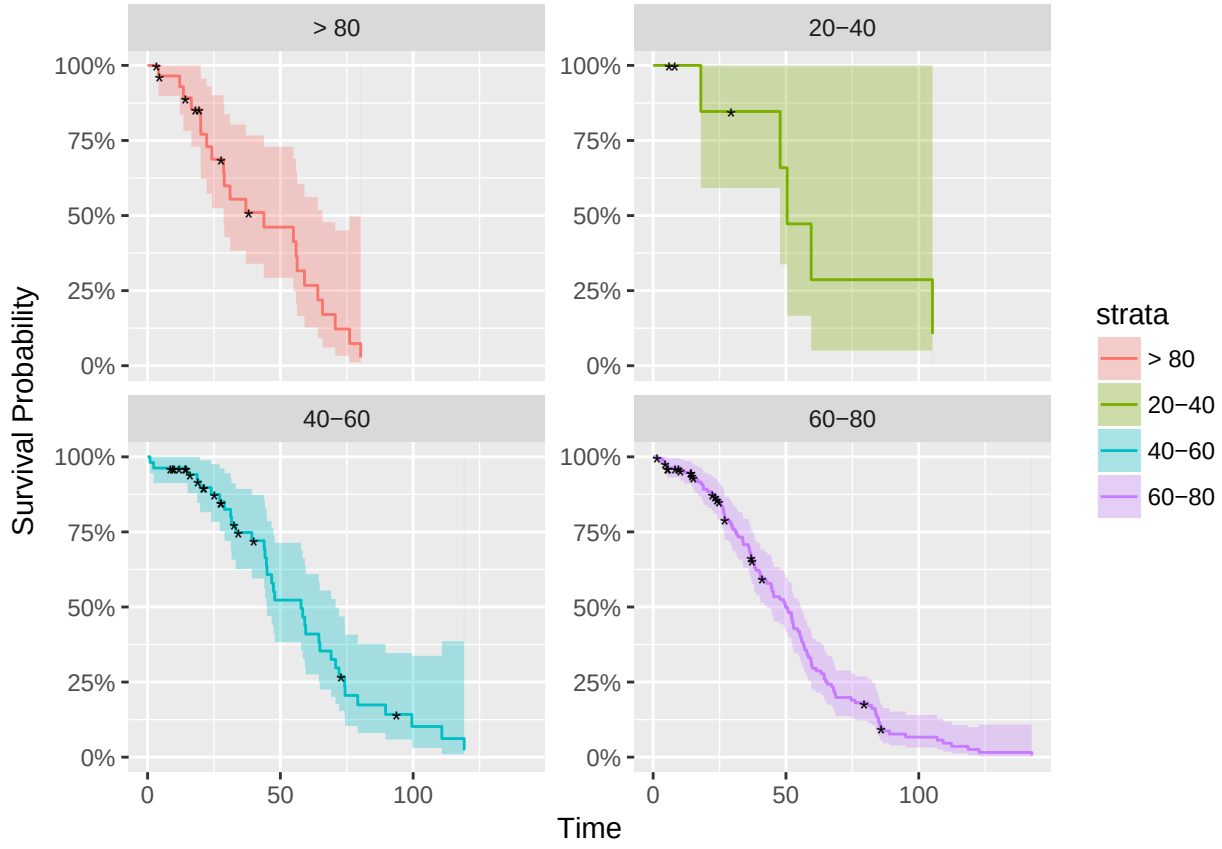
```
##  55.9      8       1   0.3645  0.1070       0.2051        0.648
##  56.3      7       1   0.3160  0.1048       0.1650        0.605
##  59.1      6       1   0.2675  0.1012       0.1274        0.562
##  64.1      5       1   0.2190  0.0963       0.0925        0.518
##  65.9      4       1   0.1706  0.0897       0.0608        0.478
##  70.7      3       1   0.1222  0.0814       0.0331        0.451
##  76.1      2       1   0.0741  0.0720       0.0110        0.497
##  80.2      1       1   0.0273     Inf       0.0000        1.000
##
##                clinical_data$age_groups=20-40
##   time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   17.9      6       1    0.846   0.155       0.5918            1
##   47.8      4       1    0.659   0.225       0.3375            1
##   50.4      3       1    0.472   0.251       0.1664            1
##   59.5      2       1    0.287   0.254       0.0506            1
##  105.2      1       1    0.105     Inf       0.0000            1
##
##                clinical_data$age_groups=40-60
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    0.92     53       1   0.9813  0.0187      0.94535        1.000
##    2.26     52       1   0.9626  0.0262      0.91264        1.000
##   15.05     45       1   0.9415  0.0332      0.87856        1.000
##   18.70     43       1   0.9198  0.0390      0.84645        1.000
##   19.75     41       1   0.8977  0.0441      0.81534        0.988
##   23.96     38       1   0.8743  0.0488      0.78368        0.975
##   27.15     36       1   0.8504  0.0532      0.75226        0.961
##   28.96     33       1   0.8250  0.0575      0.71964        0.946
##   31.30     32       1   0.7996  0.0613      0.68814        0.929
##   31.60     31       1   0.7742  0.0645      0.65758        0.912
##   33.20     29       1   0.7480  0.0676      0.62652        0.893
##   39.25     27       1   0.7208  0.0706      0.59486        0.873
##   43.90     25       1   0.6925  0.0735      0.56246        0.853
##   44.20     24       1   0.6643  0.0760      0.53089        0.831
##   44.74     23       1   0.6360  0.0780      0.50007        0.809
##   44.97     22       1   0.6078  0.0797      0.46993        0.786
##   46.71     21       1   0.5795  0.0811      0.44043        0.762
##   47.40     20       1   0.5512  0.0822      0.41154        0.738
##   47.86     19       1   0.5230  0.0829      0.38324        0.714
##   57.79     18       1   0.4947  0.0834      0.35550        0.688
##   58.40     17       1   0.4664  0.0836      0.32832        0.663
##   59.20     16       1   0.4382  0.0834      0.30169        0.636
##   59.53     15       1   0.4099  0.0830      0.27561        0.610
##   64.50     14       1   0.3817  0.0823      0.25008        0.582
##   64.86     13       1   0.3534  0.0813      0.22513        0.555
##   69.10     12       1   0.3251  0.0800      0.20077        0.527
##   70.80     11       1   0.2969  0.0783      0.17703        0.498
##   72.09     10       1   0.2686  0.0763      0.15394        0.469
##   74.20      8       1   0.2371  0.0744      0.12813        0.439
##   74.36      7       1   0.2055  0.0719      0.10353        0.408
##   79.13      6       1   0.1740  0.0686      0.08027        0.377
##   89.62      5       1   0.1424  0.0646      0.05855        0.346
##   99.51      3       1   0.1021  0.0623      0.03086        0.337
##  110.79      2       1   0.0619  0.0578      0.00992        0.386
##  119.21      1       1   0.0228     Inf      0.00000        1.000
```

```
##
##                clinical_data$age_groups=60-80
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    1.80    135       1  0.99262 0.00738      0.97826       1.0000
##    3.64    134       1  0.98524 0.01040      0.96507       1.0000
##    4.24    133       1  0.97786 0.01269      0.95331       1.0000
##    5.20    131       1  0.97042 0.01462      0.94218       0.9995
##    5.22    130       1  0.96299 0.01631      0.93155       0.9955
##   10.20    125       1  0.95531 0.01790      0.92086       0.9911
##   11.60    123       1  0.94758 0.01937      0.91037       0.9863
##   14.40    120       1  0.93972 0.02076      0.89990       0.9813
##   15.00    118       1  0.93179 0.02206      0.88954       0.9760
##   15.71    116       1  0.92379 0.02328      0.87926       0.9706
##   16.90    115       1  0.91579 0.02443      0.86914       0.9649
##   18.18    114       1  0.90779 0.02550      0.85916       0.9592
##   18.80    113       1  0.89979 0.02651      0.84930       0.9533
##   18.96    112       1  0.89179 0.02747      0.83955       0.9473
##   20.44    111       1  0.88380 0.02837      0.82990       0.9412
##   22.02    110       1  0.87580 0.02923      0.82034       0.9350
##   22.80    107       1  0.86765 0.03008      0.81065       0.9287
##   24.00    105       1  0.85943 0.03091      0.80093       0.9222
##   24.19    103       1  0.85112 0.03172      0.79117       0.9156
##   25.24    101       1  0.84274 0.03251      0.78137       0.9089
##   25.61    100       1  0.83435 0.03326      0.77165       0.9022
##   26.26     99       1  0.82597 0.03397      0.76199       0.8953
##   26.53     98       1  0.81758 0.03466      0.75240       0.8884
##   26.66     97       1  0.80920 0.03531      0.74286       0.8815
##   26.82     96       1  0.80081 0.03594      0.73338       0.8744
##   26.92     95       1  0.79243 0.03654      0.72395       0.8674
##   28.50     93       1  0.78395 0.03713      0.71446       0.8602
##   29.22     92       1  0.77548 0.03769      0.70501       0.8530
##   29.60     91       1  0.76700 0.03823      0.69561       0.8457
##   30.00     90       1  0.75853 0.03875      0.68626       0.8384
##   30.90     89       1  0.75005 0.03924      0.67695       0.8310
##   31.36     88       1  0.74158 0.03971      0.66769       0.8236
##   31.92     87       1  0.73310 0.04016      0.65846       0.8162
##   33.69     86       1  0.72463 0.04059      0.64928       0.8087
##   33.80     85       1  0.71615 0.04100      0.64013       0.8012
##   33.90     84       1  0.70768 0.04140      0.63102       0.7936
##   35.90     83       1  0.69920 0.04177      0.62195       0.7861
##   36.20     82       1  0.69073 0.04212      0.61291       0.7784
##   36.30     81       1  0.68225 0.04246      0.60390       0.7708
##   36.75     80       1  0.67378 0.04278      0.59493       0.7631
##   36.92     79       1  0.66530 0.04309      0.58599       0.7553
##   37.31     77       1  0.65672 0.04339      0.57695       0.7475
##   38.00     75       1  0.64802 0.04369      0.56781       0.7396
##   38.07     74       1  0.63932 0.04397      0.55870       0.7316
##   38.20     73       1  0.63062 0.04424      0.54962       0.7236
##   38.72     72       1  0.62192 0.04448      0.54057       0.7155
##   40.00     71       1  0.61323 0.04472      0.53156       0.7074
##   40.40     70       2  0.59595 0.04514      0.51373       0.6913
##   42.00     67       1  0.58712 0.04534      0.50466       0.6831
##   42.90     66       1  0.57830 0.04552      0.49561       0.6748
##   44.40     65       1  0.56947 0.04569      0.48660       0.6664
```

```
##   44.67     64       1  0.56064 0.04584      0.47762       0.6581
##   44.80     63       1  0.55181 0.04597      0.46868       0.6497
##   45.30     62       1  0.54298 0.04609      0.45976       0.6413
##   45.40     61       1  0.53415 0.04619      0.45087       0.6328
##   47.70     60       1  0.52532 0.04628      0.44202       0.6243
##   49.11     59       1  0.51649 0.04635      0.43319       0.6158
##   49.60     58       1  0.50767 0.04641      0.42439       0.6073
##   49.84     57       1  0.49884 0.04645      0.41563       0.5987
##   50.59     56       1  0.49001 0.04647      0.40689       0.5901
##   50.90     55       1  0.48118 0.04648      0.39819       0.5815
##   52.10     54       1  0.47235 0.04647      0.38951       0.5728
##   52.14     53       1  0.46352 0.04645      0.38086       0.5641
##   52.24     52       1  0.45469 0.04641      0.37225       0.5554
##   52.50     51       1  0.44586 0.04636      0.36366       0.5467
##   52.80     50       1  0.43704 0.04629      0.35510       0.5379
##   52.86     49       1  0.42821 0.04621      0.34657       0.5291
##   54.40     48       1  0.41938 0.04611      0.33808       0.5202
##   55.13     47       1  0.41055 0.04599      0.32961       0.5114
##   55.33     46       1  0.40172 0.04586      0.32118       0.5025
##   55.70     45       1  0.39289 0.04572      0.31277       0.4935
##   55.92     44       1  0.38406 0.04555      0.30440       0.4846
##   56.50     43       1  0.37523 0.04537      0.29606       0.4756
##   56.80     42       1  0.36641 0.04518      0.28775       0.4666
##   57.00     41       1  0.35758 0.04496      0.27947       0.4575
##   57.80     40       1  0.34875 0.04473      0.27122       0.4484
##   58.02     39       1  0.33992 0.04449      0.26301       0.4393
##   58.45     38       1  0.33109 0.04422      0.25484       0.4302
##   59.34     37       1  0.32226 0.04394      0.24669       0.4210
##   59.50     36       1  0.31343 0.04364      0.23858       0.4118
##   59.60     35       1  0.30461 0.04332      0.23051       0.4025
##   59.96     34       1  0.29578 0.04298      0.22247       0.3932
##   61.40     33       1  0.28695 0.04262      0.21447       0.3839
##   63.25     32       1  0.27812 0.04224      0.20651       0.3746
##   64.33     31       1  0.26929 0.04184      0.19859       0.3652
##   64.37     30       1  0.26046 0.04143      0.19071       0.3557
##   64.93     29       1  0.25164 0.04098      0.18287       0.3463
##   65.55     28       1  0.24281 0.04052      0.17507       0.3368
##   67.19     27       1  0.23398 0.04003      0.16732       0.3272
##   67.82     26       1  0.22515 0.03952      0.15961       0.3176
##   68.10     25       1  0.21632 0.03899      0.15195       0.3080
##   68.51     24       1  0.20749 0.03842      0.14434       0.2983
##   68.70     23       1  0.19867 0.03783      0.13678       0.2886
##   74.53     22       1  0.18984 0.03722      0.12927       0.2788
##   76.04     21       1  0.18101 0.03657      0.12183       0.2689
##   80.80     19       1  0.17173 0.03591      0.11398       0.2587
##   82.29     18       1  0.16245 0.03522      0.10621       0.2485
##   83.60     17       1  0.15317 0.03448      0.09852       0.2381
##   83.73     16       1  0.14389 0.03370      0.09092       0.2277
##   84.13     15       1  0.13461 0.03286      0.08342       0.2172
##   84.70     14       1  0.12533 0.03198      0.07601       0.2067
##   84.90     13       1  0.11605 0.03103      0.06871       0.1960
##   85.28     12       1  0.10677 0.03003      0.06153       0.1853
##   85.61     11       1  0.09749 0.02895      0.05448       0.1745
##   86.43      9       1  0.08724 0.02787      0.04664       0.1632
```

```
##   88.99      8       1  0.07699 0.02666       0.03905       0.1518
##   95.07      7       1  0.06674 0.02530       0.03175       0.1403
##  106.94      6       1  0.05649 0.02377       0.02476       0.1289
##  109.21      5       1  0.04625 0.02204       0.01818       0.1177
##  112.33      4       1  0.03602 0.02007       0.01209       0.1074
##  118.58      3       1  0.02581 0.01783       0.00667       0.0999
##  122.72      2       1  0.01566 0.01547       0.00226       0.1087
##  142.55      1       1  0.00576     Inf       0.00000       1.0000
```

```
autoplot(fhsurival1_age,
         censor.shape = '*', facets = TRUE, ncol = 2, xlab="Time",
         ylab="Survival Probability")
```



Semi-Parameter Analysis

Cox proportional hazard model - coefficients and hazard rates

First we need to create a factor of the parameter to be used in **semi_paramteric** and **parametric** analysis

```
factors <- cbind(clinical_data$location, clinical_data$dukes_stage,
                 clinical_data$age_diag,
                 clinical_data$gender, clinical_data$adjXRT, clinical_data$adjCTX)
coxph <- coxph(Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
                 factors, method="breslow")
summary(coxph)
```

```
## Call:
## coxph(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     factors, method = "breslow")
##
##   n= 226, number of events= 176
##
##               coef exp(coef)  se(coef)      z Pr(>|z|)
## factors1  0.032699  1.033239  0.085067  0.384   0.7007
## factors2  0.145615  1.156750  0.122390  1.190   0.2341
## factors3  0.013573  1.013666  0.006898  1.968   0.0491 *
## factors4 -0.114084  0.892183  0.153394 -0.744   0.4570
## factors5 -0.783852  0.456643  0.399812 -1.961   0.0499 *
## factors6 -0.077501  0.925426  0.213092 -0.364   0.7161
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##          exp(coef) exp(-coef) lower .95 upper .95
## factors1    1.0332     0.9678    0.8746    1.2207
## factors2    1.1568     0.8645    0.9100    1.4703
## factors3    1.0137     0.9865    1.0001    1.0275
## factors4    0.8922     1.1208    0.6605    1.2051
## factors5    0.4566     2.1899    0.2086    0.9998
## factors6    0.9254     1.0806    0.6095    1.4052
##
## Concordance= 0.58  (se = 0.026 )
## Rsquare= 0.059   (max possible= 0.999 )
## Likelihood ratio test= 13.83  on 6 df,   p=0.03164
## Wald test            = 12.14  on 6 df,   p=0.05897
## Score (logrank) test = 12.48  on 6 df,   p=0.05211
```

Paramteric

Exponential

```
exponential <- survreg(Surv(clinical_data$dfs_time,clinical_data$dfs_event)
                       ~ factors, dist="exponential")
summary(exponential)
```

```
##
## Call:
## survreg(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     factors, dist = "exponential")
##                 Value Std. Error       z        p
## (Intercept)  3.891455    0.76409  5.0929 3.53e-07
## factors1    -0.041423    0.08207 -0.5047 6.14e-01
## factors2     0.000229    0.12088  0.0019 9.98e-01
## factors3    -0.008022    0.00665 -1.2060 2.28e-01
## factors4     0.050161    0.15278  0.3283 7.43e-01
## factors5     0.652034    0.38759  1.6823 9.25e-02
## factors6     0.016175    0.20925  0.0773 9.38e-01
##
## Scale fixed at 1
```

```
##
## Exponential distribution
## Loglik(model)= -880.1   Loglik(intercept only)= -884.1
##  Chisq= 7.89 on 6 degrees of freedom, p= 0.25
## Number of Newton-Raphson Iterations: 4
## n= 226
```

Weibull

```
weibull <- survreg(Surv(clinical_data$dfs_time,clinical_data$dfs_event)
                   ~ factors, dist="weibull")
summary(weibull)
```

```
##
## Call:
## survreg(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     factors, dist = "weibull")
##                Value Std. Error       z        p
## (Intercept)  4.17311    0.38770  10.764 5.11e-27
## factors1    -0.01608    0.04321  -0.372 7.10e-01
## factors2    -0.07165    0.06158  -1.163 2.45e-01
## factors3    -0.00696    0.00348  -2.002 4.52e-02
## factors4     0.05396    0.07805   0.691 4.89e-01
## factors5     0.40205    0.20276   1.983 4.74e-02
## factors6     0.02840    0.10839   0.262 7.93e-01
## Log(scale)  -0.66881    0.05806 -11.518 1.06e-30
##
## Scale= 0.512
##
## Weibull distribution
## Loglik(model)= -831.5   Loglik(intercept only)= -838.4
##  Chisq= 13.77 on 6 degrees of freedom, p= 0.032
## Number of Newton-Raphson Iterations: 7
## n= 226
```

log-logistic

```
loglogistic <- survreg(Surv(clinical_data$dfs_time,clinical_data$dfs_event)
                       ~ factors, dist="loglogistic")
summary(loglogistic)
```

```
##
## Call:
## survreg(formula = Surv(clinical_data$dfs_time, clinical_data$dfs_event) ~
##     factors, dist = "loglogistic")
##                Value Std. Error       z        p
## (Intercept)  4.02692    0.49261   8.175 2.97e-16
## factors1    -0.06100    0.04870  -1.252 2.10e-01
## factors2    -0.07700    0.07900  -0.975 3.30e-01
## factors3    -0.00602    0.00412  -1.462 1.44e-01
## factors4     0.02548    0.09615   0.265 7.91e-01
## factors5     0.33845    0.22291   1.518 1.29e-01
```

```
## factors6     0.12132    0.12874   0.942 3.46e-01
## Log(scale)  -0.97595    0.06254 -15.605 6.74e-55
##
## Scale= 0.377
##
## Log logistic distribution
## Loglik(model)= -847.1   Loglik(intercept only)= -853.2
##  Chisq= 12.07 on 6 degrees of freedom, p= 0.06
## Number of Newton-Raphson Iterations: 4
## n= 226
```

Comparison between those methods

```
plot(kmsurvival_month)
curve(plnorm(x, coef(weibull)[1], weibull$scale, lower.tail=FALSE),
      from=0, to=140, col="blue", ylim=c(0,1), lwd=2, add=T, lty=5, xlab="", ylab="")
curve(plnorm(x, coef(loglogistic)[1], loglogistic$scale, lower.tail=FALSE),
      from=0, to=140, col="green", ylim=c(0,1), lwd=2, add=T, lty=5, xlab="", ylab="")
curve(plnorm(x, coef(exponential)[1], exponential$scale, lower.tail=FALSE),
      from=0, to=140, col="red", ylim=c(0,1), lwd=2, add=T, lty=5, xlab="", ylab="")
legend('topright',c("None-Parametric", "weibull", "log", "exponential"),
       col=c("black", "blue", "green", "red"), lty=c(1,1), lwd=c(5,5), cex=1.2,
       inset=c(.05,0), bty="n")
title(main="Parametric methods vs. Non Parametric",
        ylab = "Percent of Surviving Patients", xlab="Time")
```