

Assignment 2 – Brief solution

- Question 1 – fit a proportional hazards model
- Answer 1 – cut age into group as categorical variable -> create a survival object -> fit Cox model

	HR	95% CI	p-value
Age group			
0-6y	ref		
7-15y	0.66	(0.18, 2.40)	0.525
≥16y	1.25	(0.42, 3.74)	0.689
Flu type			
A	ref		
B	0.97	(0.45, 2.10)	0.942
Antibiotics	0.41	(0.17, 0.97)	0.042
Antiviral	1.17	(0.53, 2.59)	0.691
Antihistamine	0.52	(0.22, 1.23)	0.139

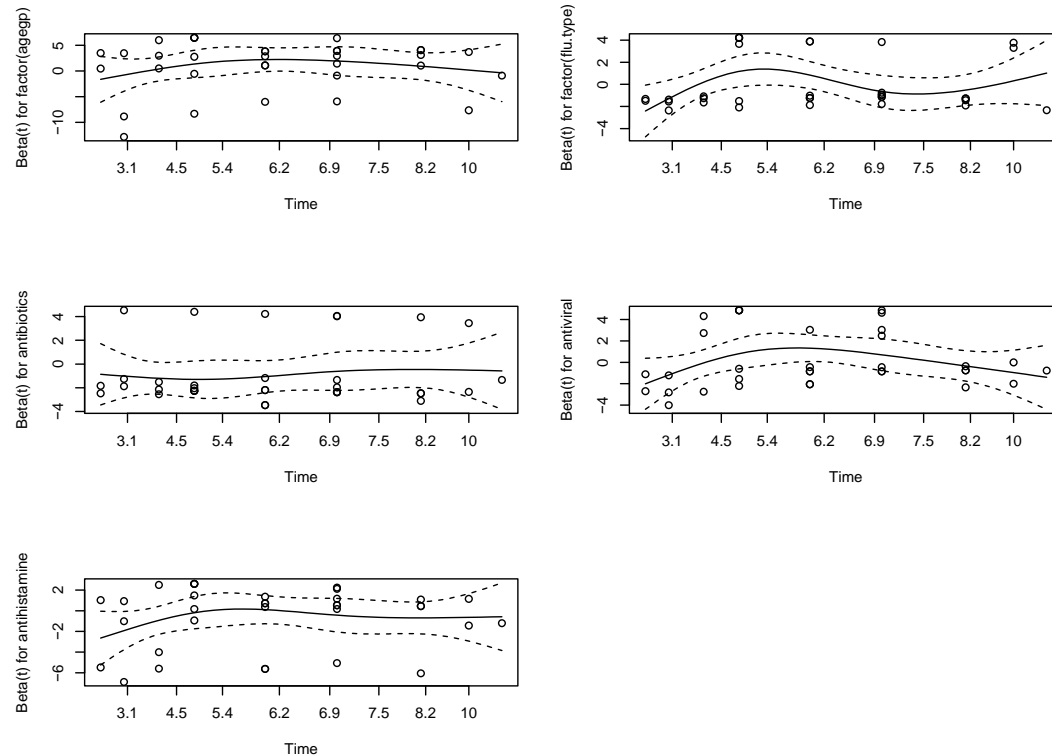
Questions and answers

- Question 2 – assess the proportional hazards assumption
- Answer 2 – the `cox.zph` function will test proportionality of all the predictors in the model by creating interactions with time. A p-value less than 0.05 indicates a violation of the proportionality assumption.

	chisq	p
Age group	2.9783	0.23
Flu type B	0.1351	0.71
Antibiotics	0.3639	0.55
Antiviral	0.0322	0.86
Aantihistamine	0.3260	0.57
GLOBAL	4.5086	0.61

Questions and answers

- Answer 2 – the function `cox.zph` also creates a `cox.zph` object that contains a list of the scaled Schoenfeld residuals. If the curve is flat and straight, the proportionality holds.



Questions and answers

- Question 3 – fit AFT models using 3 distributions.
- Answer 3 – function survreg specifying dist option.

	Lognormal	Weibull	Exponential
Age group			
0-6y	ref	ref	ref
7-15y	1.12 (0.58, 2.17)	1.28 (0.69, 2.36)	1.52 (0.42, 5.54)
≥16y	0.85 (0.47, 1.54)	0.92 (0.55, 1.55)	0.84 (0.28, 2.50)
Flu type			
A	ref	ref	ref
B	1.12 (0.75, 1.66)	1.02 (0.71, 1.48)	1.04 (0.48, 2.25)
Antibiotics	1.54 (1.02, 2.32)	1.54 (1.01, 2.35)	2.19 (0.94, 5.12)
Antiviral	0.96 (0.64, 1.43)	0.92 (0.63, 1.34)	0.92 (0.43, 2.00)
Antihistamine	1.51 (0.96, 2.36)	1.40 (0.93, 2.12)	1.70 (0.73, 3.92)

Questions and answers

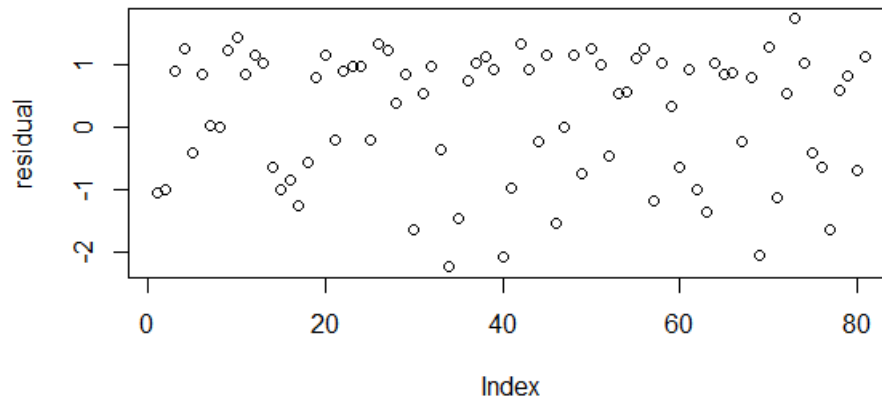
- Question 4 – AFT model selection
- Answer 4 – the model using lognormal distribution was selected with the lowest AIC

	df	AIC
Lognormal	8	256.4
Weibull	8	259.4
Exponential	7	275.2

Questions and answers

- Question 5 – assess the AFT model using lognormal distribution
- Answer 5 – the deviance residuals can be used as a measure of goodness of fit. If the fitted model is correct, these residuals are symmetrically distributed with expected value 0.

```
plot(residuals(flu.aft.lg, type='deviance'), ylab = "residual")
```



Questions and answers

- Question 6 – fit AFT model using interval censoring and 3 distribution
- Answer 6 – similar as question 3, function survreg specifying dist option. But need to set/create the event = 3, and change left censoring time to a small number.

	Lognormal	Weibull	Exponential
Age group			
0-6y	ref	ref	ref
7-15y	1.07 (0.71, 1.62)	1.11 (0.72, 1.70)	1.10 (0.46, 2.61)
≥16y	0.73 (0.50, 1.08)	0.67 (0.45, 0.99)	0.65 (0.30, 1.40)
Flu type			
A	ref	ref	ref
B	1.26 (0.97, 1.64)	1.17 (0.89, 1.53)	1.27 (0.74, 2.17)
Antibiotics	0.87 (0.67, 1.12)	0.94 (0.72, 1.23)	0.88 (0.53, 1.47)
Antiviral	0.97 (0.74, 1.27)	0.91 (0.69, 1.19)	0.92 (0.55, 1.56)
Antihistamine	1.05 (0.76, 1.46)	1.02 (0.73, 1.43)	1.03 (0.55, 1.93)

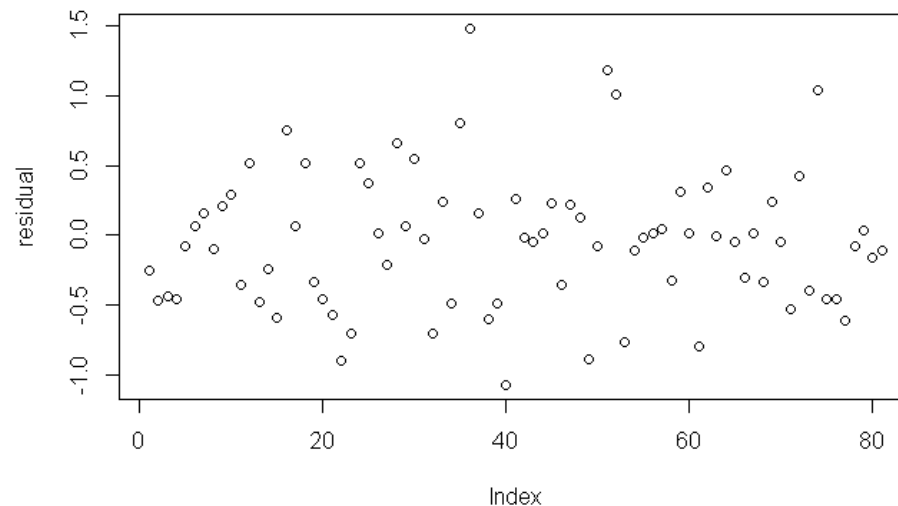
Questions and answers

- Question 7 – model selection
- Answer 7 – by comparing AIC of each model, the model with lognormal has the lowest AIC, suggesting the best model.

Model	df	AIC
Lognormal	8	164.7134
Weibull	8	176.6608
Exponential	7	218.1432

Questions and answers

- Question 8 – assess the model using lognormal distribution
- Answer 8 – plot the residuals, no obvious asymmetry identified.
(type='working' for residuals on the scale of the linear predictor to avoid error due to taking logarithm)
`plot(residuals(flu.int.lg, type="working"), ylab = "residual")`



Questions and answers

- Question 9 – conclusion
- Answer 9 – There was no significant different effect of age, flu type, antiviral and antihistamine prescription on time to symptom cessation, under the Cox regression and accelerated failure time models. However, antibiotics prescription was significantly associated with a longer time.
- There was no factor significantly associated with time to cessation of viral shedding.
- No evidence of poor fitting for the selected models.