Non And Semi Parametric Survival Analysis

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Contents

Prepare folder and file

```
setwd("E:/Epi_Stat_Matters/LectureNotes2015/Survival-Analysis/survival-analysis-DrPH-epid-2015/Practical
list.files()
```

```
## [1] "addicts.dta"
## [2] "NonAndSemipara.pdf"
## [3] "NonAndSemipara.Rmd"
## [4] "NonAndSemiParametricSurvivalAnalysis.Rproj"
```

Read data

```
library(foreign)
data1<-read.dta('addicts.dta',convert.factors = T)
```

Load library survival

```
library(survival)
```

Declare file as a survival data format

```
datas<-Surv(time=data1$survt,event=data1$status==1)
summary(datas)
```

```
##       time            status
##  Min.   :   2.0   Min.   :0.0000
##  1st Qu.: 171.2   1st Qu.:0.0000
##  Median : 367.5   Median :1.0000
##  Mean   : 402.6   Mean   :0.6303
##  3rd Qu.: 585.5   3rd Qu.:1.0000
##  Max.   :1076.0   Max.   :1.0000
```

```
head(datas,50)
```

```
##  [1] 428  275  262  183  259  714  438  796+ 892  393  161+ 836  523  612
## [15] 212  399  771  514  512  624  209  341  299  826+ 262  566+ 368  302
## [29] 602+ 652  293  564+ 394  755  591  787+ 739  550  837  612  581+ 523
## [43] 504  785  774  560  160  482  518  683
```

```
head(data1,50)
```

```
##    id clinic status survt prison dose
## 1   1      1      1   428      0   50
## 2   2      1      1   275      1   55
## 3   3      1      1   262      0   55
## 4   4      1      1   183      0   30
## 5   5      1      1   259      1   65
## 6   6      1      1   714      0   55
## 7   7      1      1   438      1   65
## 8   8      1      0   796      1   60
## 9   9      1      1   892      0   50
## 10 10      1      1   393      1   65
## 11 11      1      0   161      1   80
## 12 12      1      1   836      1   60
## 13 13      1      1   523      0   55
## 14 14      1      1   612      0   70
## 15 15      1      1   212      1   60
## 16 16      1      1   399      1   60
## 17 17      1      1   771      1   75
## 18 18      1      1   514      1   80
## 19 19      1      1   512      0   80
## 20 21      1      1   624      1   80
## 21 22      1      1   209      1   60
## 22 23      1      1   341      1   60
## 23 24      1      1   299      0   55
## 24 25      1      0   826      0   80
## 25 26      1      1   262      1   65
## 26 27      1      0   566      1   45
```

```
## 27 28      1      1   368      1   55
## 28 30      1      1   302      1   50
## 29 31      1      0   602      0   60
## 30 32      1      1   652      0   80
## 31 33      1      1   293      0   65
## 32 34      1      0   564      0   60
## 33 36      1      1   394      1   55
## 34 37      1      1   755      1   65
## 35 38      1      1   591      0   55
## 36 39      1      0   787      0   80
## 37 40      1      1   739      0   60
## 38 41      1      1   550      1   60
## 39 42      1      1   837      0   60
## 40 43      1      1   612      0   65
## 41 44      1      0   581      0   70
## 42 45      1      1   523      0   60
## 43 46      1      1   504      1   60
## 44 48      1      1   785      1   80
## 45 49      1      1   774      1   65
## 46 50      1      1   560      0   65
## 47 51      1      1   160      0   35
## 48 52      1      1   482      0   30
## 49 53      1      1   518      0   65
## 50 54      1      1   683      0   50
```

- sign is for censored observation

Estimate crude (unadjusted) survival functions for all

Using intercept-only model to obtain Kaplan-Meier survival estimates for all event times. And also for a specific time.

```
surv.fit<-survfit(datas~1)
summary(surv.fit)
```

```
## Call: survfit(formula = datas ~ 1)
##
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##     7    236       1    0.996 0.00423       0.9875        1.000
##    13    235       1    0.992 0.00597       0.9799        1.000
##    17    234       1    0.987 0.00729       0.9731        1.000
##    19    233       1    0.983 0.00840       0.9667        1.000
##    26    232       1    0.979 0.00937       0.9606        0.997
##    29    229       1    0.975 0.01026       0.9546        0.995
##    30    228       1    0.970 0.01107       0.9488        0.992
##    33    227       1    0.966 0.01182       0.9431        0.989
##    35    226       2    0.957 0.01317       0.9320        0.984
##    37    224       1    0.953 0.01379       0.9265        0.981
##    41    223       2    0.945 0.01493       0.9158        0.974
##    47    221       1    0.940 0.01546       0.9105        0.971
##    49    220       1    0.936 0.01597       0.9053        0.968
##    50    219       1    0.932 0.01646       0.9001        0.965
##    59    216       1    0.927 0.01694       0.8949        0.961
##    62    215       1    0.923 0.01740       0.8897        0.958
```

```
##    67    213       1    0.919 0.01785       0.8845       0.954
##    75    211       1    0.914 0.01829       0.8793       0.951
##    79    210       1    0.910 0.01871       0.8742       0.948
##    84    209       1    0.906 0.01913       0.8691       0.944
##    90    207       1    0.901 0.01953       0.8639       0.940
##    95    206       1    0.897 0.01992       0.8588       0.937
##    96    205       1    0.893 0.02029       0.8537       0.933
##   109    202       1    0.888 0.02067       0.8486       0.930
##   117    200       1    0.884 0.02104       0.8435       0.926
##   122    199       1    0.879 0.02140       0.8384       0.922
##   126    198       1    0.875 0.02174       0.8333       0.919
##   127    197       1    0.870 0.02208       0.8282       0.915
##   129    196       1    0.866 0.02241       0.8232       0.911
##   136    194       1    0.862 0.02274       0.8181       0.907
##   143    193       1    0.857 0.02305       0.8131       0.903
##   145    192       1    0.853 0.02336       0.8080       0.900
##   147    190       1    0.848 0.02366       0.8030       0.896
##   149    188       1    0.844 0.02396       0.7979       0.892
##   150    187       1    0.839 0.02426       0.7929       0.888
##   157    185       1    0.835 0.02455       0.7878       0.884
##   160    184       1    0.830 0.02483       0.7828       0.880
##   161    183       1    0.826 0.02510       0.7777       0.876
##   167    181       1    0.821 0.02538       0.7727       0.872
##   168    180       1    0.816 0.02564       0.7676       0.868
##   170    179       1    0.812 0.02590       0.7626       0.864
##   175    178       1    0.807 0.02615       0.7576       0.860
##   176    176       1    0.803 0.02640       0.7526       0.856
##   180    175       2    0.794 0.02689       0.7425       0.848
##   181    173       1    0.789 0.02712       0.7375       0.844
##   183    172       1    0.784 0.02735       0.7325       0.840
##   190    171       1    0.780 0.02757       0.7275       0.836
##   192    170       1    0.775 0.02779       0.7226       0.832
##   193    169       1    0.771 0.02800       0.7176       0.827
##   204    168       1    0.766 0.02821       0.7127       0.823
##   205    166       1    0.761 0.02841       0.7077       0.819
##   207    165       1    0.757 0.02861       0.7027       0.815
##   209    164       1    0.752 0.02881       0.6978       0.811
##   212    162       2    0.743 0.02919       0.6878       0.802
##   216    160       2    0.734 0.02955       0.6779       0.794
##   223    157       1    0.729 0.02973       0.6729       0.790
##   231    156       1    0.724 0.02991       0.6679       0.785
##   232    155       1    0.720 0.03008       0.6630       0.781
##   237    154       1    0.715 0.03024       0.6580       0.777
##   244    153       1    0.710 0.03040       0.6531       0.772
##   247    152       1    0.706 0.03056       0.6481       0.768
##   257    151       1    0.701 0.03071       0.6432       0.764
##   258    150       1    0.696 0.03086       0.6383       0.759
##   259    149       1    0.692 0.03101       0.6333       0.755
##   262    148       2    0.682 0.03128       0.6235       0.746
##   268    146       2    0.673 0.03154       0.6138       0.738
##   275    144       1    0.668 0.03167       0.6089       0.733
##   280    143       1    0.663 0.03179       0.6040       0.729
##   286    141       1    0.659 0.03191       0.5991       0.724
##   293    140       1    0.654 0.03203       0.5942       0.720
```

```
##   294   139       1   0.649 0.03214       0.5893       0.716
##   299   138       1   0.645 0.03225       0.5844       0.711
##   302   137       1   0.640 0.03236       0.5796       0.707
##   314   136       1   0.635 0.03246       0.5747       0.702
##   322   134       1   0.631 0.03256       0.5698       0.698
##   337   131       1   0.626 0.03267       0.5648       0.693
##   341   129       1   0.621 0.03277       0.5598       0.689
##   348   126       1   0.616 0.03288       0.5547       0.684
##   350   125       1   0.611 0.03298       0.5496       0.679
##   358   124       1   0.606 0.03308       0.5446       0.675
##   366   122       1   0.601 0.03318       0.5395       0.670
##   367   121       1   0.596 0.03328       0.5343       0.665
##   368   119       1   0.591 0.03338       0.5292       0.660
##   376   118       1   0.586 0.03347       0.5241       0.656
##   386   117       1   0.581 0.03355       0.5189       0.651
##   389   116       1   0.576 0.03364       0.5138       0.646
##   393   115       1   0.571 0.03371       0.5087       0.641
##   394   114       1   0.566 0.03379       0.5036       0.636
##   399   112       1   0.561 0.03386       0.4984       0.631
##   428   109       1   0.556 0.03394       0.4932       0.627
##   434   108       1   0.551 0.03401       0.4879       0.622
##   438   107       1   0.546 0.03408       0.4827       0.617
##   450   105       1   0.540 0.03415       0.4774       0.612
##   452   104       1   0.535 0.03422       0.4722       0.607
##   457   102       1   0.530 0.03428       0.4668       0.602
##   460   101       1   0.525 0.03434       0.4615       0.597
##   465    99       1   0.519 0.03440       0.4562       0.591
##   482    96       1   0.514 0.03447       0.4507       0.586
##   489    95       1   0.509 0.03453       0.4452       0.581
##   496    94       1   0.503 0.03458       0.4398       0.576
##   504    92       1   0.498 0.03463       0.4342       0.570
##   512    91       1   0.492 0.03468       0.4287       0.565
##   514    90       1   0.487 0.03473       0.4232       0.560
##   517    89       1   0.481 0.03476       0.4178       0.554
##   518    87       1   0.476 0.03480       0.4122       0.549
##   522    86       1   0.470 0.03483       0.4067       0.544
##   523    85       2   0.459 0.03488       0.3956       0.533
##   532    80       1   0.453 0.03491       0.3899       0.527
##   533    78       1   0.448 0.03495       0.3841       0.522
##   540    77       1   0.442 0.03497       0.3783       0.516
##   546    74       1   0.436 0.03501       0.3723       0.510
##   550    73       1   0.430 0.03503       0.3664       0.504
##   560    70       1   0.424 0.03507       0.3603       0.498
##   563    69       1   0.418 0.03509       0.3542       0.492
##   581    62       1   0.411 0.03517       0.3474       0.486
##   591    59       1   0.404 0.03525       0.3404       0.479
##   612    54       2   0.389 0.03550       0.3252       0.465
##   624    51       1   0.381 0.03561       0.3175       0.458
##   646    48       1   0.373 0.03574       0.3095       0.450
##   652    47       1   0.365 0.03586       0.3015       0.443
##   661    46       1   0.357 0.03595       0.2935       0.435
##   667    45       1   0.350 0.03601       0.2856       0.428
##   679    44       1   0.342 0.03606       0.2777       0.420
##   683    43       1   0.334 0.03609       0.2699       0.412
```

```
##   708     39       1    0.325 0.03616       0.2614        0.404
##   714     37       1    0.316 0.03623       0.2527        0.396
##   739     35       1    0.307 0.03631       0.2437        0.387
##   749     34       1    0.298 0.03635       0.2348        0.379
##   755     33       1    0.289 0.03635       0.2260        0.370
##   760     32       1    0.280 0.03632       0.2173        0.361
##   771     28       1    0.270 0.03638       0.2075        0.352
##   774     27       1    0.260 0.03638       0.1978        0.342
##   785     26       1    0.250 0.03633       0.1882        0.332
##   821     20       2    0.225 0.03675       0.1635        0.310
##   836     17       1    0.212 0.03690       0.1506        0.298
##   837     16       1    0.199 0.03689       0.1380        0.286
##   857     14       1    0.184 0.03688       0.1246        0.273
##   878     13       1    0.170 0.03667       0.1116        0.260
##   892     10       1    0.153 0.03675       0.0958        0.245
##   899      9       1    0.136 0.03639       0.0807        0.230
```

```
summary(surv.fit,times = 100)
```

```
## Call: survfit(formula = datas ~ 1)
##
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   100    203      25    0.893  0.0203        0.854        0.933
```

Estimate crude (unadjusted) survival functions for strata

```
surv.clin<-survfit(datas~clinic, data = data1)
summary(surv.clin)
```

```
## Call: survfit(formula = datas ~ clinic, data = data1)
##
##                 clinic=1
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##     7    162       1   0.9938 0.00615      0.98184        1.000
##    17    161       1   0.9877 0.00868      0.97080        1.000
##    19    160       1   0.9815 0.01059      0.96094        1.000
##    29    157       1   0.9752 0.01223      0.95155        0.999
##    30    156       1   0.9690 0.01366      0.94258        0.996
##    33    155       1   0.9627 0.01493      0.93390        0.992
##    35    154       1   0.9565 0.01609      0.92545        0.989
##    37    153       1   0.9502 0.01716      0.91719        0.984
##    41    152       1   0.9440 0.01815      0.90907        0.980
##    47    151       1   0.9377 0.01907      0.90107        0.976
##    49    150       1   0.9315 0.01994      0.89319        0.971
##    50    149       1   0.9252 0.02077      0.88540        0.967
##    59    147       1   0.9189 0.02156      0.87763        0.962
##    62    146       1   0.9126 0.02231      0.86993        0.957
##    67    144       1   0.9063 0.02304      0.86224        0.953
##    75    143       1   0.9000 0.02373      0.85462        0.948
##    84    142       1   0.8936 0.02440      0.84706        0.943
##    90    141       1   0.8873 0.02503      0.83955        0.938
##    95    140       1   0.8809 0.02564      0.83209        0.933
##    96    139       1   0.8746 0.02623      0.82467        0.928
```

```
##   117   135     1  0.8681 0.02683   0.81711   0.922
##   126   134     1  0.8616 0.02740   0.80959   0.917
##   127   133     1  0.8552 0.02795   0.80211   0.912
##   129   132     1  0.8487 0.02848   0.79467   0.906
##   136   130     1  0.8422 0.02899   0.78721   0.901
##   145   129     1  0.8356 0.02950   0.77978   0.895
##   147   128     1  0.8291 0.02998   0.77238   0.890
##   150   126     1  0.8225 0.03045   0.76495   0.884
##   157   124     1  0.8159 0.03092   0.75748   0.879
##   160   123     1  0.8093 0.03138   0.75004   0.873
##   167   121     1  0.8026 0.03182   0.74256   0.867
##   168   120     1  0.7959 0.03225   0.73512   0.862
##   175   119     1  0.7892 0.03267   0.72770   0.856
##   176   117     1  0.7824 0.03308   0.72023   0.850
##   180   116     2  0.7690 0.03385   0.70539   0.838
##   181   114     1  0.7622 0.03422   0.69801   0.832
##   183   113     1  0.7555 0.03458   0.69065   0.826
##   192   112     1  0.7487 0.03492   0.68331   0.820
##   193   111     1  0.7420 0.03525   0.67601   0.814
##   204   110     1  0.7352 0.03557   0.66872   0.808
##   205   108     1  0.7284 0.03589   0.66138   0.802
##   207   107     1  0.7216 0.03619   0.65406   0.796
##   209   106     1  0.7148 0.03648   0.64676   0.790
##   212   104     2  0.7011 0.03705   0.63207   0.778
##   216   102     1  0.6942 0.03732   0.62476   0.771
##   223   101     1  0.6873 0.03758   0.61747   0.765
##   237   100     1  0.6804 0.03783   0.61020   0.759
##   244    99     1  0.6736 0.03807   0.60295   0.752
##   247    98     1  0.6667 0.03829   0.59571   0.746
##   257    97     1  0.6598 0.03851   0.58850   0.740
##   258    96     1  0.6530 0.03872   0.58131   0.733
##   259    95     1  0.6461 0.03892   0.57413   0.727
##   262    94     2  0.6323 0.03928   0.55984   0.714
##   275    92     1  0.6255 0.03945   0.55272   0.708
##   293    90     1  0.6185 0.03962   0.54553   0.701
##   294    89     1  0.6116 0.03978   0.53836   0.695
##   299    88     1  0.6046 0.03993   0.53120   0.688
##   302    87     1  0.5977 0.04007   0.52406   0.682
##   314    86     1  0.5907 0.04020   0.51694   0.675
##   337    83     1  0.5836 0.04035   0.50964   0.668
##   341    81     1  0.5764 0.04049   0.50226   0.661
##   348    78     1  0.5690 0.04063   0.49468   0.654
##   350    77     1  0.5616 0.04077   0.48712   0.647
##   358    76     1  0.5542 0.04090   0.47958   0.640
##   367    75     1  0.5468 0.04102   0.47207   0.633
##   368    74     1  0.5394 0.04112   0.46457   0.626
##   376    73     1  0.5321 0.04122   0.45710   0.619
##   386    72     1  0.5247 0.04130   0.44964   0.612
##   393    71     1  0.5173 0.04138   0.44221   0.605
##   394    70     1  0.5099 0.04144   0.43480   0.598
##   399    69     1  0.5025 0.04149   0.42741   0.591
##   428    66     1  0.4949 0.04156   0.41978   0.583
##   434    65     1  0.4873 0.04161   0.41217   0.576
##   438    64     1  0.4797 0.04165   0.40459   0.569
```

```
##   452     62       1   0.4719 0.04169      0.39688        0.561
##   457     61       1   0.4642 0.04172      0.38921        0.554
##   465     59       1   0.4563 0.04175      0.38140        0.546
##   482     56       1   0.4482 0.04179      0.37331        0.538
##   489     55       1   0.4400 0.04182      0.36524        0.530
##   496     54       1   0.4319 0.04183      0.35719        0.522
##   504     53       1   0.4237 0.04183      0.34918        0.514
##   512     52       1   0.4156 0.04181      0.34120        0.506
##   514     51       1   0.4074 0.04177      0.33325        0.498
##   517     50       1   0.3993 0.04173      0.32532        0.490
##   518     48       1   0.3910 0.04168      0.31724        0.482
##   522     47       1   0.3826 0.04161      0.30918        0.474
##   523     46       2   0.3660 0.04143      0.29317        0.457
##   532     44       1   0.3577 0.04132      0.28521        0.449
##   533     43       1   0.3494 0.04119      0.27729        0.440
##   546     40       1   0.3406 0.04107      0.26894        0.431
##   550     39       1   0.3319 0.04094      0.26062        0.423
##   560     38       1   0.3232 0.04078      0.25235        0.414
##   563     37       1   0.3144 0.04060      0.24412        0.405
##   581     33       1   0.3049 0.04048      0.23505        0.396
##   591     31       1   0.2951 0.04035      0.22570        0.386
##   612     29       2   0.2747 0.04005      0.20644        0.366
##   624     26       1   0.2641 0.03988      0.19649        0.355
##   646     25       1   0.2536 0.03966      0.18664        0.345
##   652     24       1   0.2430 0.03939      0.17688        0.334
##   667     23       1   0.2325 0.03907      0.16722        0.323
##   679     22       1   0.2219 0.03869      0.15765        0.312
##   683     21       1   0.2113 0.03827      0.14818        0.301
##   714     20       1   0.2008 0.03778      0.13882        0.290
##   739     19       1   0.1902 0.03724      0.12957        0.279
##   749     18       1   0.1796 0.03664      0.12042        0.268
##   755     17       1   0.1691 0.03598      0.11140        0.257
##   760     16       1   0.1585 0.03525      0.10249        0.245
##   771     15       1   0.1479 0.03444      0.09372        0.233
##   774     14       1   0.1374 0.03357      0.08508        0.222
##   785     13       1   0.1268 0.03260      0.07660        0.210
##   821     10       2   0.1014 0.03062      0.05613        0.183
##   836      7       1   0.0869 0.02948      0.04474        0.169
##   837      6       1   0.0725 0.02790      0.03406        0.154
##   857      4       1   0.0543 0.02615      0.02116        0.140
##   892      3       1   0.0362 0.02286      0.01052        0.125
##   899      2       1   0.0181 0.01717      0.00283        0.116
##
##                clinic=2
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    13     74       1    0.986  0.0134        0.961        1.000
##    26     73       1    0.973  0.0189        0.937        1.000
##    35     72       1    0.959  0.0229        0.916        1.000
##    41     71       1    0.946  0.0263        0.896        0.999
##    79     68       1    0.932  0.0294        0.876        0.991
##   109     66       1    0.918  0.0321        0.857        0.983
##   122     65       1    0.904  0.0346        0.838        0.974
##   143     64       1    0.890  0.0368        0.820        0.965
##   149     62       1    0.875  0.0389        0.802        0.955
```

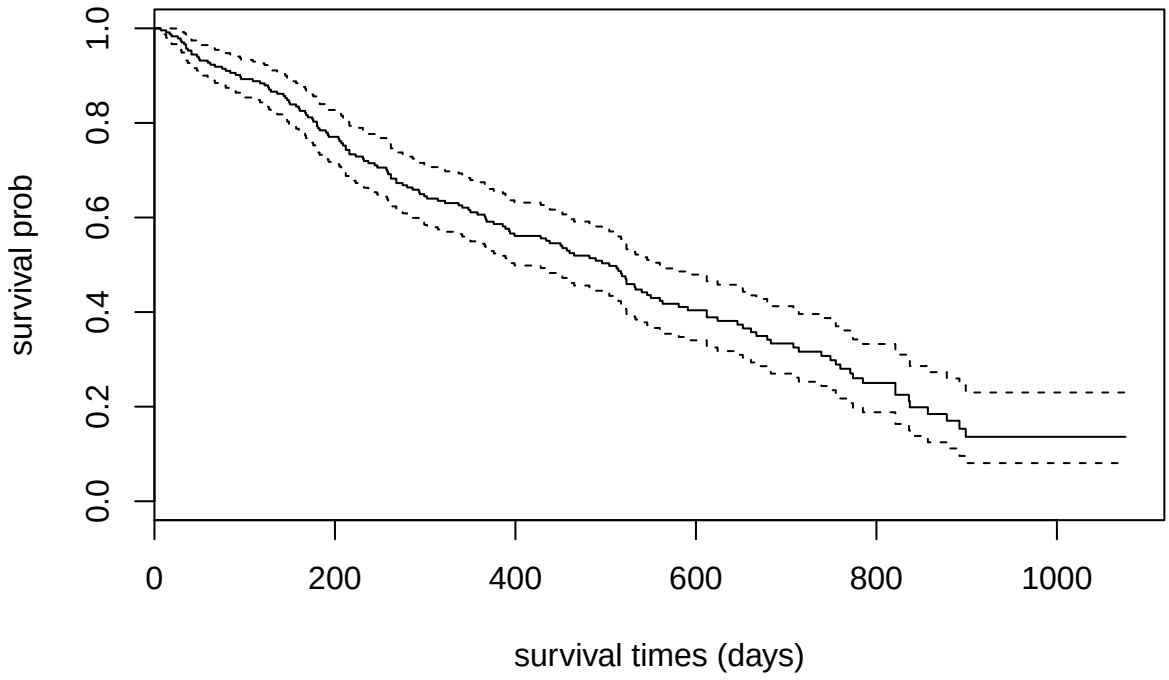
```
##   161     61       1    0.861  0.0408        0.785        0.945
##   170     60       1    0.847  0.0426        0.767        0.934
##   190     59       1    0.832  0.0442        0.750        0.924
##   216     58       1    0.818  0.0457        0.733        0.913
##   231     56       1    0.803  0.0472        0.716        0.901
##   232     55       1    0.789  0.0486        0.699        0.890
##   268     54       2    0.759  0.0510        0.666        0.866
##   280     52       1    0.745  0.0520        0.650        0.854
##   286     51       1    0.730  0.0530        0.633        0.842
##   322     50       1    0.716  0.0539        0.617        0.830
##   366     47       1    0.700  0.0549        0.601        0.817
##   389     45       1    0.685  0.0558        0.584        0.804
##   450     43       1    0.669  0.0568        0.566        0.790
##   460     41       1    0.653  0.0577        0.549        0.776
##   540     35       1    0.634  0.0590        0.528        0.761
##   661     23       1    0.606  0.0625        0.495        0.742
##   708     19       1    0.575  0.0669        0.457        0.722
##   878     10       1    0.517  0.0812        0.380        0.703
```

```
summary(surv.clin,times = 100)
```

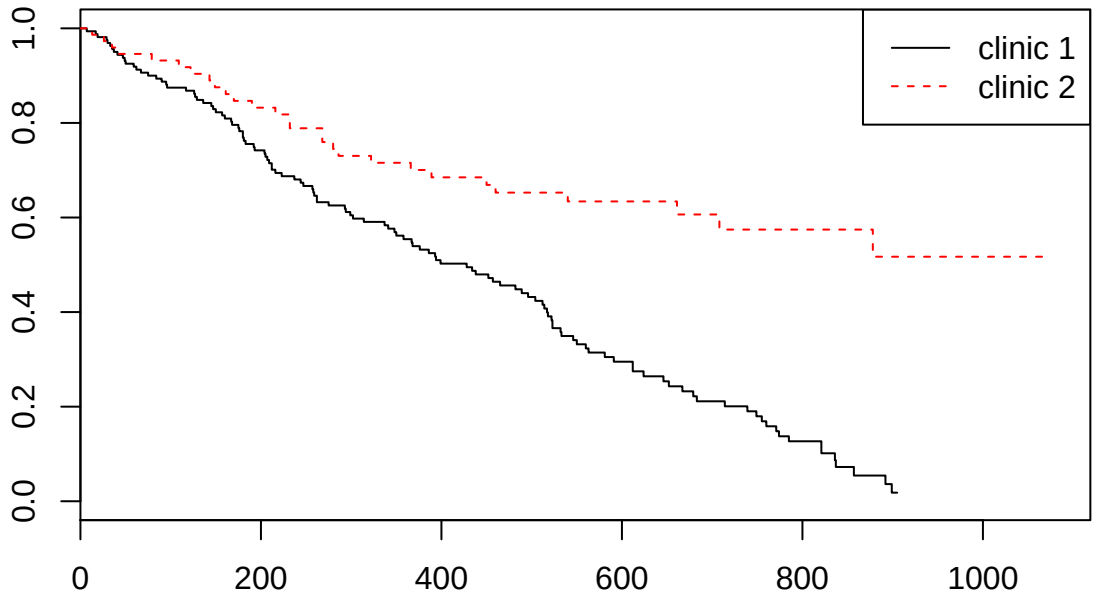
```
## Call: survfit(formula = datas ~ clinic, data = data1)
##
##                 clinic=1
##         time       n.risk      n.event     survival      std.err
##     100.0000     137.0000      20.0000       0.8746       0.0262
## lower 95% CI upper 95% CI
##       0.8247       0.9276
##
##                 clinic=2
##         time       n.risk      n.event     survival      std.err
##     100.0000      66.0000       5.0000       0.9320       0.0294
## lower 95% CI upper 95% CI
##       0.8762       0.9914
```

Plots

```
plot(surv.fit, xlab='survival times (days)', ylab='survival prob')
```




```
plot(surv.clin, lty=c('solid','dashed'), col=c('black','red'))
  legend('topright',c('clinic 1','clinic 2'),lty=c('solid','dashed'), col=c('black','red'))
```



Check for survival difference

Default is log-rank test

```
survdiff(datas~clinic, data = data1)
```

```
## Call:
## survdiff(formula = datas ~ clinic, data = data1)
##
##             N Observed Expected (O-E)^2/E (O-E)^2/V
## clinic=1 163      122     90.9      10.6      27.9
## clinic=2  75       28     59.1      16.4      27.9
##
##  Chisq= 27.9  on 1 degrees of freedom, p= 1.28e-07
```

Cox PH model

Efron is default method

```
data1.cox<-coxph(datas~prison+dose+clinic,data=data1)
summary(data1.cox)
```

```
## Call:
## coxph(formula = datas ~ prison + dose + clinic, data = data1)
```

```
##
##   n= 238, number of events= 150
##
##             coef exp(coef)  se(coef)      z Pr(>|z|)
## prison  0.326555  1.386184  0.167225  1.953   0.0508 .
## dose   -0.035369  0.965249  0.006379 -5.545 2.94e-08 ***
## clinic -1.009896  0.364257  0.214889 -4.700 2.61e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
## prison    1.3862     0.7214    0.9988    1.9238
## dose      0.9652     1.0360    0.9533    0.9774
## clinic    0.3643     2.7453    0.2391    0.5550
##
## Concordance= 0.665  (se = 0.026 )
## Rsquare= 0.238   (max possible= 0.997 )
## Likelihood ratio test= 64.56  on 3 df,   p=6.228e-14
## Wald test            = 54.12  on 3 df,   p=1.056e-11
## Score (logrank) test = 56.32  on 3 df,   p=3.598e-12
```

Other alternatives = Breslow , Exact

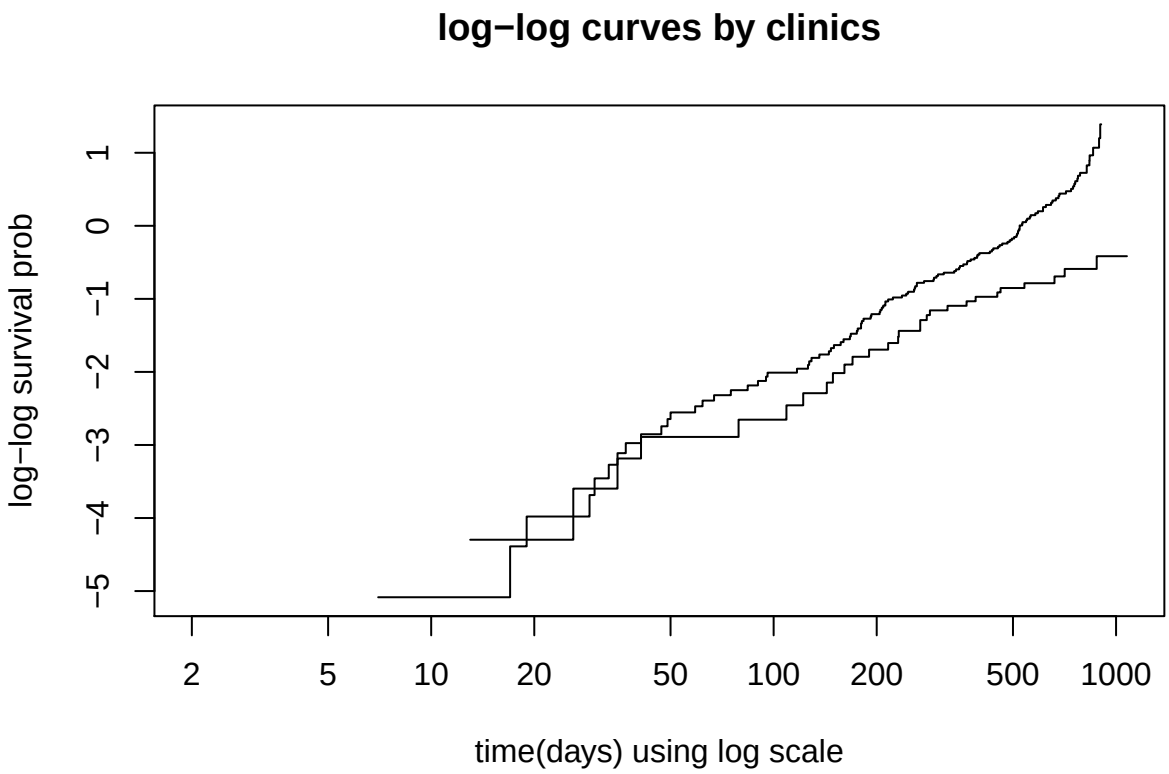
Checking PH assumption

Using graphical methods

Check PH assumption for clinic

method 1

```
plot(surv.clin,fun='cloglog',
    xlab='time(days) using log scale', ylab='log-log survival prob',
    main='log-log curves by clinics')
```



method 2

```
surv.clin2<-summary(surv.clin)
surv.clin2
```

```
## Call: survfit(formula = datas ~ clinic, data = data1)
##
##                 clinic=1
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##     7    162       1   0.9938 0.00615      0.98184        1.000
##    17    161       1   0.9877 0.00868      0.97080        1.000
##    19    160       1   0.9815 0.01059      0.96094        1.000
##    29    157       1   0.9752 0.01223      0.95155        0.999
##    30    156       1   0.9690 0.01366      0.94258        0.996
##    33    155       1   0.9627 0.01493      0.93390        0.992
##    35    154       1   0.9565 0.01609      0.92545        0.989
##    37    153       1   0.9502 0.01716      0.91719        0.984
##    41    152       1   0.9440 0.01815      0.90907        0.980
##    47    151       1   0.9377 0.01907      0.90107        0.976
##    49    150       1   0.9315 0.01994      0.89319        0.971
##    50    149       1   0.9252 0.02077      0.88540        0.967
##    59    147       1   0.9189 0.02156      0.87763        0.962
##    62    146       1   0.9126 0.02231      0.86993        0.957
##    67    144       1   0.9063 0.02304      0.86224        0.953
##    75    143       1   0.9000 0.02373      0.85462        0.948
##    84    142       1   0.8936 0.02440      0.84706        0.943
##    90    141       1   0.8873 0.02503      0.83955        0.938
```

```
##    95    140       1   0.8809 0.02564      0.83209        0.933
##    96    139       1   0.8746 0.02623      0.82467        0.928
##   117    135       1   0.8681 0.02683      0.81711        0.922
##   126    134       1   0.8616 0.02740      0.80959        0.917
##   127    133       1   0.8552 0.02795      0.80211        0.912
##   129    132       1   0.8487 0.02848      0.79467        0.906
##   136    130       1   0.8422 0.02899      0.78721        0.901
##   145    129       1   0.8356 0.02950      0.77978        0.895
##   147    128       1   0.8291 0.02998      0.77238        0.890
##   150    126       1   0.8225 0.03045      0.76495        0.884
##   157    124       1   0.8159 0.03092      0.75748        0.879
##   160    123       1   0.8093 0.03138      0.75004        0.873
##   167    121       1   0.8026 0.03182      0.74256        0.867
##   168    120       1   0.7959 0.03225      0.73512        0.862
##   175    119       1   0.7892 0.03267      0.72770        0.856
##   176    117       1   0.7824 0.03308      0.72023        0.850
##   180    116       2   0.7690 0.03385      0.70539        0.838
##   181    114       1   0.7622 0.03422      0.69801        0.832
##   183    113       1   0.7555 0.03458      0.69065        0.826
##   192    112       1   0.7487 0.03492      0.68331        0.820
##   193    111       1   0.7420 0.03525      0.67601        0.814
##   204    110       1   0.7352 0.03557      0.66872        0.808
##   205    108       1   0.7284 0.03589      0.66138        0.802
##   207    107       1   0.7216 0.03619      0.65406        0.796
##   209    106       1   0.7148 0.03648      0.64676        0.790
##   212    104       2   0.7011 0.03705      0.63207        0.778
##   216    102       1   0.6942 0.03732      0.62476        0.771
##   223    101       1   0.6873 0.03758      0.61747        0.765
##   237    100       1   0.6804 0.03783      0.61020        0.759
##   244     99       1   0.6736 0.03807      0.60295        0.752
##   247     98       1   0.6667 0.03829      0.59571        0.746
##   257     97       1   0.6598 0.03851      0.58850        0.740
##   258     96       1   0.6530 0.03872      0.58131        0.733
##   259     95       1   0.6461 0.03892      0.57413        0.727
##   262     94       2   0.6323 0.03928      0.55984        0.714
##   275     92       1   0.6255 0.03945      0.55272        0.708
##   293     90       1   0.6185 0.03962      0.54553        0.701
##   294     89       1   0.6116 0.03978      0.53836        0.695
##   299     88       1   0.6046 0.03993      0.53120        0.688
##   302     87       1   0.5977 0.04007      0.52406        0.682
##   314     86       1   0.5907 0.04020      0.51694        0.675
##   337     83       1   0.5836 0.04035      0.50964        0.668
##   341     81       1   0.5764 0.04049      0.50226        0.661
##   348     78       1   0.5690 0.04063      0.49468        0.654
##   350     77       1   0.5616 0.04077      0.48712        0.647
##   358     76       1   0.5542 0.04090      0.47958        0.640
##   367     75       1   0.5468 0.04102      0.47207        0.633
##   368     74       1   0.5394 0.04112      0.46457        0.626
##   376     73       1   0.5321 0.04122      0.45710        0.619
##   386     72       1   0.5247 0.04130      0.44964        0.612
##   393     71       1   0.5173 0.04138      0.44221        0.605
##   394     70       1   0.5099 0.04144      0.43480        0.598
##   399     69       1   0.5025 0.04149      0.42741        0.591
##   428     66       1   0.4949 0.04156      0.41978        0.583
```

```
##   434     65       1   0.4873 0.04161      0.41217        0.576
##   438     64       1   0.4797 0.04165      0.40459        0.569
##   452     62       1   0.4719 0.04169      0.39688        0.561
##   457     61       1   0.4642 0.04172      0.38921        0.554
##   465     59       1   0.4563 0.04175      0.38140        0.546
##   482     56       1   0.4482 0.04179      0.37331        0.538
##   489     55       1   0.4400 0.04182      0.36524        0.530
##   496     54       1   0.4319 0.04183      0.35719        0.522
##   504     53       1   0.4237 0.04183      0.34918        0.514
##   512     52       1   0.4156 0.04181      0.34120        0.506
##   514     51       1   0.4074 0.04177      0.33325        0.498
##   517     50       1   0.3993 0.04173      0.32532        0.490
##   518     48       1   0.3910 0.04168      0.31724        0.482
##   522     47       1   0.3826 0.04161      0.30918        0.474
##   523     46       2   0.3660 0.04143      0.29317        0.457
##   532     44       1   0.3577 0.04132      0.28521        0.449
##   533     43       1   0.3494 0.04119      0.27729        0.440
##   546     40       1   0.3406 0.04107      0.26894        0.431
##   550     39       1   0.3319 0.04094      0.26062        0.423
##   560     38       1   0.3232 0.04078      0.25235        0.414
##   563     37       1   0.3144 0.04060      0.24412        0.405
##   581     33       1   0.3049 0.04048      0.23505        0.396
##   591     31       1   0.2951 0.04035      0.22570        0.386
##   612     29       2   0.2747 0.04005      0.20644        0.366
##   624     26       1   0.2641 0.03988      0.19649        0.355
##   646     25       1   0.2536 0.03966      0.18664        0.345
##   652     24       1   0.2430 0.03939      0.17688        0.334
##   667     23       1   0.2325 0.03907      0.16722        0.323
##   679     22       1   0.2219 0.03869      0.15765        0.312
##   683     21       1   0.2113 0.03827      0.14818        0.301
##   714     20       1   0.2008 0.03778      0.13882        0.290
##   739     19       1   0.1902 0.03724      0.12957        0.279
##   749     18       1   0.1796 0.03664      0.12042        0.268
##   755     17       1   0.1691 0.03598      0.11140        0.257
##   760     16       1   0.1585 0.03525      0.10249        0.245
##   771     15       1   0.1479 0.03444      0.09372        0.233
##   774     14       1   0.1374 0.03357      0.08508        0.222
##   785     13       1   0.1268 0.03260      0.07660        0.210
##   821     10       2   0.1014 0.03062      0.05613        0.183
##   836      7       1   0.0869 0.02948      0.04474        0.169
##   837      6       1   0.0725 0.02790      0.03406        0.154
##   857      4       1   0.0543 0.02615      0.02116        0.140
##   892      3       1   0.0362 0.02286      0.01052        0.125
##   899      2       1   0.0181 0.01717      0.00283        0.116
##
##                clinic=2
##  time n.risk n.event survival std.err lower 95% CI upper 95% CI
##    13     74       1    0.986  0.0134        0.961        1.000
##    26     73       1    0.973  0.0189        0.937        1.000
##    35     72       1    0.959  0.0229        0.916        1.000
##    41     71       1    0.946  0.0263        0.896        0.999
##    79     68       1    0.932  0.0294        0.876        0.991
##   109     66       1    0.918  0.0321        0.857        0.983
##   122     65       1    0.904  0.0346        0.838        0.974
```

```
##   143     64       1    0.890  0.0368        0.820        0.965
##   149     62       1    0.875  0.0389        0.802        0.955
##   161     61       1    0.861  0.0408        0.785        0.945
##   170     60       1    0.847  0.0426        0.767        0.934
##   190     59       1    0.832  0.0442        0.750        0.924
##   216     58       1    0.818  0.0457        0.733        0.913
##   231     56       1    0.803  0.0472        0.716        0.901
##   232     55       1    0.789  0.0486        0.699        0.890
##   268     54       2    0.759  0.0510        0.666        0.866
##   280     52       1    0.745  0.0520        0.650        0.854
##   286     51       1    0.730  0.0530        0.633        0.842
##   322     50       1    0.716  0.0539        0.617        0.830
##   366     47       1    0.700  0.0549        0.601        0.817
##   389     45       1    0.685  0.0558        0.584        0.804
##   450     43       1    0.669  0.0568        0.566        0.790
##   460     41       1    0.653  0.0577        0.549        0.776
##   540     35       1    0.634  0.0590        0.528        0.761
##   661     23       1    0.606  0.0625        0.495        0.742
##   708     19       1    0.575  0.0669        0.457        0.722
##   878     10       1    0.517  0.0812        0.380        0.703
```

```
surv.clin3<-data.frame(surv.clin2$strata,surv.clin2$time,surv.clin2$surv)
surv.clin3
```

```
##     surv.clin2.strata surv.clin2.time surv.clin2.surv
## 1            clinic=1               7      0.99382716
## 2            clinic=1              17      0.98765432
## 3            clinic=1              19      0.98148148
## 4            clinic=1              29      0.97523001
## 5            clinic=1              30      0.96897853
## 6            clinic=1              33      0.96272706
## 7            clinic=1              35      0.95647558
## 8            clinic=1              37      0.95022411
## 9            clinic=1              41      0.94397264
## 10           clinic=1              47      0.93772116
## 11           clinic=1              49      0.93146969
## 12           clinic=1              50      0.92521821
## 13           clinic=1              59      0.91892421
## 14           clinic=1              62      0.91263021
## 15           clinic=1              67      0.90629250
## 16           clinic=1              75      0.89995479
## 17           clinic=1              84      0.89361708
## 18           clinic=1              90      0.88727937
## 19           clinic=1              95      0.88094166
## 20           clinic=1              96      0.87460395
## 21           clinic=1             117      0.86812540
## 22           clinic=1             126      0.86164685
## 23           clinic=1             127      0.85516831
## 24           clinic=1             129      0.84868976
## 25           clinic=1             136      0.84216138
## 26           clinic=1             145      0.83563299
## 27           clinic=1             147      0.82910461
## 28           clinic=1             150      0.82252442
## 29           clinic=1             157      0.81589115
## 30           clinic=1             160      0.80925789
```

```
## 31          clinic=1          167      0.80256981
## 32          clinic=1          168      0.79588173
## 33          clinic=1          175      0.78919365
## 34          clinic=1          176      0.78244840
## 35          clinic=1          180      0.76895791
## 36          clinic=1          181      0.76221267
## 37          clinic=1          183      0.75546742
## 38          clinic=1          192      0.74872218
## 39          clinic=1          193      0.74197693
## 40          clinic=1          204      0.73523169
## 41          clinic=1          205      0.72842399
## 42          clinic=1          207      0.72161629
## 43          clinic=1          209      0.71480859
## 44          clinic=1          212      0.70106227
## 45          clinic=1          216      0.69418911
## 46          clinic=1          223      0.68731595
## 47          clinic=1          237      0.68044279
## 48          clinic=1          244      0.67356963
## 49          clinic=1          247      0.66669647
## 50          clinic=1          257      0.65982331
## 51          clinic=1          258      0.65295015
## 52          clinic=1          259      0.64607699
## 53          clinic=1          262      0.63233067
## 54          clinic=1          275      0.62545751
## 55          clinic=1          293      0.61850798
## 56          clinic=1          294      0.61155846
## 57          clinic=1          299      0.60460893
## 58          clinic=1          302      0.59765940
## 59          clinic=1          314      0.59070987
## 60          clinic=1          337      0.58359289
## 61          clinic=1          341      0.57638804
## 62          clinic=1          348      0.56899845
## 63          clinic=1          350      0.56160886
## 64          clinic=1          358      0.55421927
## 65          clinic=1          367      0.54682968
## 66          clinic=1          368      0.53944009
## 67          clinic=1          376      0.53205050
## 68          clinic=1          386      0.52466090
## 69          clinic=1          393      0.51727131
## 70          clinic=1          394      0.50988172
## 71          clinic=1          399      0.50249213
## 72          clinic=1          428      0.49487862
## 73          clinic=1          434      0.48726510
## 74          clinic=1          438      0.47965158
## 75          clinic=1          452      0.47191527
## 76          clinic=1          457      0.46417895
## 77          clinic=1          465      0.45631151
## 78          clinic=1          482      0.44816309
## 79          clinic=1          489      0.44001467
## 80          clinic=1          496      0.43186625
## 81          clinic=1          504      0.42371783
## 82          clinic=1          512      0.41556941
## 83          clinic=1          514      0.40742099
## 84          clinic=1          517      0.39927257
```

```
## 85          clinic=1          518     0.39095439
## 86          clinic=1          522     0.38263622
## 87          clinic=1          523     0.36599986
## 88          clinic=1          532     0.35768168
## 89          clinic=1          533     0.34936350
## 90          clinic=1          546     0.34062941
## 91          clinic=1          550     0.33189533
## 92          clinic=1          560     0.32316124
## 93          clinic=1          563     0.31442715
## 94          clinic=1          581     0.30489906
## 95          clinic=1          591     0.29506360
## 96          clinic=1          612     0.27471439
## 97          clinic=1          624     0.26414845
## 98          clinic=1          646     0.25358251
## 99          clinic=1          652     0.24301657
## 100         clinic=1          667     0.23245064
## 101         clinic=1          679     0.22188470
## 102         clinic=1          683     0.21131876
## 103         clinic=1          714     0.20075282
## 104         clinic=1          739     0.19018688
## 105         clinic=1          749     0.17962095
## 106         clinic=1          755     0.16905501
## 107         clinic=1          760     0.15848907
## 108         clinic=1          771     0.14792313
## 109         clinic=1          774     0.13735719
## 110         clinic=1          785     0.12679126
## 111         clinic=1          821     0.10143300
## 112         clinic=1          836     0.08694258
## 113         clinic=1          837     0.07245215
## 114         clinic=1          857     0.05433911
## 115         clinic=1          892     0.03622607
## 116         clinic=1          899     0.01811304
## 117         clinic=2           13     0.98648649
## 118         clinic=2           26     0.97297297
## 119         clinic=2           35     0.95945946
## 120         clinic=2           41     0.94594595
## 121         clinic=2           79     0.93203498
## 122         clinic=2          109     0.91791323
## 123         clinic=2          122     0.90379149
## 124         clinic=2          143     0.88966975
## 125         clinic=2          149     0.87532024
## 126         clinic=2          161     0.86097073
## 127         clinic=2          170     0.84662121
## 128         clinic=2          190     0.83227170
## 129         clinic=2          216     0.81792219
## 130         clinic=2          231     0.80331644
## 131         clinic=2          232     0.78871068
## 132         clinic=2          268     0.75949918
## 133         clinic=2          280     0.74489342
## 134         clinic=2          286     0.73028767
## 135         clinic=2          322     0.71568192
## 136         clinic=2          366     0.70045464
## 137         clinic=2          389     0.68488898
## 138         clinic=2          450     0.66896133
```

```
## 139          clinic=2            460      0.65264520
## 140          clinic=2            540      0.63399820
## 141          clinic=2            661      0.60643306
## 142          clinic=2            708      0.57451553
## 143          clinic=2            878      0.51706397
```

```
#give column names
colnames(surv.clin3)<-c('clinic','time','survival')
surv.clin3[1:5,]
```

```
##     clinic time  survival
## 1 clinic=1    7 0.9938272
## 2 clinic=1   17 0.9876543
## 3 clinic=1   19 0.9814815
## 4 clinic=1   29 0.9752300
## 5 clinic=1   30 0.9689785
```

```
#stratify
clinic1<-surv.clin3[surv.clin3$clinic=='clinic=1',]
clinic1
```

```
##       clinic time   survival
## 1   clinic=1    7 0.99382716
## 2   clinic=1   17 0.98765432
## 3   clinic=1   19 0.98148148
## 4   clinic=1   29 0.97523001
## 5   clinic=1   30 0.96897853
## 6   clinic=1   33 0.96272706
## 7   clinic=1   35 0.95647558
## 8   clinic=1   37 0.95022411
## 9   clinic=1   41 0.94397264
## 10  clinic=1   47 0.93772116
## 11  clinic=1   49 0.93146969
## 12  clinic=1   50 0.92521821
## 13  clinic=1   59 0.91892421
## 14  clinic=1   62 0.91263021
## 15  clinic=1   67 0.90629250
## 16  clinic=1   75 0.89995479
## 17  clinic=1   84 0.89361708
## 18  clinic=1   90 0.88727937
## 19  clinic=1   95 0.88094166
## 20  clinic=1   96 0.87460395
## 21  clinic=1  117 0.86812540
## 22  clinic=1  126 0.86164685
## 23  clinic=1  127 0.85516831
## 24  clinic=1  129 0.84868976
## 25  clinic=1  136 0.84216138
## 26  clinic=1  145 0.83563299
## 27  clinic=1  147 0.82910461
## 28  clinic=1  150 0.82252442
## 29  clinic=1  157 0.81589115
## 30  clinic=1  160 0.80925789
## 31  clinic=1  167 0.80256981
## 32  clinic=1  168 0.79588173
## 33  clinic=1  175 0.78919365
## 34  clinic=1  176 0.78244840
```

```
## 35  clinic=1  180 0.76895791
## 36  clinic=1  181 0.76221267
## 37  clinic=1  183 0.75546742
## 38  clinic=1  192 0.74872218
## 39  clinic=1  193 0.74197693
## 40  clinic=1  204 0.73523169
## 41  clinic=1  205 0.72842399
## 42  clinic=1  207 0.72161629
## 43  clinic=1  209 0.71480859
## 44  clinic=1  212 0.70106227
## 45  clinic=1  216 0.69418911
## 46  clinic=1  223 0.68731595
## 47  clinic=1  237 0.68044279
## 48  clinic=1  244 0.67356963
## 49  clinic=1  247 0.66669647
## 50  clinic=1  257 0.65982331
## 51  clinic=1  258 0.65295015
## 52  clinic=1  259 0.64607699
## 53  clinic=1  262 0.63233067
## 54  clinic=1  275 0.62545751
## 55  clinic=1  293 0.61850798
## 56  clinic=1  294 0.61155846
## 57  clinic=1  299 0.60460893
## 58  clinic=1  302 0.59765940
## 59  clinic=1  314 0.59070987
## 60  clinic=1  337 0.58359289
## 61  clinic=1  341 0.57638804
## 62  clinic=1  348 0.56899845
## 63  clinic=1  350 0.56160886
## 64  clinic=1  358 0.55421927
## 65  clinic=1  367 0.54682968
## 66  clinic=1  368 0.53944009
## 67  clinic=1  376 0.53205050
## 68  clinic=1  386 0.52466090
## 69  clinic=1  393 0.51727131
## 70  clinic=1  394 0.50988172
## 71  clinic=1  399 0.50249213
## 72  clinic=1  428 0.49487862
## 73  clinic=1  434 0.48726510
## 74  clinic=1  438 0.47965158
## 75  clinic=1  452 0.47191527
## 76  clinic=1  457 0.46417895
## 77  clinic=1  465 0.45631151
## 78  clinic=1  482 0.44816309
## 79  clinic=1  489 0.44001467
## 80  clinic=1  496 0.43186625
## 81  clinic=1  504 0.42371783
## 82  clinic=1  512 0.41556941
## 83  clinic=1  514 0.40742099
## 84  clinic=1  517 0.39927257
## 85  clinic=1  518 0.39095439
## 86  clinic=1  522 0.38263622
## 87  clinic=1  523 0.36599986
## 88  clinic=1  532 0.35768168
```

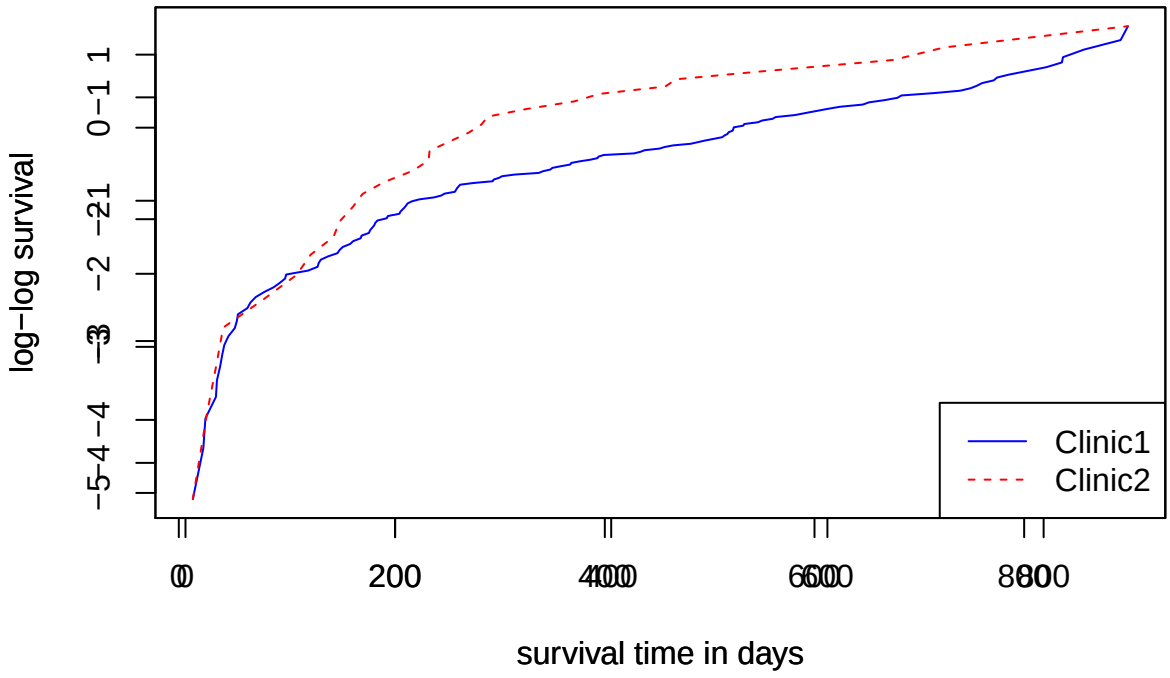
```
## 89  clinic=1  533 0.34936350
## 90  clinic=1  546 0.34062941
## 91  clinic=1  550 0.33189533
## 92  clinic=1  560 0.32316124
## 93  clinic=1  563 0.31442715
## 94  clinic=1  581 0.30489906
## 95  clinic=1  591 0.29506360
## 96  clinic=1  612 0.27471439
## 97  clinic=1  624 0.26414845
## 98  clinic=1  646 0.25358251
## 99  clinic=1  652 0.24301657
## 100 clinic=1  667 0.23245064
## 101 clinic=1  679 0.22188470
## 102 clinic=1  683 0.21131876
## 103 clinic=1  714 0.20075282
## 104 clinic=1  739 0.19018688
## 105 clinic=1  749 0.17962095
## 106 clinic=1  755 0.16905501
## 107 clinic=1  760 0.15848907
## 108 clinic=1  771 0.14792313
## 109 clinic=1  774 0.13735719
## 110 clinic=1  785 0.12679126
## 111 clinic=1  821 0.10143300
## 112 clinic=1  836 0.08694258
## 113 clinic=1  837 0.07245215
## 114 clinic=1  857 0.05433911
## 115 clinic=1  892 0.03622607
## 116 clinic=1  899 0.01811304
```

```
clinic2<-surv.clin3[surv.clin3$clinic=='clinic=2',]
clinic2
```

```
##       clinic time  survival
## 117 clinic=2   13 0.9864865
## 118 clinic=2   26 0.9729730
## 119 clinic=2   35 0.9594595
## 120 clinic=2   41 0.9459459
## 121 clinic=2   79 0.9320350
## 122 clinic=2  109 0.9179132
## 123 clinic=2  122 0.9037915
## 124 clinic=2  143 0.8896697
## 125 clinic=2  149 0.8753202
## 126 clinic=2  161 0.8609707
## 127 clinic=2  170 0.8466212
## 128 clinic=2  190 0.8322717
## 129 clinic=2  216 0.8179222
## 130 clinic=2  231 0.8033164
## 131 clinic=2  232 0.7887107
## 132 clinic=2  268 0.7594992
## 133 clinic=2  280 0.7448934
## 134 clinic=2  286 0.7302877
## 135 clinic=2  322 0.7156819
## 136 clinic=2  366 0.7004546
## 137 clinic=2  389 0.6848890
## 138 clinic=2  450 0.6689613
```

```
## 139 clinic=2  460 0.6526452
## 140 clinic=2  540 0.6339982
## 141 clinic=2  661 0.6064331
## 142 clinic=2  708 0.5745155
## 143 clinic=2  878 0.5170640
```

```
plot(clinic1$time,log(-log(clinic1$survival)),xlab='survival time in days',ylab='log-log survival',col=
#overlay plots
par(new=T)
plot(clinic2$time,log(-log(clinic2$survival)),xlab='survival time in days',ylab='log-log survival',col=
#back to default
par(new=F)
legend('bottomright', c('Clinic1', 'Clinic2'), lty = c('solid', 'dashed'),col=c
('blue','red'))
```



Looks the curves cross each other. This indicate model violate PH assumption

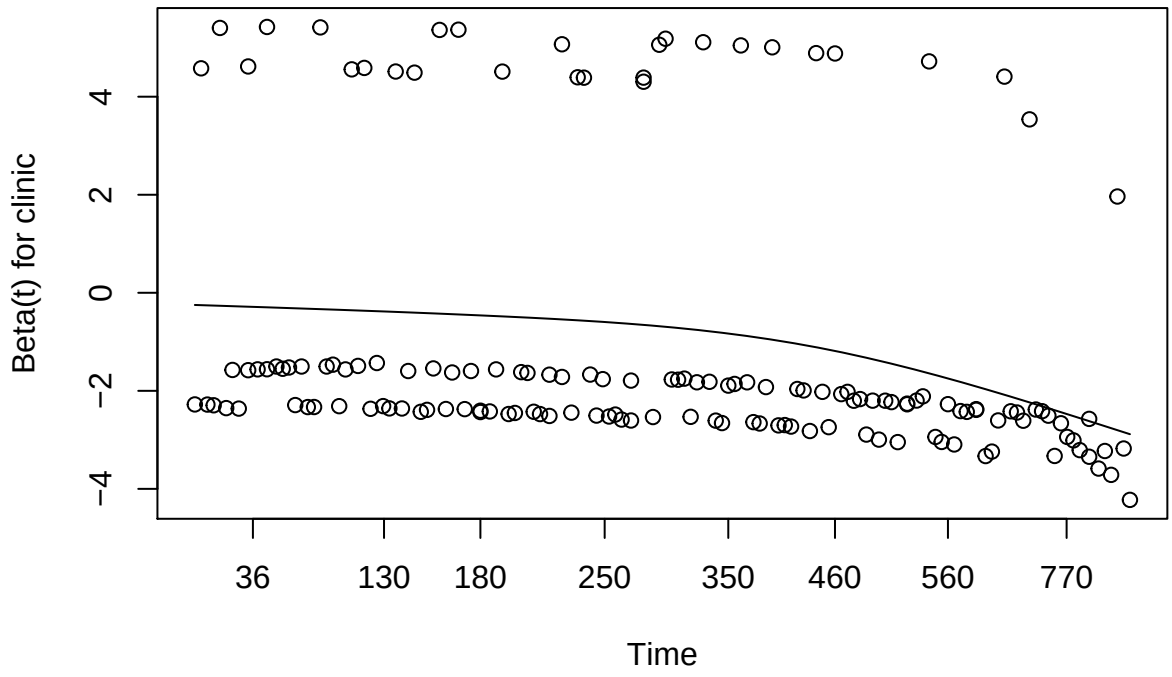
Using statistical test

```
test.ph<-coxph(datas~prison+dose+clinic,data=data1)
test.ph2<-cox.zph(test.ph,transform = rank)
test.ph2
```

```
##            rho  chisq       p
## prison -0.0462  0.322 0.57068
## dose    0.0905  1.096 0.29521
```

```
## clinic -0.2498 10.495 0.00120
## GLOBAL      NA 12.425 0.00606
```

```
# var = clinic means residuals should pertain to the variable clinic
plot(test.ph2,se=FALSE,var='clinic')
```



Running stratified Cox model

When models violate PH assumption. in our case, 'clinic' does violate PH assumption but others are not. So we do stratified Cox model

```
surv.strata<-coxph(datas~prison+dose+strata(clinic),data=data1)
summary(surv.strata)
```

```
## Call:
## coxph(formula = datas ~ prison + dose + strata(clinic), data = data1)
##
##   n= 238, number of events= 150
##
##             coef exp(coef)  se(coef)      z Pr(>|z|)
## prison  0.389605  1.476397  0.168930  2.306   0.0211 *
## dose   -0.035115  0.965495  0.006465 -5.432 5.59e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##        exp(coef) exp(-coef) lower .95 upper .95
```

```
## prison    1.4764     0.6773    1.0603    2.0559
## dose      0.9655     1.0357    0.9533    0.9778
##
## Concordance= 0.651  (se = 0.034 )
## Rsquare= 0.133   (max possible= 0.994 )
## Likelihood ratio test= 33.91  on 2 df,   p=4.322e-08
## Wald test            = 32.66  on 2 df,   p=8.076e-08
## Score (logrank) test = 33.33  on 2 df,   p=5.774e-08
```

Running stratified Cox model with interaction

```
surv.strata.ia<-coxph(datas~prison+dose+clinic:dose+clinic:prison+strata(clinic),data=data1)
summary(surv.strata.ia)
```

```
## Call:
## coxph(formula = datas ~ prison + dose + clinic:dose + clinic:prison +
##     strata(clinic), data = data1)
##
##   n= 238, number of events= 150
##
##                    coef exp(coef)  se(coef)      z Pr(>|z|)
## prison         1.085836  2.961914  0.538636  2.016   0.0438 *
## dose          -0.034635  0.965958  0.019797 -1.750   0.0802 .
## dose:clinic   -0.001164  0.998837  0.014570 -0.080   0.9363
## prison:clinic -0.582989  0.558227  0.428135 -1.362   0.1733
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               exp(coef) exp(-coef) lower .95 upper .95
## prison           2.9619     0.3376    1.0306     8.513
## dose             0.9660     1.0352    0.9292     1.004
## dose:clinic      0.9988     1.0012    0.9707     1.028
## prison:clinic    0.5582     1.7914    0.2412     1.292
##
## Concordance= 0.649  (se = 0.034 )
## Rsquare= 0.14   (max possible= 0.994 )
## Likelihood ratio test= 35.77  on 4 df,   p=3.222e-07
## Wald test            = 34.09  on 4 df,   p=7.138e-07
## Score (logrank) test = 34.97  on 4 df,   p=4.706e-07
```

Calculating the HR

If we want to calculate the HR betwwen PRISON=1 vs PRISON=0 for CLINIC=2, then one way is by making CLINIC equals 0. So when CLINIC==2, then CLINIC2==0.

```
data1$clinic2<-data1$clinic-1
head(data1$clinic2)
```

```
## [1] 0 0 0 0 0 0
```

```
head(data1$clinic)
```

```
## [1] 1 1 1 1 1 1
```

```
surv.strata.ia2<-coxph(datas~prison+dose+clinic2:prison+clinic2:dose+
                       strata(clinic2),data=data1)
summary(surv.strata.ia2)
```

```
## Call:
## coxph(formula = datas ~ prison + dose + clinic2:prison + clinic2:dose +
##     strata(clinic2), data = data1)
##
##   n= 238, number of events= 150
##
##                      coef exp(coef)  se(coef)      z Pr(>|z|)
## prison           0.502846  1.653421  0.188706  2.665  0.00771 **
## dose            -0.035799  0.964834  0.007738 -4.626 3.72e-06 ***
## prison:clinic2 -0.582989  0.558227  0.428135 -1.362  0.17329
## dose:clinic2   -0.001164  0.998837  0.014570 -0.080  0.93632
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                exp(coef) exp(-coef) lower .95 upper .95
## prison            1.6534     0.6048    1.1422    2.3934
## dose              0.9648     1.0364    0.9503    0.9796
## prison:clinic2    0.5582     1.7914    0.2412    1.2919
## dose:clinic2      0.9988     1.0012    0.9707    1.0278
##
## Concordance= 0.649  (se = 0.034 )
## Rsquare= 0.14   (max possible= 0.994 )
## Likelihood ratio test= 35.77  on 4 df,   p=3.222e-07
## Wald test            = 34.09  on 4 df,   p=7.138e-07
## Score (logrank) test = 34.97  on 4 df,   p=4.706e-07
```