

Exercise on survival analysis

Introduction

In the period 1962-77 205 patients had their tumor removed and were followed until 1977. At the end of 1977:

- 57 died of malignant melanoma (status=1)
- 134 were still alive (status=2)
- 14 died from other causes (status=3)

Purpose of this exercise it to study effect on survival of sex, age, thickness of tumor, ulceration. Data are in the file “melanom-surv.csv”, which contain the following variables:

- N: Patient id number.
- time: Time in days to event or end of follow-up; whatever came first.
- status: Event type indicator – see above.
- sex: Gender of the patient (2=male).
- ulc: Presence of ulceration (1=yes).
- thick: thickness of the tumor (in mm).
- age: Age at tumor removal.

Questions:

1. Compute cause specific hazard ratios (comparing male and female) as well as HR for overall survival. Provide an interpretation of both numbers.
2. Construct survival curves comparing male and female survival (that is overall survival not considering cause of death). Make the time-scale in years not days.
3. Try to include ulceration status, thickness and age at diagnose along with sex in a multiple Cox model for the overall survival. Examine if “thick” or its log-transform are most appropriate. Provide an interpretation of obtained estimates and compare with your answer in question 1.
4. Use the `cox.zph` function to assess the assumption of proportionality in the model from question 3.
5. (Extra – not mandatory) Repeat the analysis in question 3 using an Aalen additive hazard model.