

Task_3_report

November 14, 2025

```
[46]: # a first look at the data
head(data)
summary(data)
```

	X <int>	ID <int>	TreatmentGroup <chr>	Age <int>	Sex <chr>	ECOG_PS <int>	GFR <int>	Time <dbl>	Event <dbl>
A data.frame: 6 × 9	1	1	Treatment	73	Female	2	83	0.6	1
	2	2	Treatment	62	Male	0	86	6.3	1
	3	3	Treatment	61	Female	0	98	57.7	0
	4	4	Treatment	66	Male	1	58	0.7	1
	5	5	Treatment	88	Female	0	120	30.7	0
	6	6	Treatment	73	Male	0	55	6.5	1

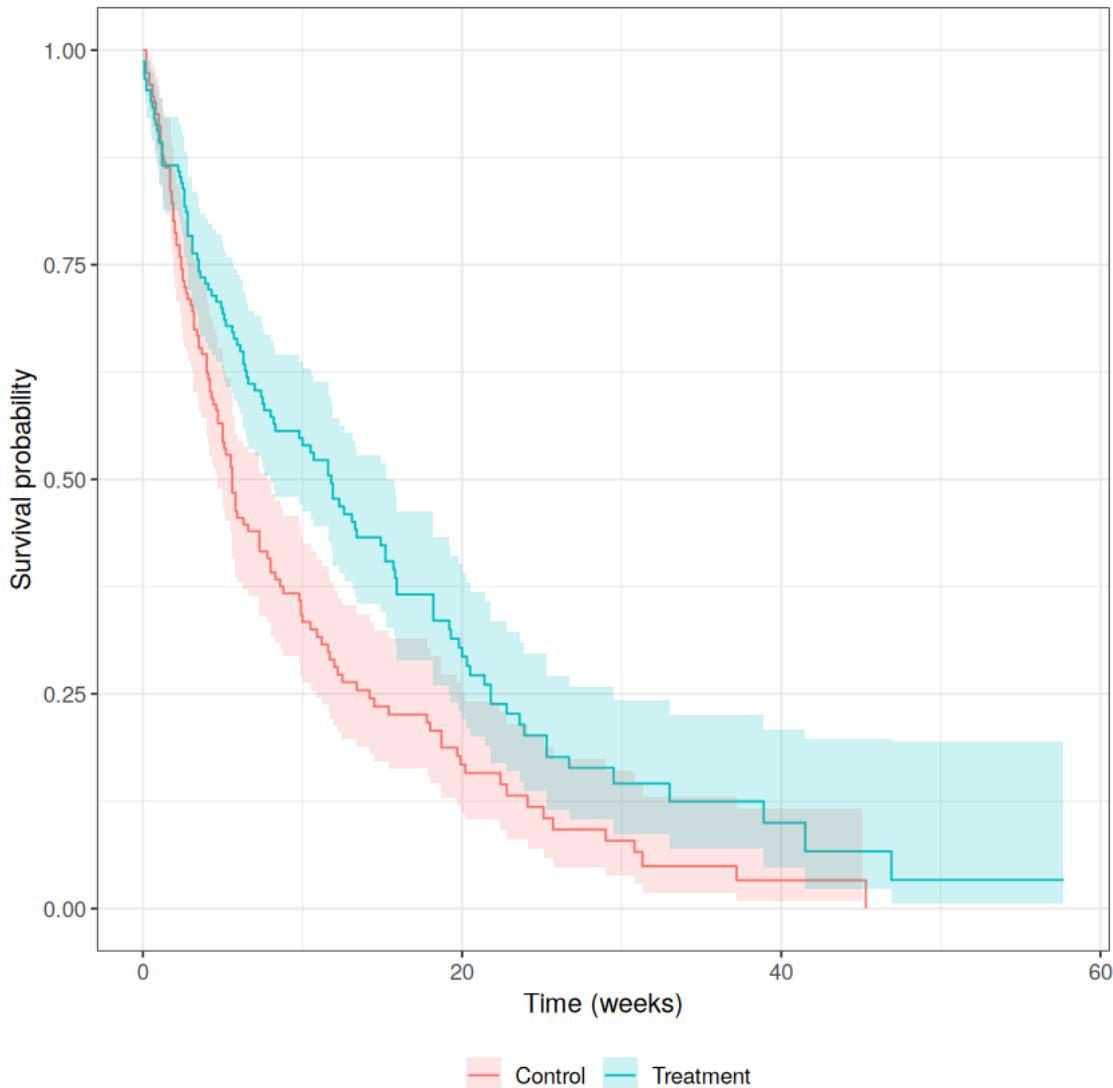
X	ID	TreatmentGroup	Age
Min. : 1.00	Min. : 1.00	Length:300	Min. :38.0
1st Qu.: 75.75	1st Qu.: 75.75	Class :character	1st Qu.:59.0
Median :150.50	Median :150.50	Mode :character	Median :65.0
Mean :150.50	Mean :150.50		Mean :65.3
3rd Qu.:225.25	3rd Qu.:225.25		3rd Qu.:72.0
Max. :300.00	Max. :300.00		Max. :91.0

Sex	ECOG_PS	GFR	Time
Length:300	Min. :0.0000	Min. : 30.00	Min. : 0.000
Class :character	1st Qu.:0.0000	1st Qu.: 66.00	1st Qu.: 2.600
Mode :character	Median :1.0000	Median : 81.00	Median : 5.900
	Mean :0.8167	Mean : 78.89	Mean : 9.673
	3rd Qu.:1.0000	3rd Qu.: 91.00	3rd Qu.:13.600
	Max. :2.0000	Max. :120.00	Max. :57.700

Event
Min. :0.00
1st Qu.:1.00
Median :1.00
Mean :0.76
3rd Qu.:1.00
Max. :1.00

From the visual graphs we can observe quite a even split between the control and treatment group, further more the number of male are more in number making the data is skewed. For GFR, Age the data distribution look quite normal but time distribution is heavily left skewed.

```
[57]: # Kaplan-Meier survival curves with confidence intervals by treatment group
survfit2(Surv(Time, Event) ~ TreatmentGroup, data = data) |>
  ggsurvfit() +
  labs(
    x = "Time (weeks)",
    y = "Survival probability"
  ) +
  add_confidence_interval() #+
# add_risktable()
```



```
[68]: summary(survfit2(Surv(Time, Event) ~ TreatmentGroup, data = data), times = 5)
```

Call: survfit(formula = Surv(Time, Event) ~ TreatmentGroup, data = data)

TreatmentGroup=Control						
time	n.risk	n.event	survival	std.err	lower	95% CI
5.000	77.000	65.000	0.543	0.042	0.467	
upper 95% CI						
0.632						
TreatmentGroup=Treatment						
time	n.risk	n.event	survival	std.err	lower	95% CI
5.0000	99.0000	45.0000	0.6927	0.0382	0.6217	
upper 95% CI						
0.7718						

We are using Kaplan-Meier survival modeling here, a thing to observe here the early treatment for first 4 weeks we can see the control group having better survival odds but with increasing time the treatment shows effect and we can see uplift of the treatment course.

Can be observed in the graphs.

```
[53]: # Fit the Cox PH model
cox_model <- coxph(Surv(Time, Event) ~ TreatmentGroup + Age + Sex + ECOG_PS + GFR, data = data)

# Summarize the model
summary(cox_model)
```

Call:

```
coxph(formula = Surv(Time, Event) ~ TreatmentGroup + Age + Sex +
    ECOG_PS + GFR, data = data)
```

```
n= 300, number of events= 228
```

	coef	exp(coef)	se(coef)	z	Pr(> z)
TreatmentGroupTreatment	-0.525216	0.591428	0.138716	-3.786	0.000153 ***
Age	-0.010326	0.989727	0.006697	-1.542	0.123080
SexMale	-0.086113	0.917490	0.137160	-0.628	0.530115
ECOG_PS	0.444375	1.559514	0.091175	4.874	1.09e-06 ***
GFR	-0.013653	0.986439	0.003674	-3.716	0.000202 ***

Signif. codes:	0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1				

	exp(coef)	exp(-coef)	lower .95	upper .95
TreatmentGroupTreatment	0.5914	1.6908	0.4506	0.7762
Age	0.9897	1.0104	0.9768	1.0028
SexMale	0.9175	1.0899	0.7012	1.2005
ECOG_PS	1.5595	0.6412	1.3043	1.8647
GFR	0.9864	1.0137	0.9794	0.9936

```

Concordance= 0.646  (se = 0.019 )
Likelihood ratio test= 54.07  on 5 df,   p=2e-10
Wald test            = 54.51  on 5 df,   p=2e-10
Score (logrank) test = 55.88  on 5 df,   p=9e-11

```

Key observations: After analyzing the $\Pr(>|z|)$, we find 3 factors to be significant - TreatmentGroup, ECOG_PS & GFR * TreatmentGroup = Treatment, P value is quite small and we can see there is a negative coefficient meaning there is an inverse correlation to the risk of death, meaning the person having the treatment has a higher chance of recovery and by $\exp(\text{coef})$ reduces it by 41% * ECOG_PS, p value is quite small and is significant furthermore it has a positive correlation and by looking at the $\exp(\text{coef})$ we can see it increases the chance of death. * GFR, is relevant due to the small p value, and has a negative relation i.e. 1 unit increase in GFR adds decreased risk by 1.4%.

[55]: # Extract the hazard ratios and 95% CI

```

hazard_ratios <- coef(cox_model)
conf_int <- confint(cox_model)

# Print the results
print(paste("Hazard Ratios and 95% CI:"))
print(hazard_ratios)
print(conf_int)

```

[1] "Hazard Ratios and 95% CI:"

TreatmentGroupTreatment	Age	SexMale
-0.52521603	-0.01032611	-0.08611317
ECOG_PS	GFR	
0.44437455	-0.01365335	
	2.5 %	97.5 %
TreatmentGroupTreatment	-0.79709423	-0.253337834
Age	-0.02345135	0.002799134
SexMale	-0.35494193	0.182715596
ECOG_PS	0.26567435	0.623074745
GFR	-0.02085457	-0.006452126

Looking at the HR ratios of the Cox PH model, we draw similar conclusions as before. Furthermore there are some slightly significant observations that can be drawn are being Male reduced the risk marginally or with age the risk goes down as well. But looking at the data imbalance we can see the data to be favoring men as well as higher ages.