Outcome Inequalty by Race in Early Stage High Grade Serous Ovarian Cancer
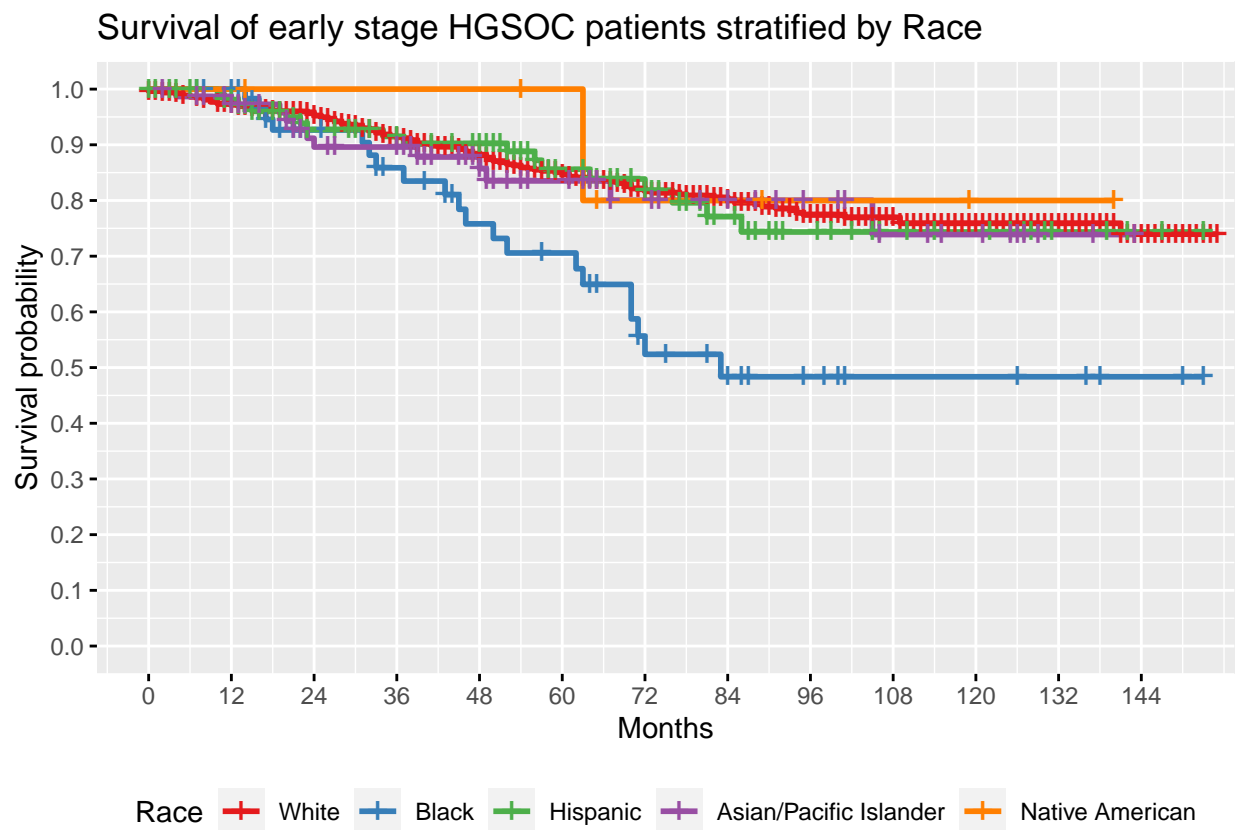
Kevin Kremer

01/14/21

Survival of early-stage HGSOC by race

Survival of early stage HGSOC patients stratified by Race

```
##
##  Pairwise comparisons using Log-Rank test
##
## data:  HGS.ES and Race
##
##          White    Black    Hispanic API
## Black    0.00099  -        -        -
## Hispanic 0.88561  0.03049  -        -
```
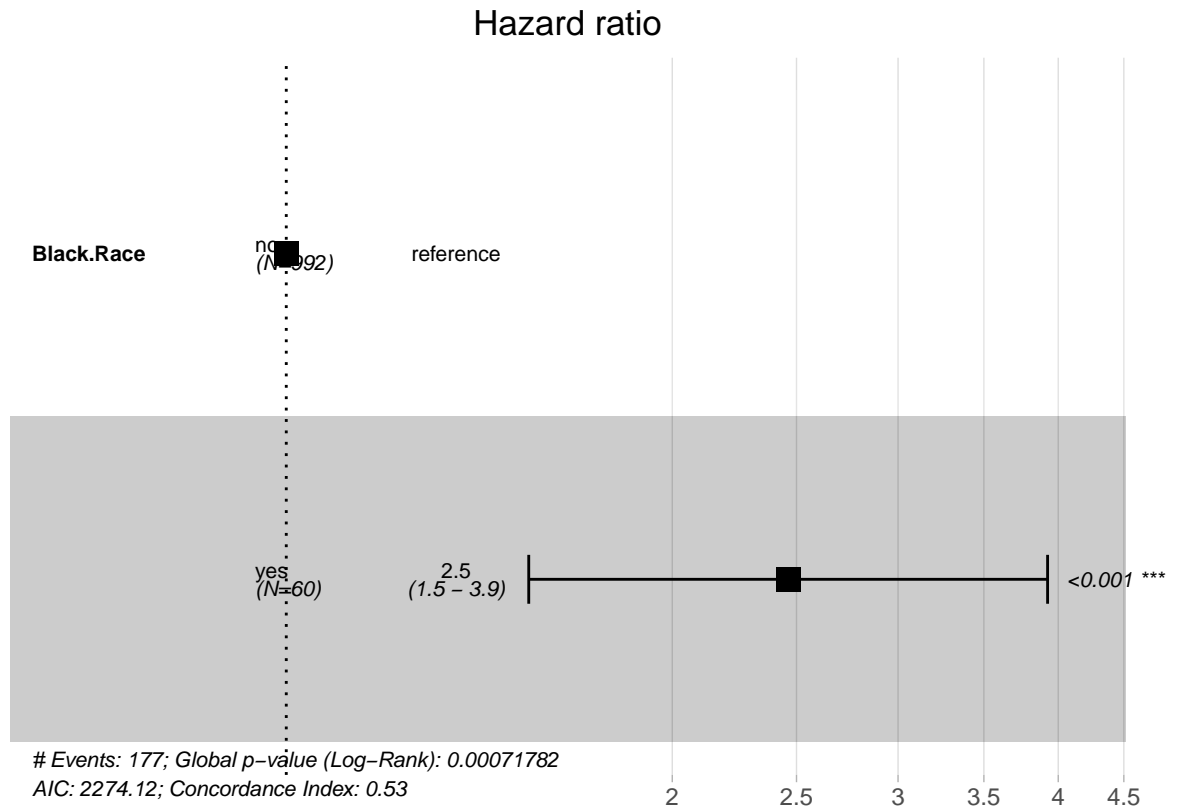
```
## API      0.88561 0.08697 0.88561   -
## Native   0.88561 0.51590 0.88561  0.88561
##
## P value adjustment method: BH
```

Race	Count
White	795
Black	60
Hispanic	111
API	76
Native	7

Comparing Black Race to All Other Races Combined

Survival of early stage HGSOC patients stratified by Race
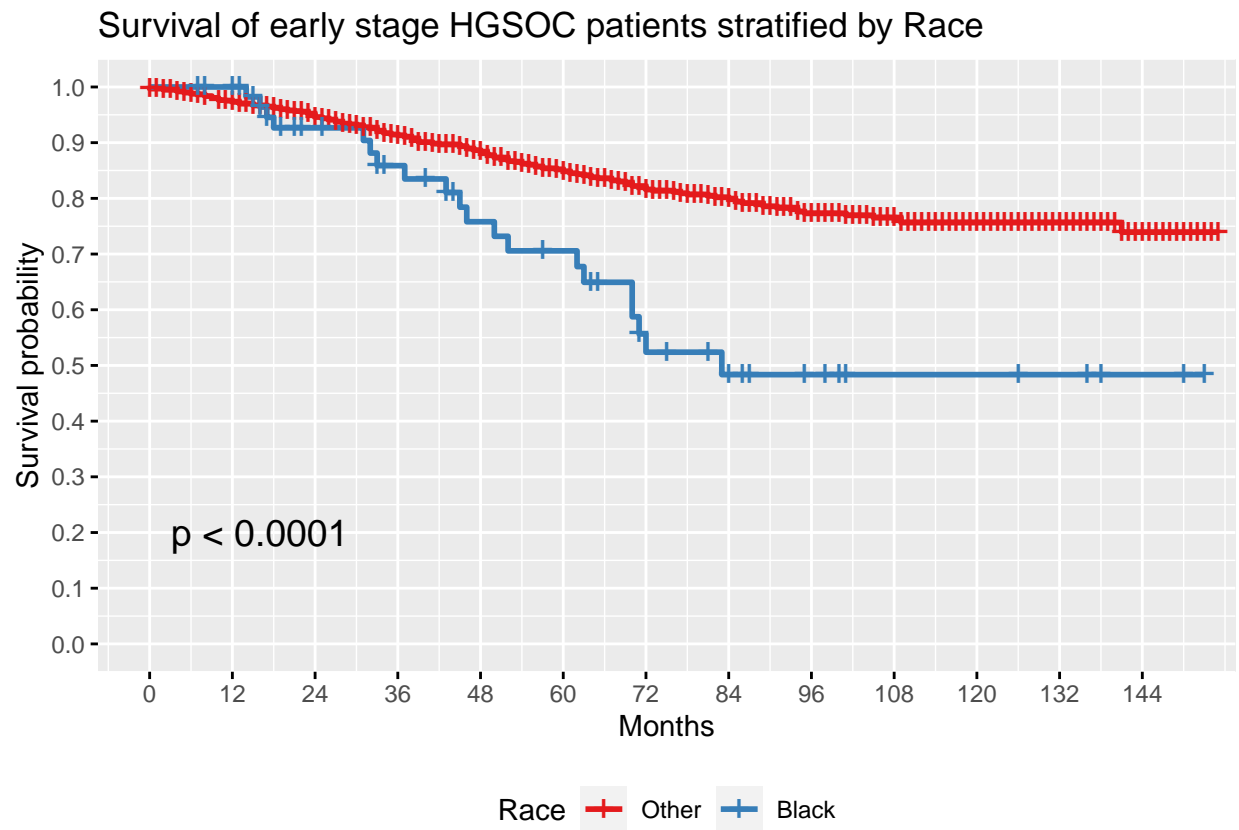
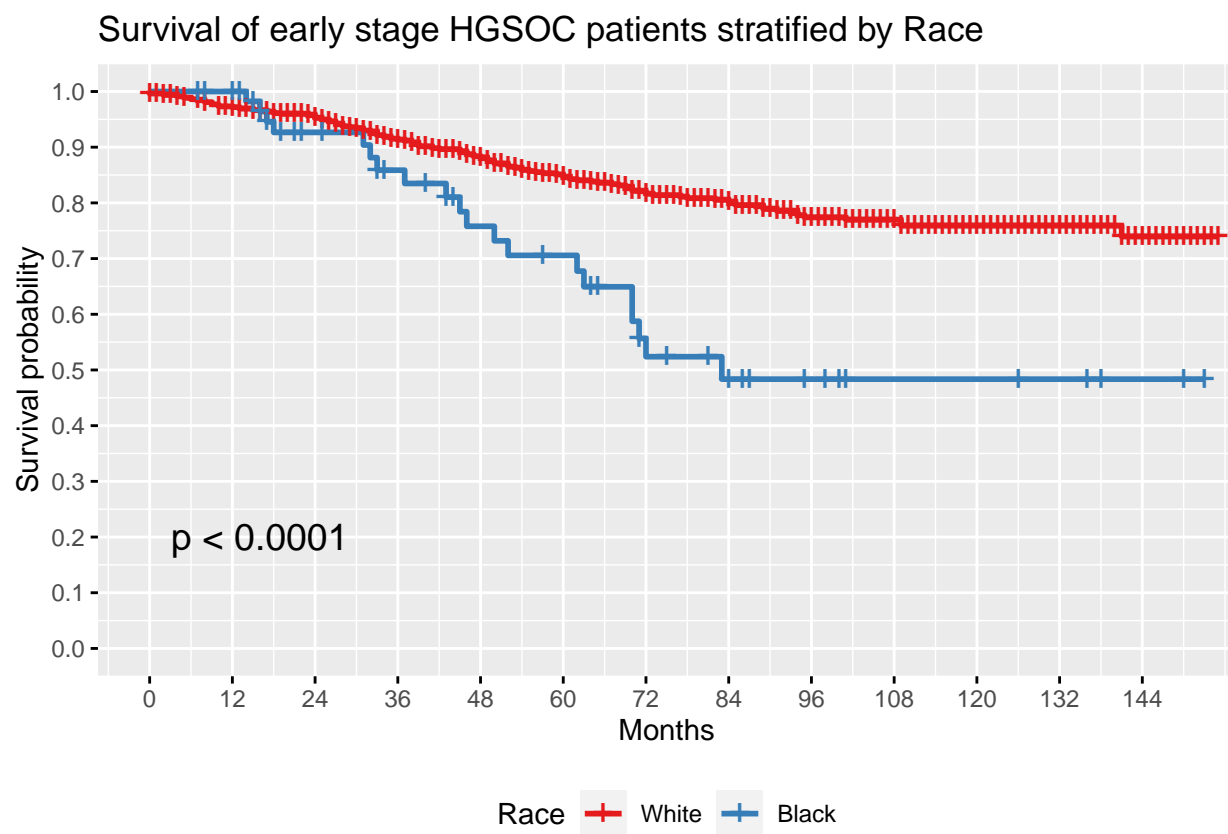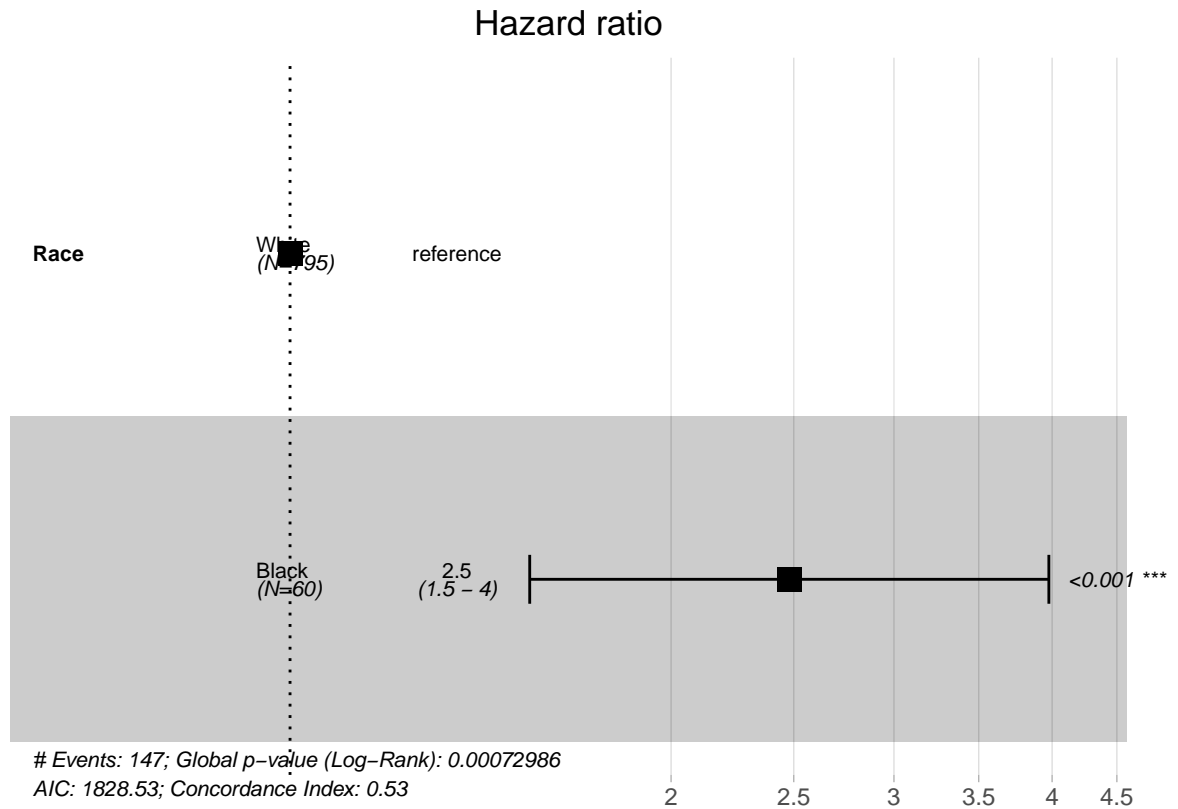| Black Race	Count
no	992
yes	60

Hazard ratio


```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Black.Race, data = HGS.ES)
##
##   n= 1052, number of events= 177
##
##                  coef exp(coef) se(coef)      z Pr(>|z|)
## Black.Raceyes 0.9013    2.4628   0.2377 3.792  0.00015 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##               exp(coef) exp(-coef) lower .95 upper .95
## Black.Raceyes    2.463      0.406     1.546     3.924
##
## Concordance= 0.527  (se = 0.011 )
## Likelihood ratio test= 11.44  on 1 df,    p=7e-04
## Wald test            = 14.38  on 1 df,    p=1e-04
## Score (logrank) test = 15.38  on 1 df,    p=9e-05
```
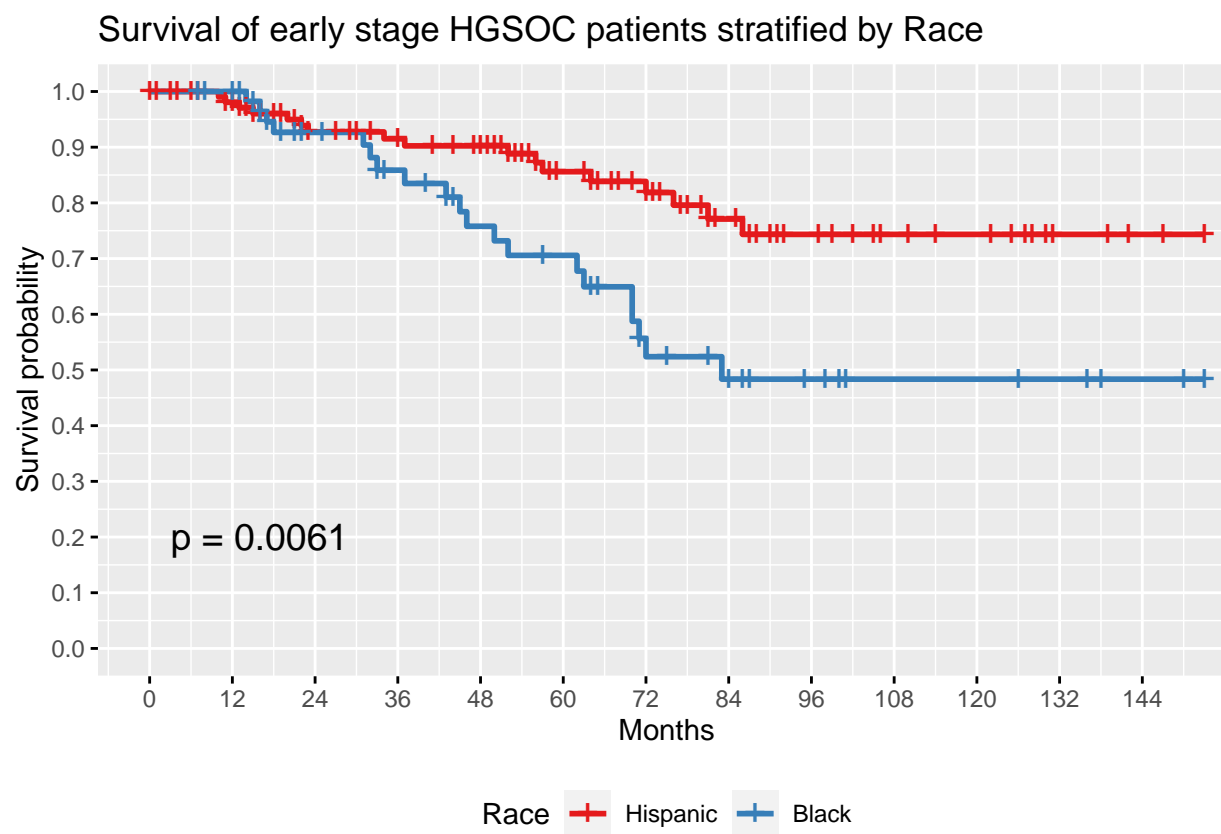
Comparing Black Race to White Race

Survival of early stage HGSOC patients stratified by Race

Race	Count
White	795
Black	60

Hazard ratio

Race	White (N=795)	reference	
	Black (N=60)	2.5 (1.5 – 4)	<0.001 ***

Events: 147; Global p–value (Log–Rank): 0.00072986
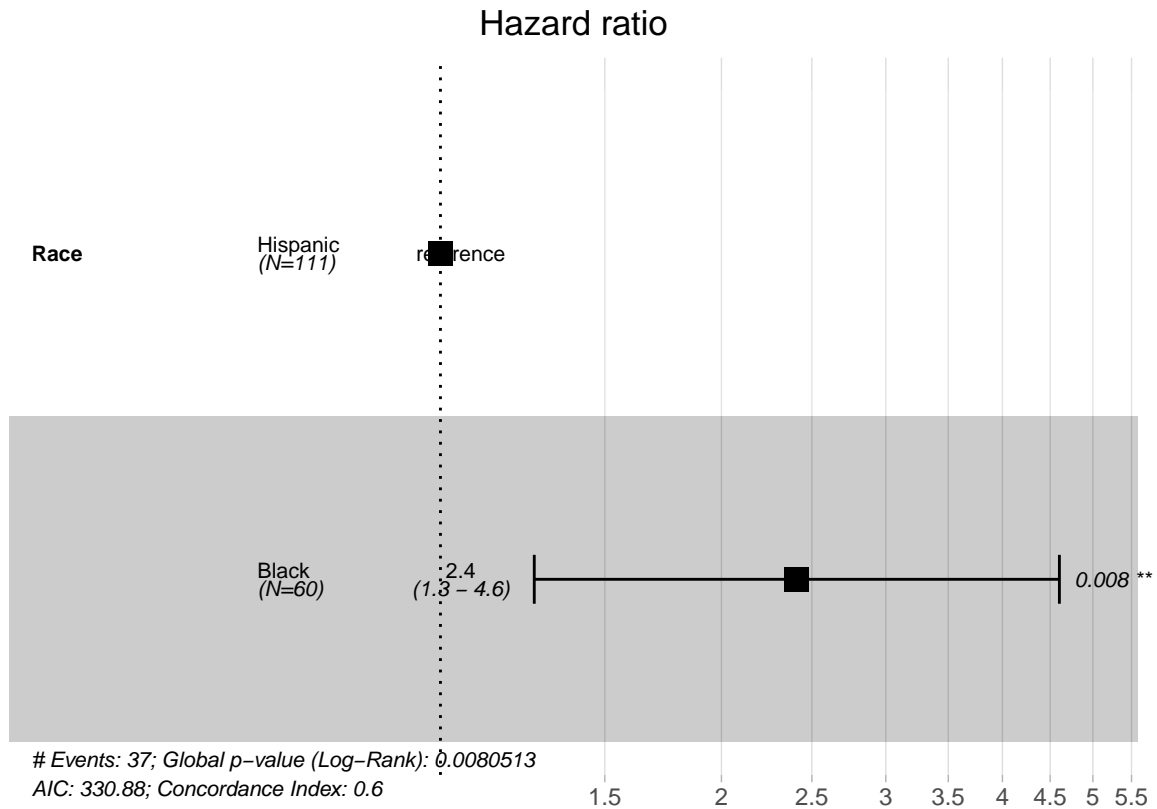AIC: 1828.53; Concordance Index: 0.53

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Race, data = HGS.WB)
##
##   n= 855, number of events= 147
##
##              coef exp(coef) se(coef)    z Pr(>|z|)
## RaceBlack 0.9082    2.4798   0.2409 3.77 0.000164 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##           exp(coef) exp(-coef) lower .95 upper .95
## RaceBlack      2.48     0.4033     1.546     3.977
##
## Concordance= 0.533  (se = 0.013 )
## Likelihood ratio test= 11.41  on 1 df,    p=7e-04
## Wald test            = 14.21  on 1 df,    p=2e-04
## Score (logrank) test = 15.21  on 1 df,    p=1e-04
```

Comparing Black Race to Hispanic Race

Survival of early stage HGSOC patients stratified by Race

Race	Count
Hispanic	111
Black	60

Hazard ratio

Race	Hispanic (N=111)	reference	
	Black (N=60)	2.4 (1.3 – 4.6)	0.008 **

Events: 37; Global p–value (Log–Rank): 0.0080513
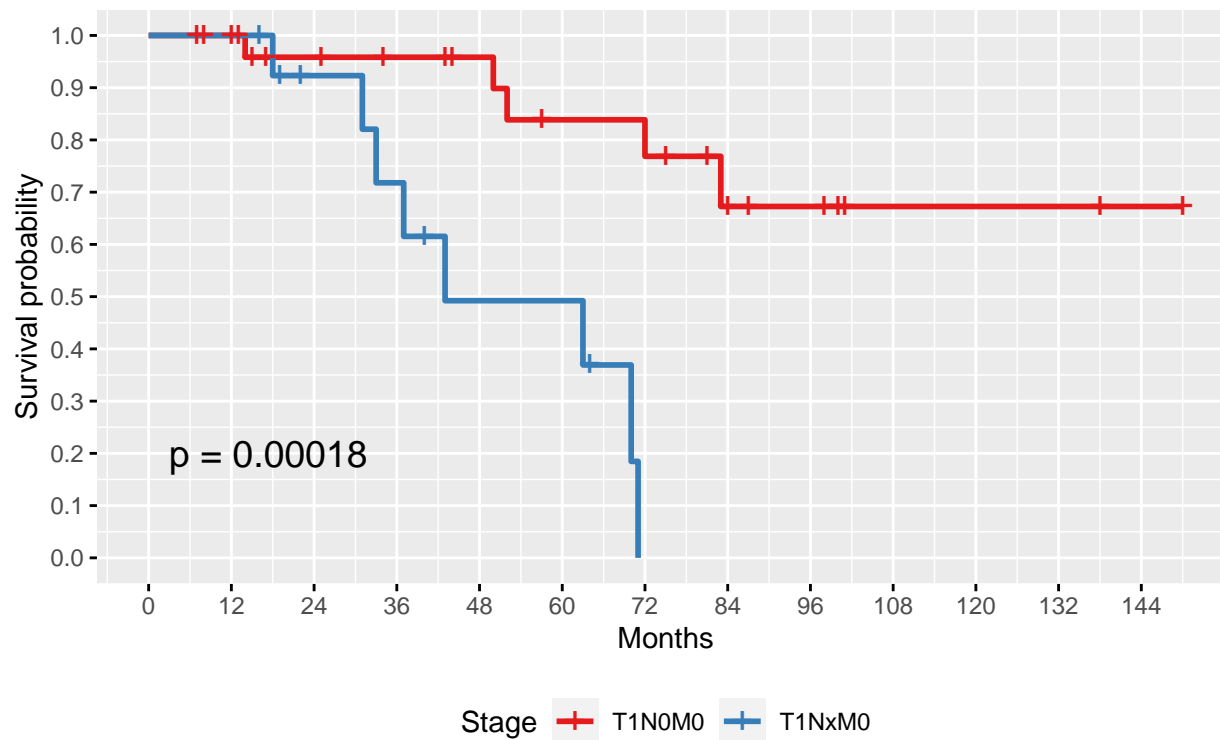AIC: 330.88; Concordance Index: 0.6

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Race, data = HGS.HB)
##
##   n= 171, number of events= 37
##
##             coef exp(coef) se(coef)    z Pr(>|z|)
## RaceBlack 0.8791    2.4088   0.3304 2.66  0.00781 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##           exp(coef) exp(-coef) lower .95 upper .95
## RaceBlack     2.409     0.4152      1.26     4.603
##
## Concordance= 0.596  (se = 0.044 )
## Likelihood ratio test= 7.02  on 1 df,   p=0.008
## Wald test            = 7.08  on 1 df,   p=0.008
## Score (logrank) test = 7.54  on 1 df,   p=0.006
```
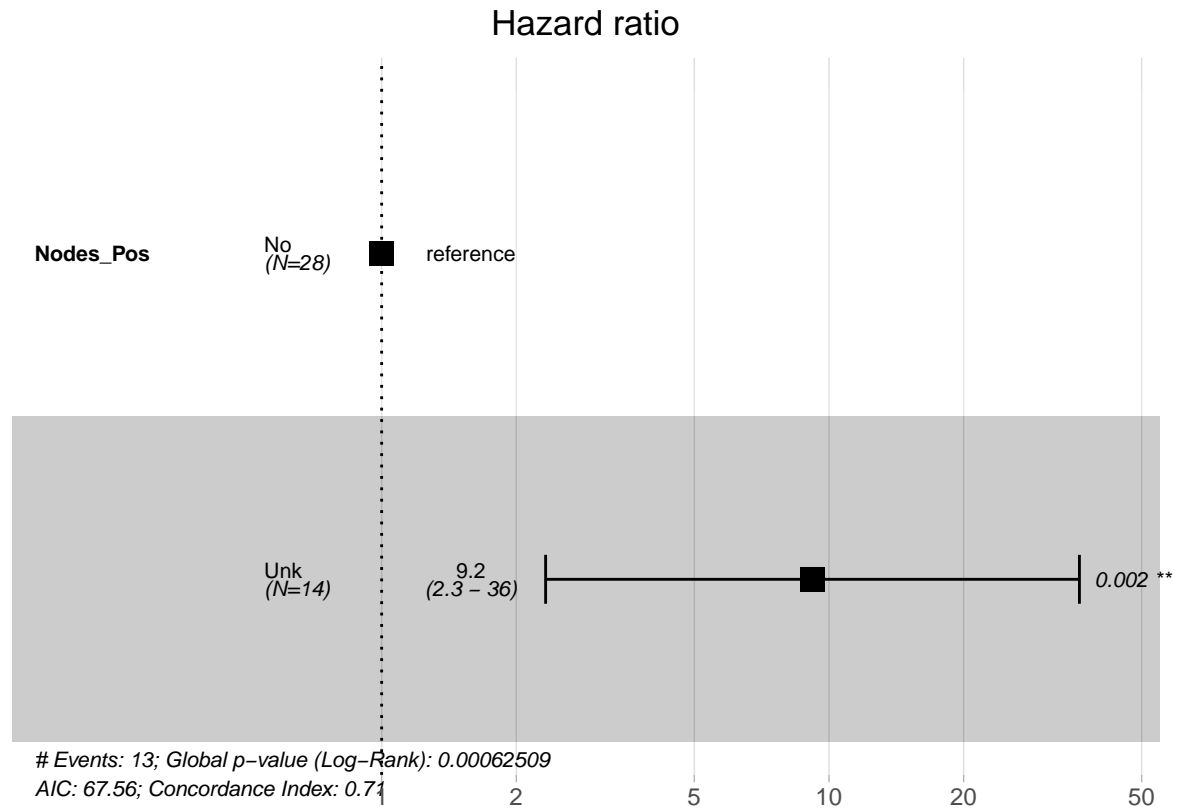
Does the addition of chemotherapy in patients with unknown nodal status improve outcomes in different races?

Black Race

Survival of Black early stage HGSOC patients that received chemotherapy stratified by Stage
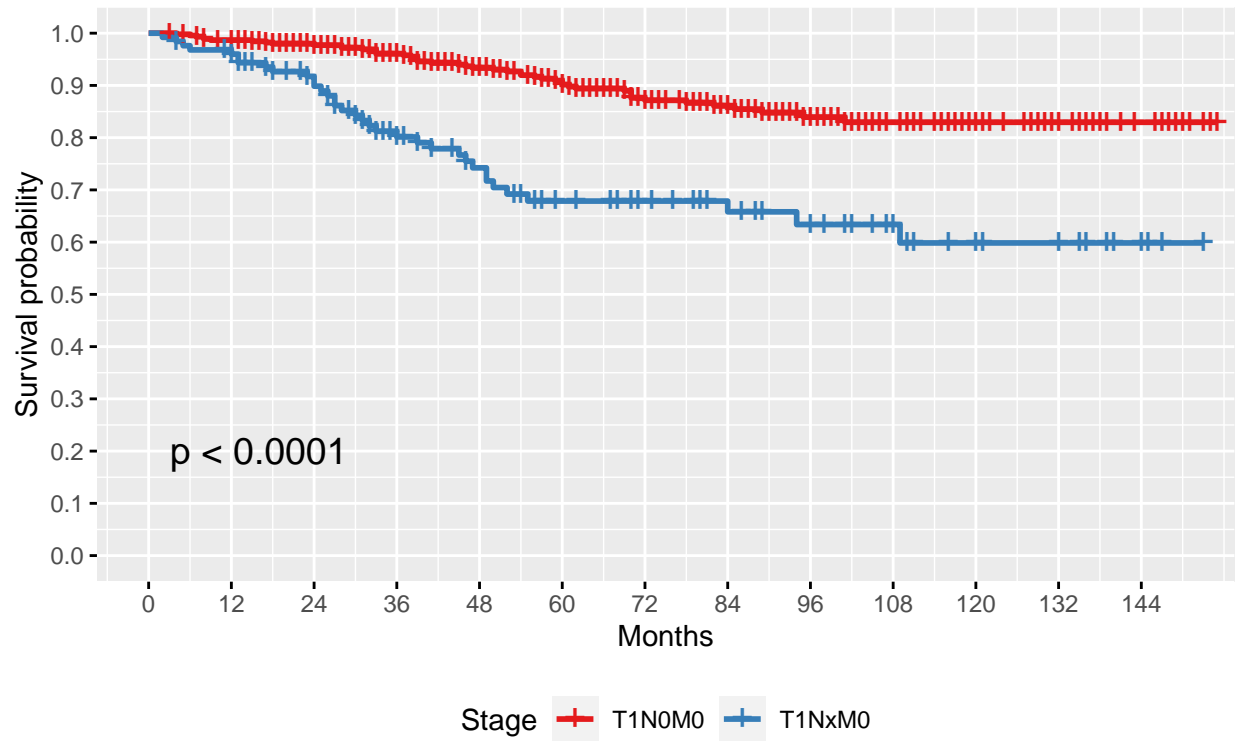
Positive Nodes	Count
No	28
Unk	14

Hazard ratio

Nodes_Pos	No (N=28)	reference	
	Unk (N=14)	9.2 (2.3 – 36)	0.002 **

 # Events: 13; Global p–value (Log–Rank): 0.00062509
AIC: 67.56; Concordance Index: 0.71

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Nodes_Pos, data = HGS.ES.Black.Chemo)
##
##   n= 42, number of events= 13
##
##               coef exp(coef) se(coef)       z Pr(>|z|)
## Nodes_PosUnk 2.218     9.188    0.701 3.164  0.00156 **
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
##              exp(coef) exp(-coef) lower .95 upper .95
## Nodes_PosUnk     9.187     0.1088     2.326      36.3
##
## Concordance= 0.706  (se = 0.07 )
## Likelihood ratio test= 11.7  on 1 df,   p=6e-04
## Wald test            = 10.01  on 1 df,   p=0.002
## Score (logrank) test = 13.98  on 1 df,   p=2e-04
```

9

White Race

Survival of White early stage HGSOC patients that received chemotherapy stratified by Stage

Positive Nodes	Count
No	454
Unk	126

Hazard ratio

Node **Pos**

No
(N=454)   reference

Unk
(N=126)   3.2
(2.1 − 5)   <0.001 ***

 # Events: 82; Global p−value (Log−Rank): 7.7012e−07
AIC: 943.84; Concordance Index: 0.64
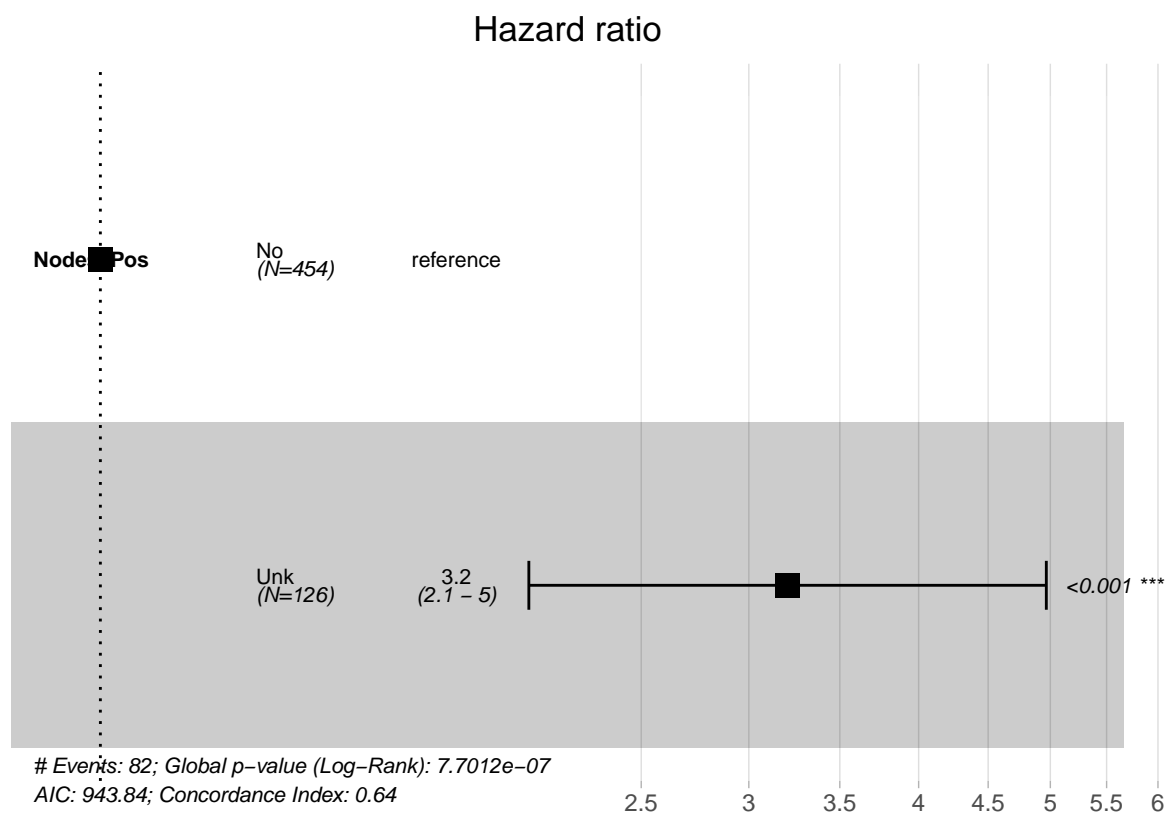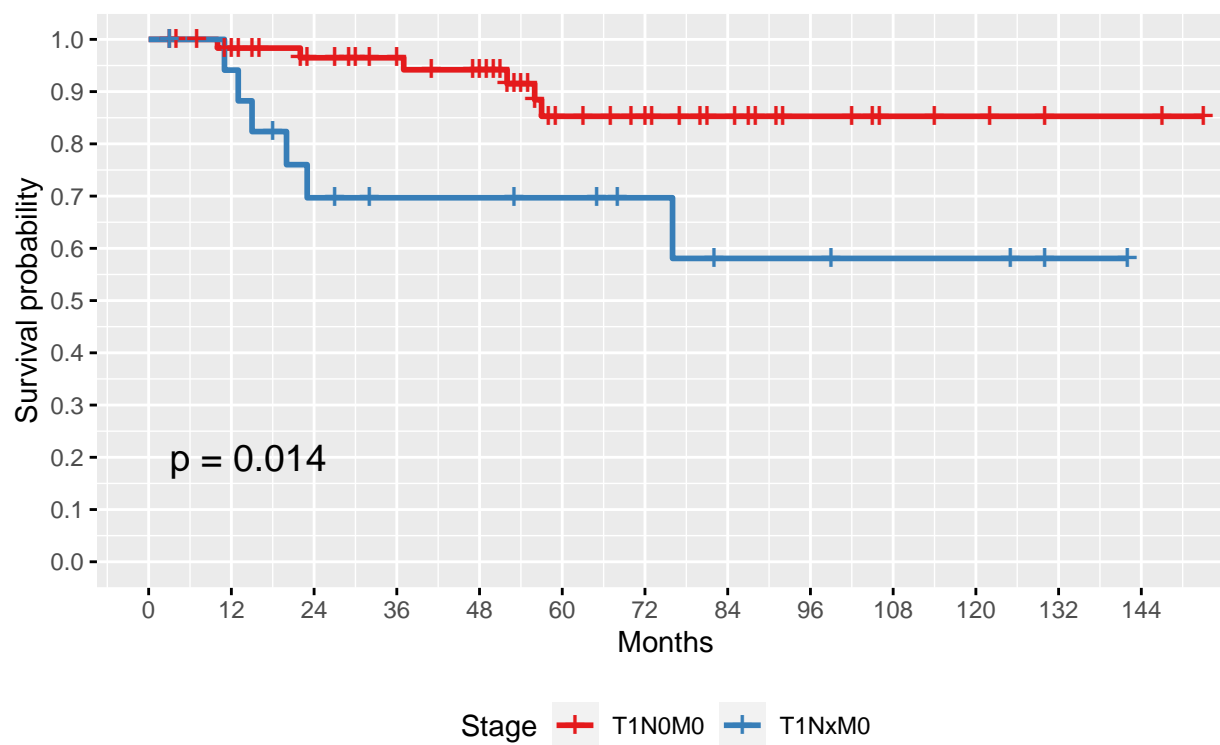
2.5 3 3.5 4 4.5 5 5.5 6

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Nodes_Pos, data = HGS.ES.White.Chemo)
##
##   n= 580, number of events= 82
##
##                  coef exp(coef) se(coef)      z Pr(>|z|)
## Nodes_PosUnk 1.1643    3.2036   0.2237 5.206 1.93e-07 ***
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
##              exp(coef) exp(-coef) lower .95 upper .95
## Nodes_PosUnk     3.204     0.3122     2.067     4.966
##
## Concordance= 0.637  (se = 0.028 )
## Likelihood ratio test= 24.43  on 1 df,   p=8e-07
## Wald test            = 27.1  on 1 df,   p=2e-07
## Score (logrank) test = 30.28  on 1 df,   p=4e-08
```

Hispanic Race

Survival of Hispanic early stage HGSOC patients that received chemotherapy stratified by Stage

p = 0.014

Stage — T1N0M0 — T1NxM0

Positive Nodes	Count
No	63
Unk	18

Hazard ratio

Nodes_Pos	No (N=63)	reference	
	Unk (N=18)	3.7 (1.2 – 12)	0.022 *

Events: 12; Global p–value (Log–Rank): 0.027277
AIC: 92.6; Concordance Index: 0.67
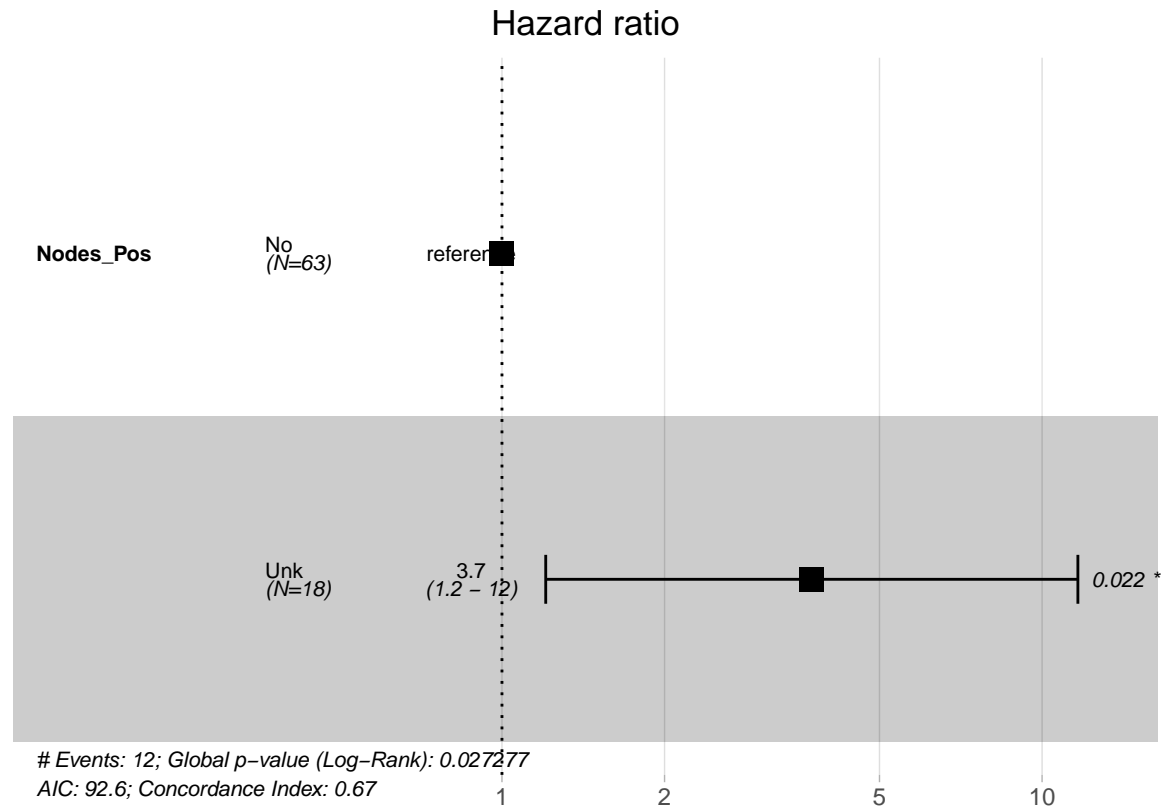
```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Nodes_Pos, data = HGS.ES.Hisp.Chemo)
##
##   n= 81, number of events= 12
##
##                coef exp(coef) se(coef)     z Pr(>|z|)
## Nodes_PosUnk 1.3209    3.7468   0.5787 2.282   0.0225 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##              exp(coef) exp(-coef) lower .95 upper .95
## Nodes_PosUnk     3.747     0.2669     1.205     11.65
##
## Concordance= 0.67  (se = 0.074 )
## Likelihood ratio test= 4.87  on 1 df,   p=0.03
## Wald test            = 5.21  on 1 df,   p=0.02
## Score (logrank) test = 6  on 1 df,   p=0.01
```

Does use of chemotherapy matter by stage for each race?

Black Race

Survival of Black T1N0M0 patients stratified by receipt of chemotherapy

p = 0.62

Chemotherapy received   —+— No/Unknown   —+— Yes

Chemotherapy received	Count
No/Unknown	15
Yes	28

Hazard ratio

Chemo	No/Unknown (N=15)	reference		
	Yes (N=28)	0.72 (0.19 – 2.7)		0.626

Events: 9; Global p–value (Log–Rank): 0.62889
AIC: 58.68; Concordance Index: 0.56

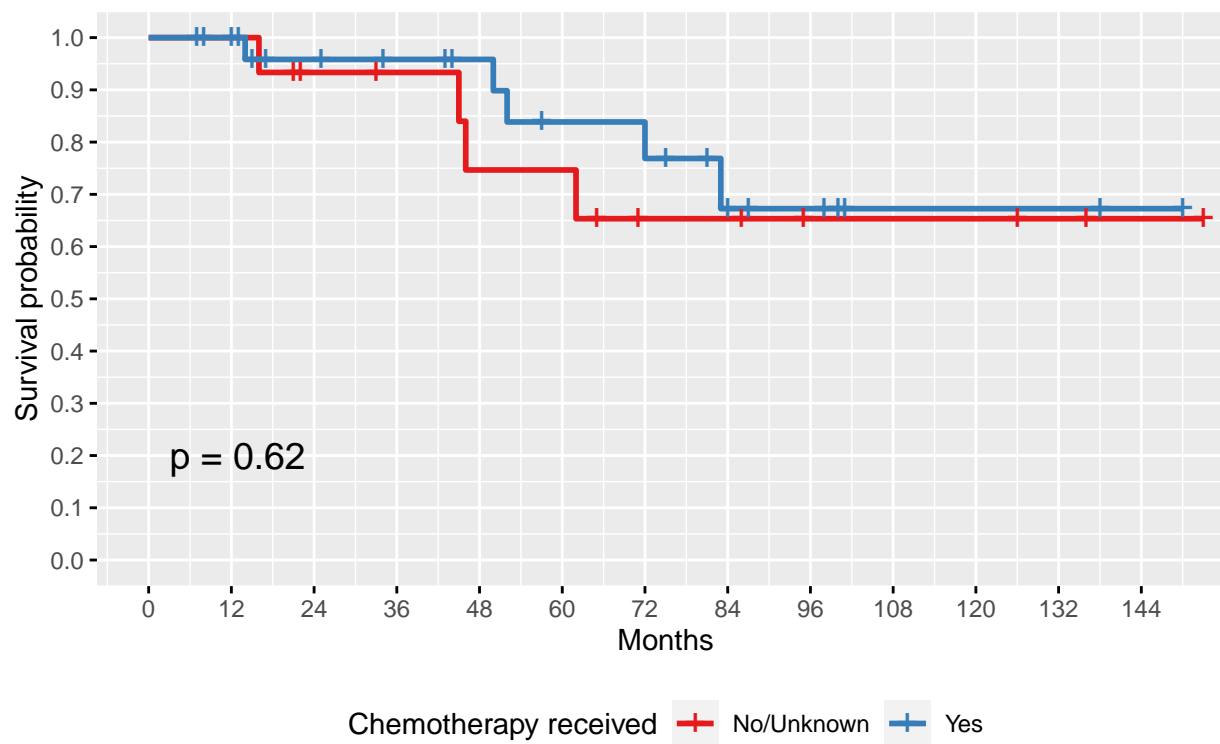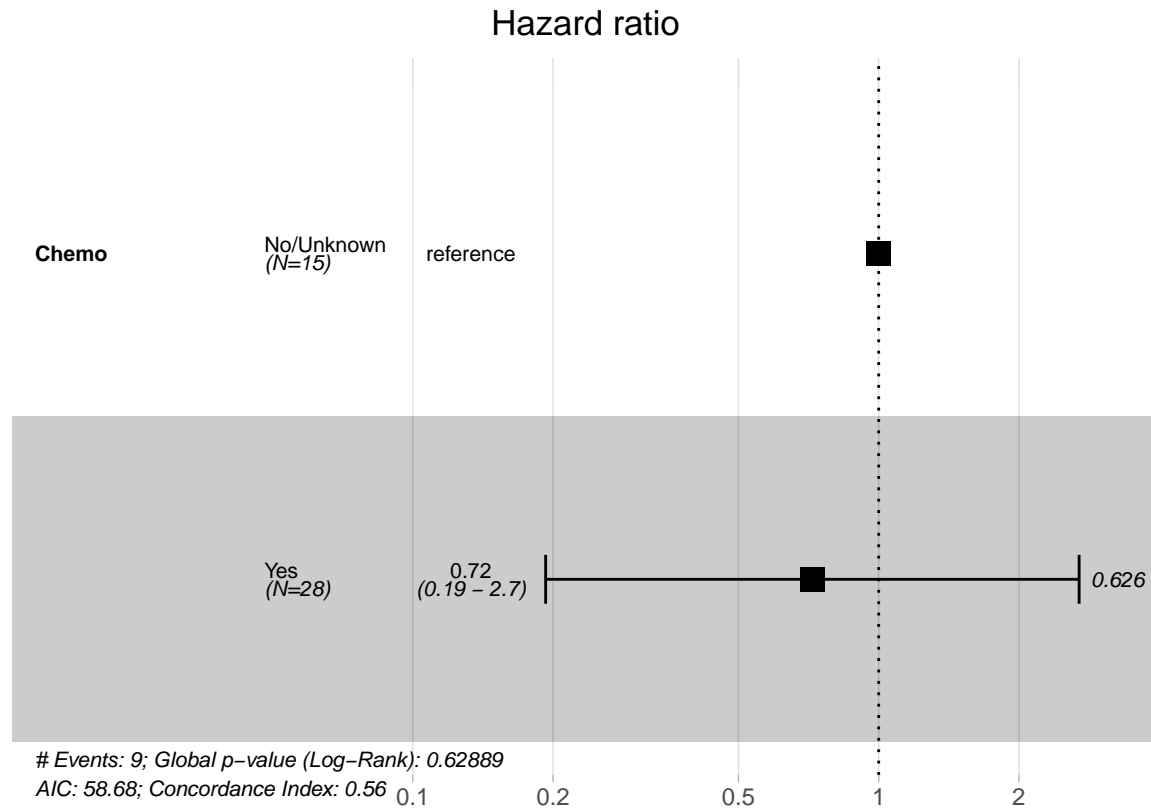0.1   0.2   0.5   1   2

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.Black.N0)
##
##   n= 43, number of events= 9
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## ChemoYes -0.3277    0.7206   0.6726 -0.487    0.626
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes    0.7206      1.388    0.1928     2.693
##
## Concordance= 0.558  (se = 0.089 )
## Likelihood ratio test= 0.23  on 1 df,   p=0.6
## Wald test            = 0.24  on 1 df,   p=0.6
## Score (logrank) test = 0.24  on 1 df,   p=0.6
```

Survival of Black T1NxM0 patients stratified by receipt of chemotherapy

p = 0.37

Chemotherapy received ─┼─ No/Unknown ─┼─ Yes
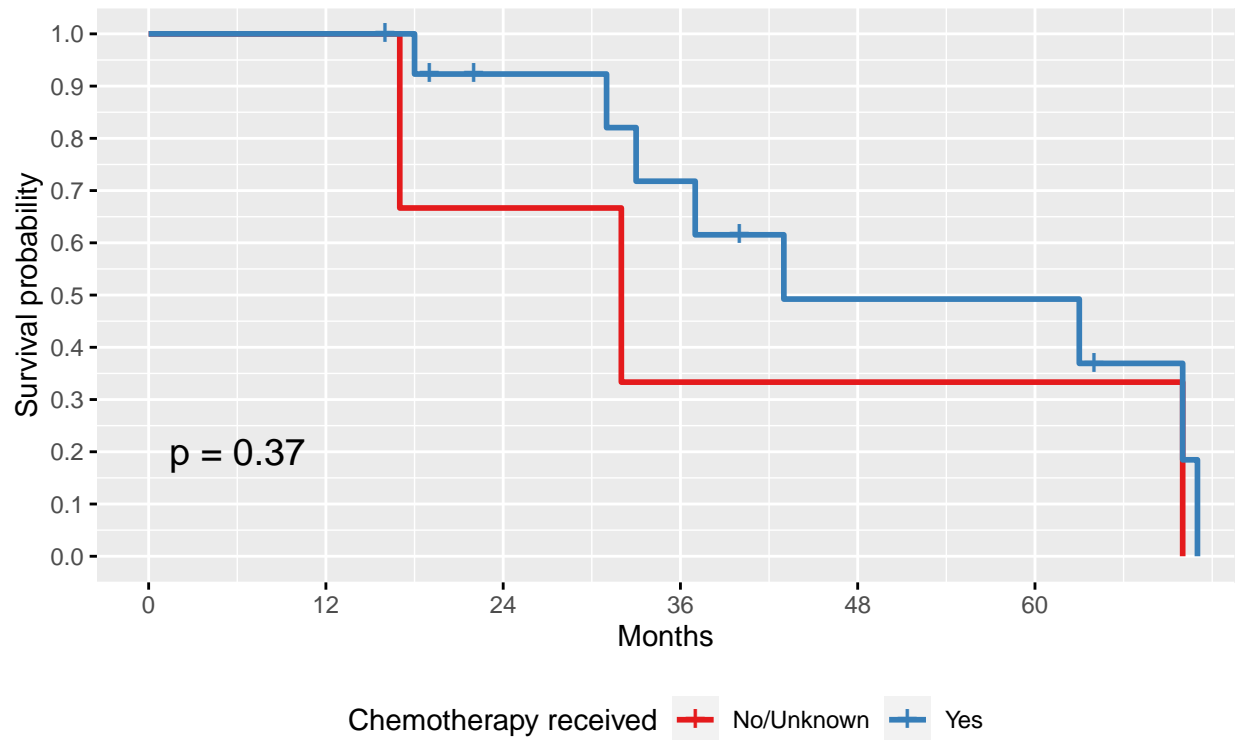
Chemotherapy received	Count
No/Unknown	3
Yes	14

Hazard ratio

Chemo	No/Unknown (N=3)	reference	
	Yes (N=14)	0.53 (0.13 − 2.1)	0.37

Events: 11; Global p−value (Log−Rank): 0.39164
AIC: 40.57; Concordance Index: 0.59

0.1   0.2   0.5   1   2
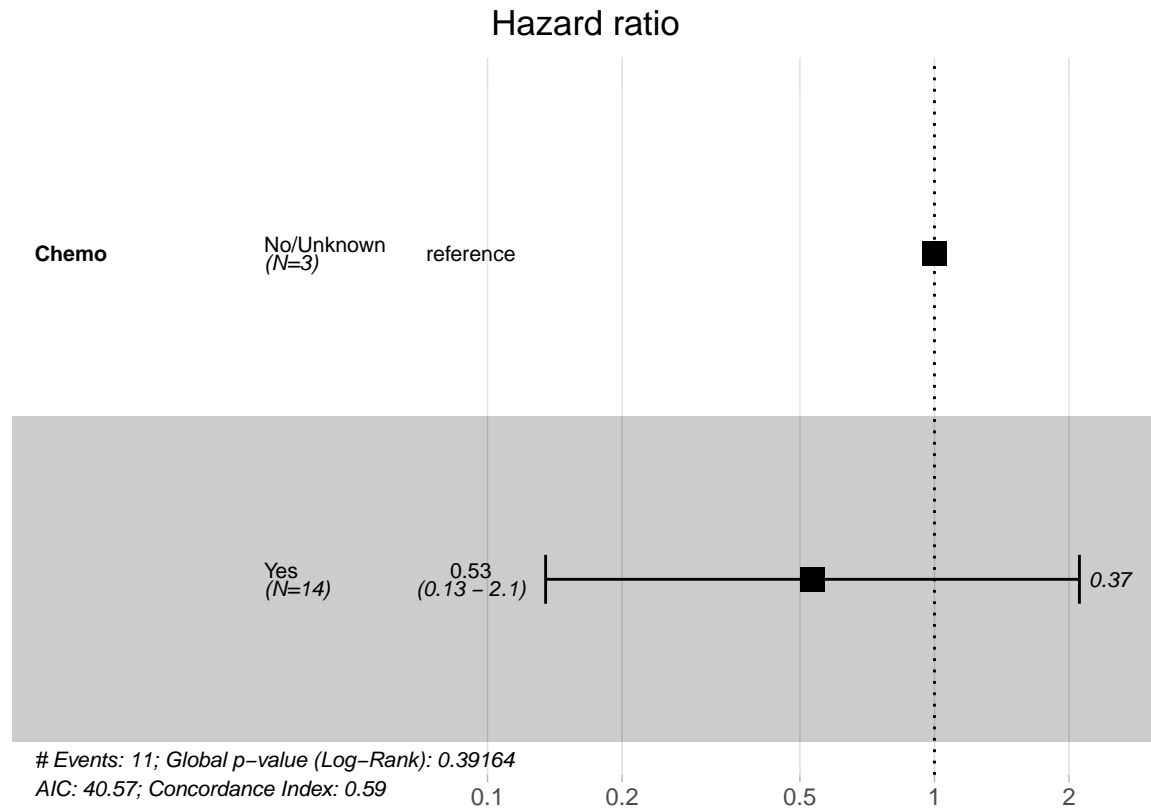
```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.Black.Nx)
##
##   n= 17, number of events= 11
##
##            coef exp(coef) se(coef)       z Pr(>|z|)
## ChemoYes -0.6283    0.5335   0.7016 -0.896     0.37
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes    0.5335      1.874    0.1349      2.11
##
## Concordance= 0.595  (se = 0.095 )
## Likelihood ratio test= 0.73  on 1 df,    p=0.4
## Wald test            = 0.8  on 1 df,   p=0.4
## Score (logrank) test = 0.83  on 1 df,    p=0.4
```

White Race

Survival of White T1N0M0 patients stratified by receipt of chemotherapy

p = 0.13

Chemotherapy received ┼ No/Unknown ┼ Yes
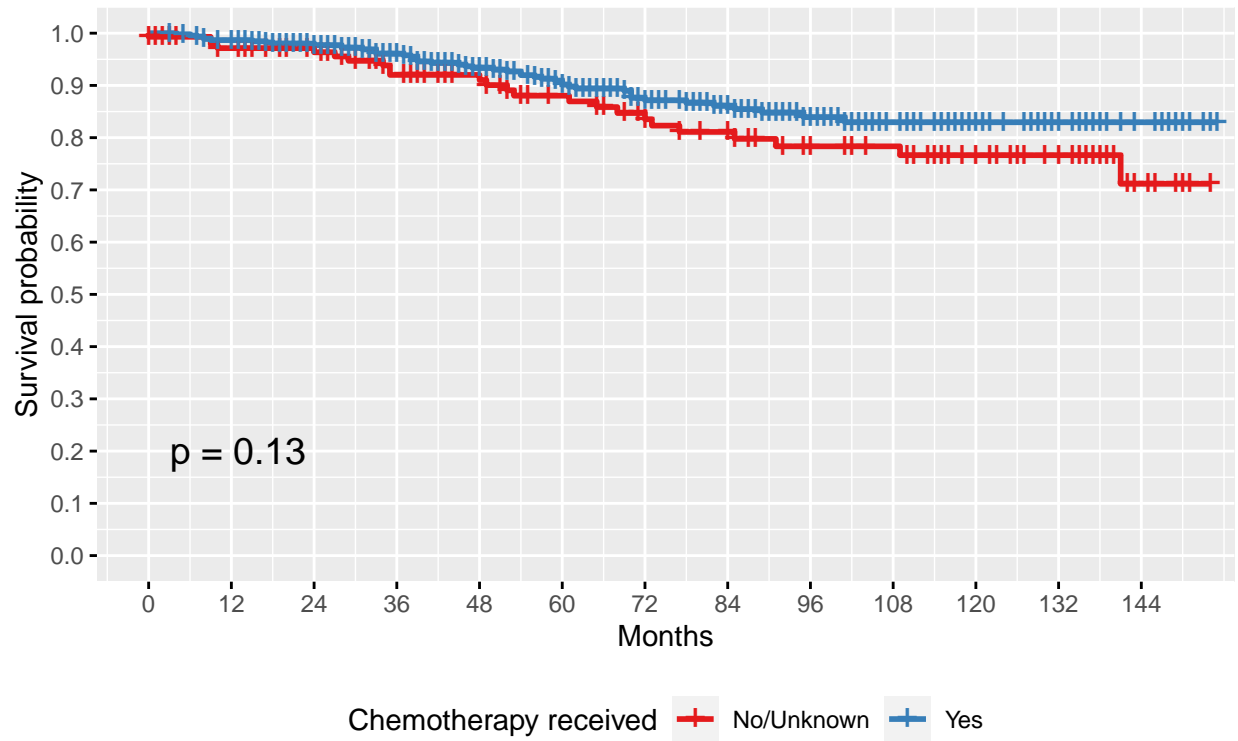
Chemotherapy received	Count
No/Unknown	144
Yes	454

Hazard ratio

Chemo	No/Unknown (N=144)	reference	
	Yes (N=454)	0.68 (0.42 – 1.1)	0.129

 # Events: 71; Global p–value (Log–Rank): 0.13766
AIC: 831.87; Concordance Index: 0.54

0.4   0.5   0.6   0.7   0.8   0.9   1   1.1
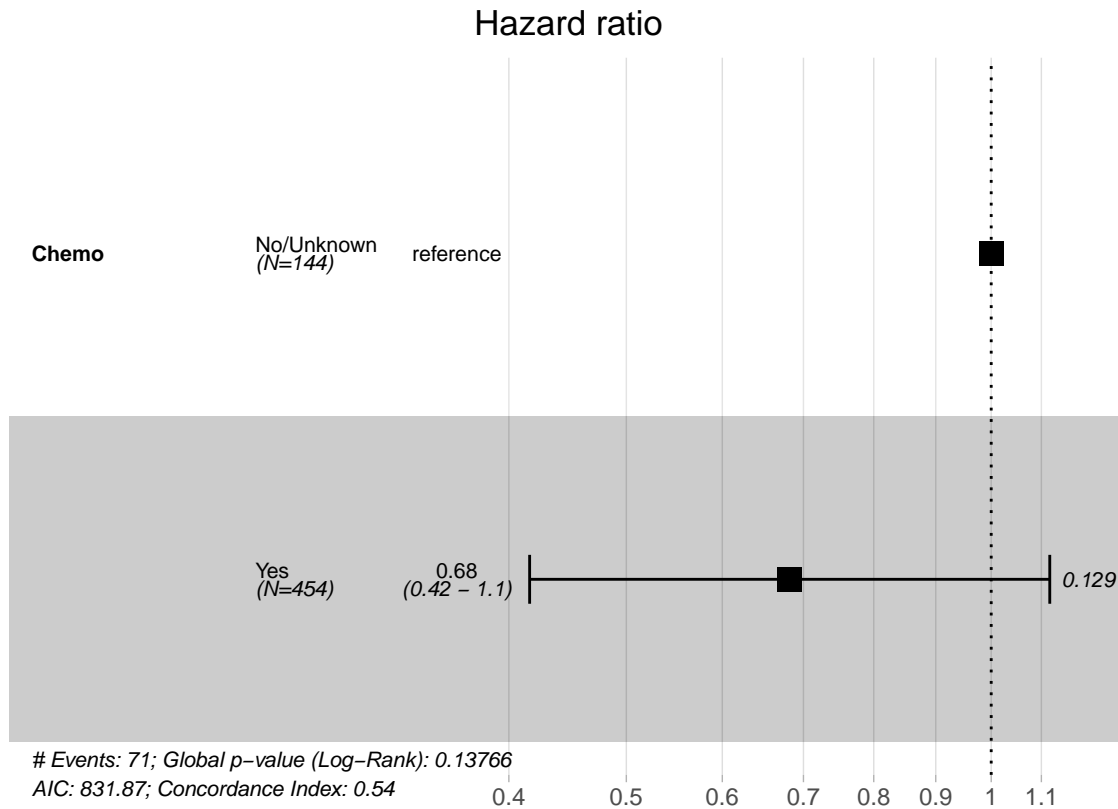
```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.White.N0)
##
##   n= 598, number of events= 71
##
##             coef exp(coef) se(coef)      z Pr(>|z|)
## ChemoYes -0.3828    0.6820   0.2521 -1.519    0.129
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes     0.682      1.466    0.4161     1.118
##
## Concordance= 0.538  (se = 0.029 )
## Likelihood ratio test= 2.2  on 1 df,   p=0.1
## Wald test            = 2.31  on 1 df,   p=0.1
## Score (logrank) test = 2.33  on 1 df,   p=0.1
```

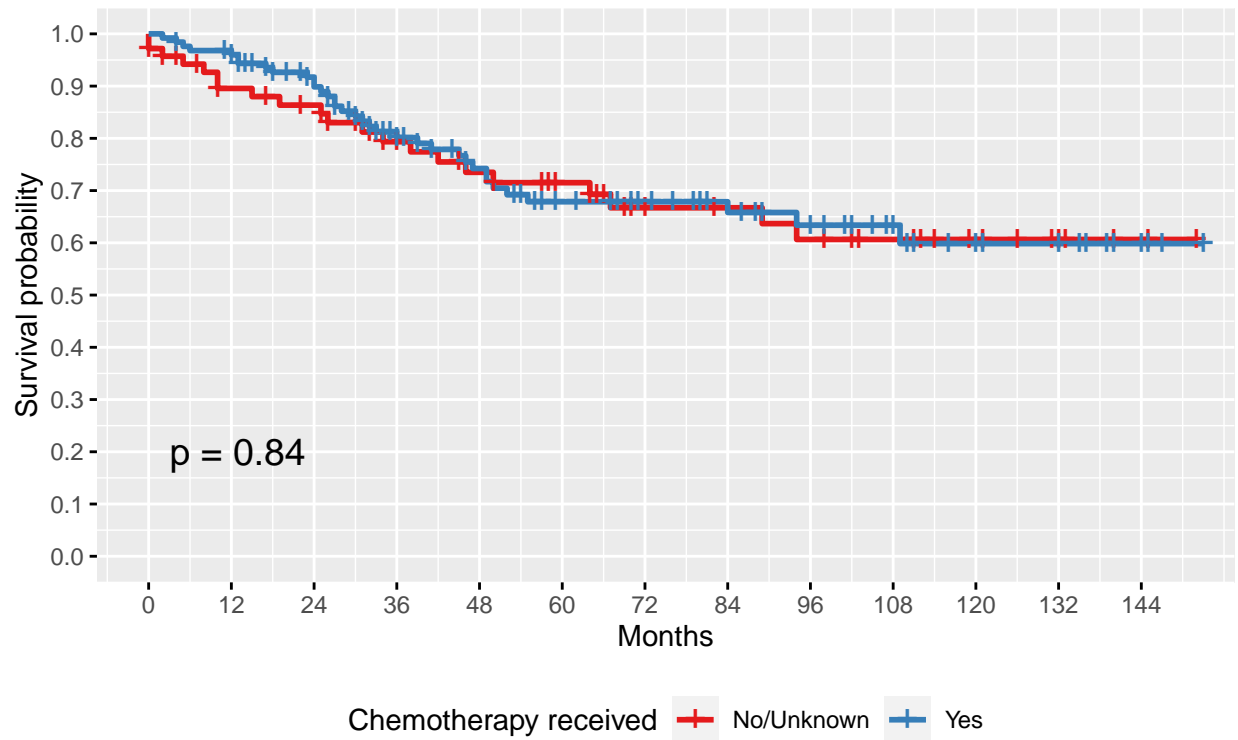## Survival of White T1NxM0 patients stratified by receipt of chemotherapy

p = 0.84

Chemotherapy received ┼ No/Unknown ┼ Yes

Chemotherapy received	Count
No/Unknown	71
Yes	126

Hazard ratio

Chemo	No/Unknown (N=71)	reference	
	Yes (N=126)	0.95 (0.55 – 1.6)	0.841

 # Events: 56; Global p-value (Log-Rank): 0.84175
AIC: 540.66; Concordance Index: 0.52

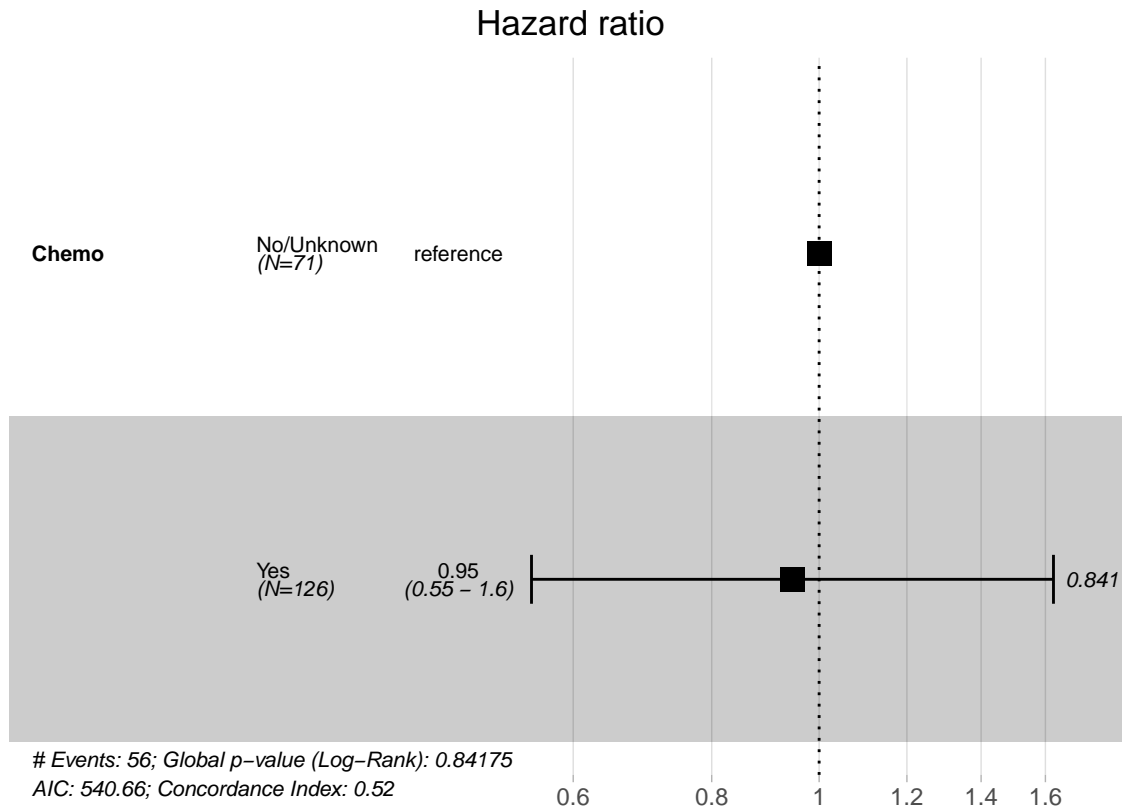0.6   0.8   1   1.2   1.4   1.6

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.White.Nx)
##
##   n= 197, number of events= 56
##
##              coef exp(coef) se(coef)     z Pr(>|z|)
## ChemoYes -0.05535   0.94615  0.27660 -0.2    0.841
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes    0.9461      1.057    0.5502     1.627
##
## Concordance= 0.516  (se = 0.035 )
## Likelihood ratio test= 0.04  on 1 df,   p=0.8
## Wald test            = 0.04  on 1 df,   p=0.8
## Score (logrank) test = 0.04  on 1 df,   p=0.8
```

Hispanic

Survival of Hispanic T1N0M0 patients stratified by receipt of chemotherapy
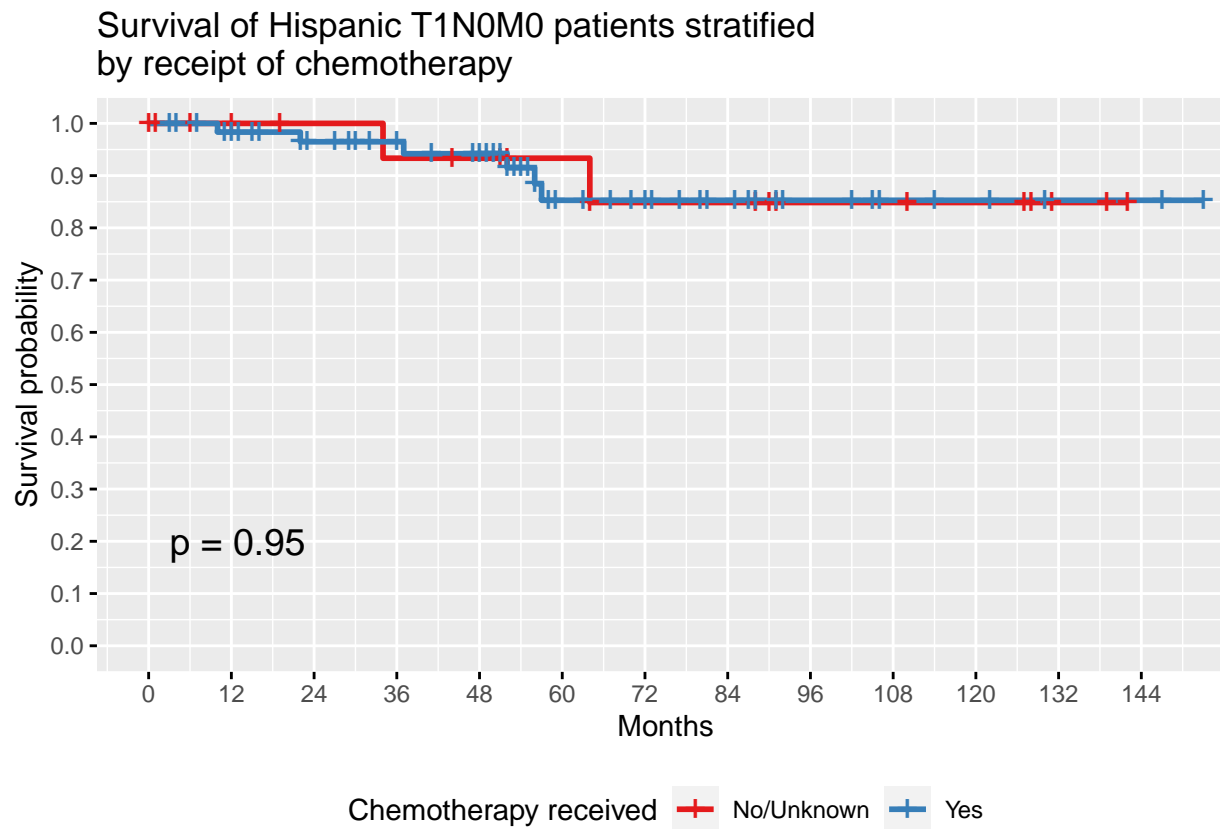
Chemotherapy received	Count
No/Unknown	20
Yes	63

Hazard ratio

Chemo	No/Unknown (N=20)	reference	
	Yes (N=63)	1.1 (0.21 – 5.2)	0.952

 # Events: 8; Global p–value (Log–Rank): 0.95157
AIC: 64.84; Concordance Index: 0.52

```
0.1        0.2        0.5        1        2        5
```
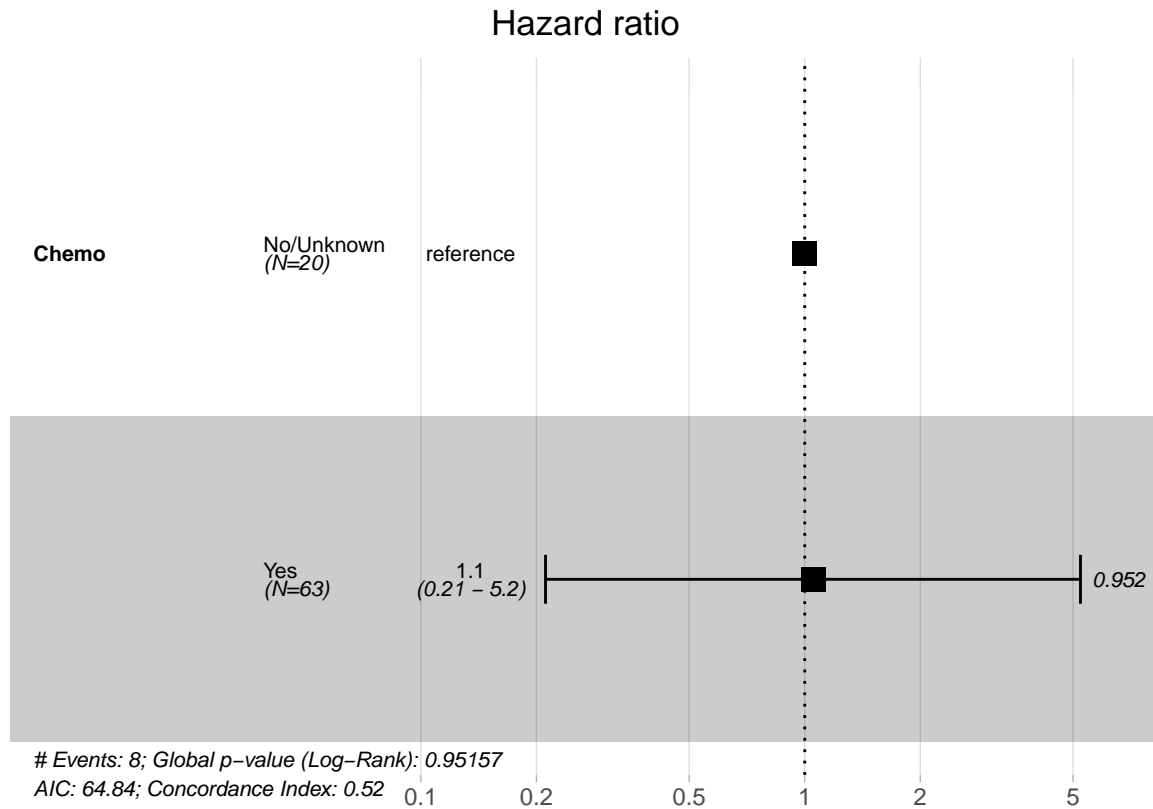
```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.Hisp.NO)
##
##   n= 83, number of events= 8
##
##            coef exp(coef) se(coef)    z Pr(>|z|)
## ChemoYes 0.04951   1.05076  0.81854 0.06    0.952
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes     1.051     0.9517    0.2112     5.227
##
## Concordance= 0.516  (se = 0.072 )
## Likelihood ratio test= 0  on 1 df,   p=1
## Wald test            = 0  on 1 df,   p=1
## Score (logrank) test = 0  on 1 df,   p=1
```

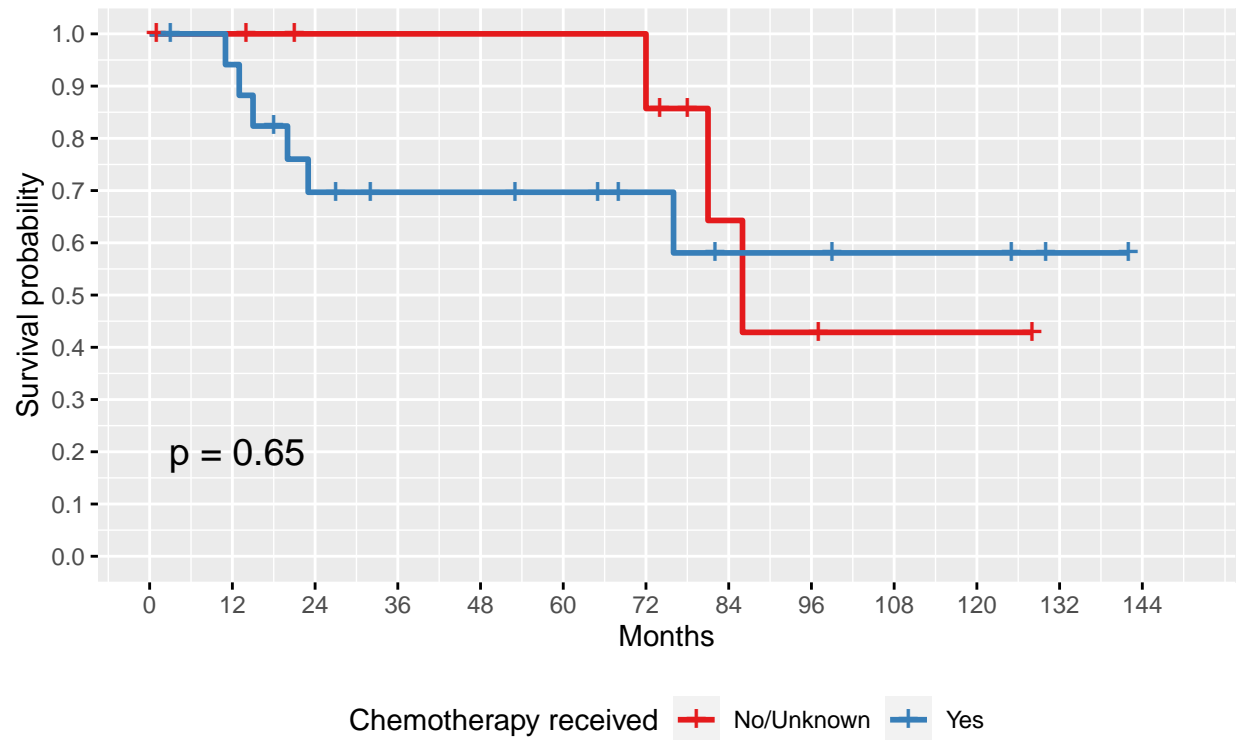## Survival of Hispanic T1NxM0 patients stratified by receipt of chemotherapy

p = 0.65

Chemotherapy received ── No/Unknown ── Yes

Chemotherapy received	Count
No/Unknown	10
Yes	18

Hazard ratio

Chemo	No/Unknown *(N=10)*	reference	
	Yes *(N=18)*	1.4 *(0.34 – 5.6)*	*0.649*

 # Events: 9; Global p–value (Log–Rank): 0.64346
AIC: 51.2; Concordance Index: 0.61
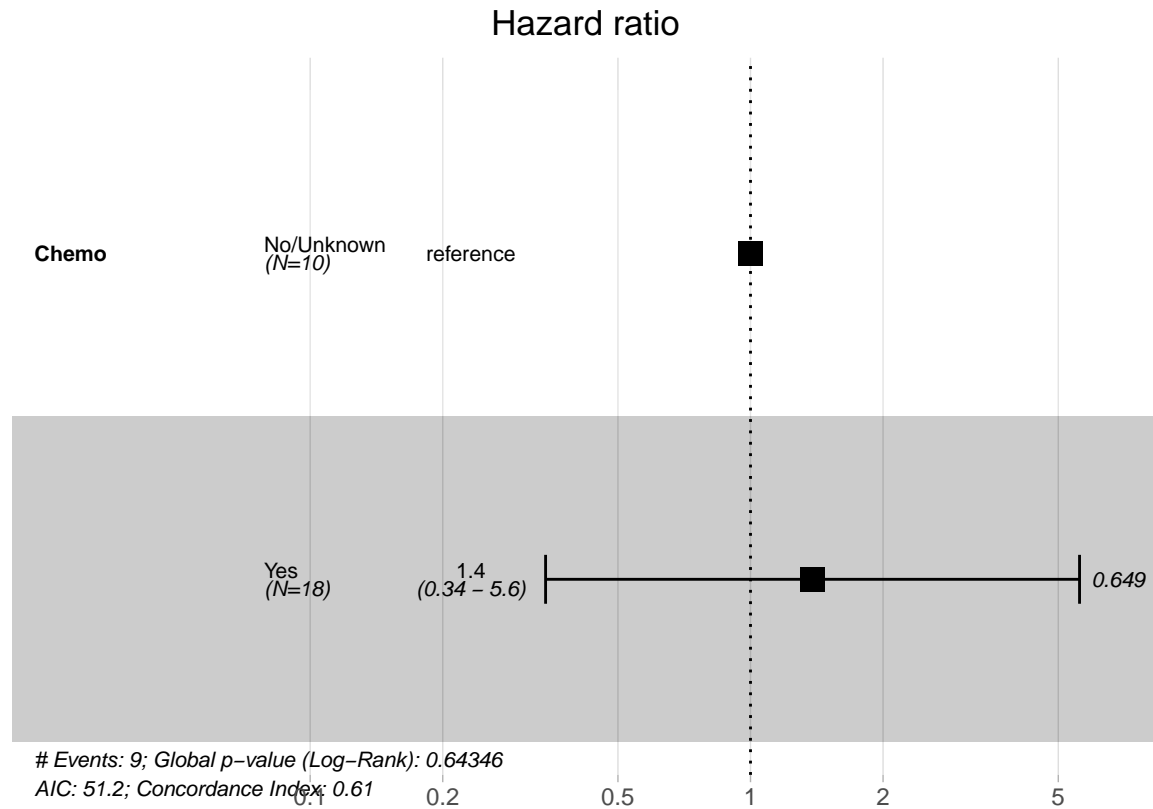
0.1   0.2   0.5   1   2   5

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ Chemo, data = HGS.Hisp.Nx)
##
##   n= 28, number of events= 9
##
##            coef exp(coef) se(coef)      z Pr(>|z|)
## ChemoYes 0.3245    1.3834   0.7123 0.456    0.649
##
##          exp(coef) exp(-coef) lower .95 upper .95
## ChemoYes     1.383     0.7229    0.3425     5.587
##
## Concordance= 0.607  (se = 0.057 )
## Likelihood ratio test= 0.21  on 1 df,   p=0.6
## Wald test            = 0.21  on 1 df,   p=0.6
## Score (logrank) test = 0.21  on 1 df,   p=0.6
```

Overall CoxPH and Forest plot

Hazard ratio

TNM.Stage	T1N0M0 (N=789)	reference	
	T1NxM0 (N=263)	3.18 (2.25 – 4.5)	<0.001 ***
Lat	Bilateral (N=281)	reference	
	Left (N=380)	0.85 (0.58 – 1.2)	0.387
	Right (N=381)	0.92 (0.63 – 1.3)	0.665
	Unknown (N=10)	1.13 (0.40 – 3.2)	0.821
Chemo	No/Unknown (N=293)	reference	
	Yes (N=759)	0.86 (0.63 – 1.2)	0.338
Race.Group	White (N=795)	reference	
	Hispanic (N=111)	0.99 (0.60 – 1.7)	0.982
	Black (N=60)	2.53 (1.57 – 4.1)	<0.001 ***
	Other (N=86)	1.00 (0.56 – 1.8)	0.995
LND	Adequate (N=513)	reference	
	Inadequate (N=276)	1.22 (0.81 – 1.8)	0.346
	None (N=263)	reference	

 # Events: 177; Global p–value (Log–Rank): 3.5327e–10
AIC: 2238.56; Concordance Index: 0.67

Hazard ratio axis: 0.5 1 2 5

```
## Call:
## coxph(formula = Surv(SurvMonths, COD) ~ TNM.Stage + Lat + Chemo +
##     Race.Group + LND, data = HGS.ES)
##
##   n= 1052, number of events= 177
##
##                         coef exp(coef)  se(coef)      z Pr(>|z|)
## TNM.StageT1NxM0     1.158405  3.184850  0.176442  6.565 5.19e-11 ***
## LatLeft            -0.164370  0.848428  0.189861 -0.866 0.386635
## LatRight           -0.083209  0.920159  0.191995 -0.433 0.664732
## LatUnknown          0.118951  1.126314  0.526900  0.226 0.821392
## ChemoYes           -0.153641  0.857580  0.160357 -0.958 0.338002
## Race.GroupHispanic -0.005811  0.994206  0.259451 -0.022 0.982132
## Race.GroupBlack     0.927706  2.528703  0.243005  3.818 0.000135 ***
## Race.GroupOther    -0.001817  0.998185  0.294047 -0.006 0.995070
## LNDInadequate       0.195856  1.216351  0.207715  0.943 0.345729
## LNDNone                   NA        NA  0.000000     NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##                 exp(coef) exp(-coef) lower .95 upper .95
## TNM.StageT1NxM0    3.1848     0.3140    2.2537     4.501
## LatLeft            0.8484     1.1787    0.5848     1.231
```

```
## LatRight                 0.9202     1.0868     0.6316     1.341
## LatUnknown               1.1263     0.8879     0.4010     3.163
## ChemoYes                 0.8576     1.1661     0.6263     1.174
## Race.GroupHispanic       0.9942     1.0058     0.5979     1.653
## Race.GroupBlack          2.5287     0.3955     1.5705     4.071
## Race.GroupOther          0.9982     1.0018     0.5609     1.776
## LNDInadequate            1.2164     0.8221     0.8096     1.828
## LNDNone                      NA         NA         NA        NA
##
## Concordance= 0.667  (se = 0.021 )
## Likelihood ratio test= 63  on 9 df,   p=4e-10
## Wald test            = 68.56  on 9 df,   p=3e-11
## Score (logrank) test = 75.54  on 9 df,   p=1e-12


##               chisq df      p
## TNM.Stage    4.6037  1  0.032
## Lat          3.6356  3  0.304
## Chemo        0.0854  1  0.770
## Race.Group   4.3033  3  0.231
## LND          0.8886  1  0.346
## GLOBAL      17.6237  9  0.040
```


Global Schoenfeld Test p: 0.0398