Practical "Univariable survival analysis"
P8

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Exercise 1 Dataset `bromo.sav` is an example of an animal tumorigenicity study. In those studies, animals (rats, mice) are exposed at different doses and followed until death or end of study. Subjects alive at the end of the study are terminally sacrificed. All subjects are necropsied at death. This dataset includes the data of the US National Toxicology Program (NTP) long-term study on 1-bromopropane (1-BP), a new solvent effective in dissolving fats, waxes and resins. It is used in the furniture and the dry cleaning industry, and is considered as possible replacement for other organic solvents that damage the ozone layer in the upper atmosphere. Case reports demonstrate neurotoxic, reproductive, development and other health effects in workers who use or make 1-BP. The dataset includes 50 mice of each gender exposed to four levels of 1-BP (0, 125, 250, 500 ppm) and followed until death over two years (with no interim sacrifices). Variables are

- `sex`: gender (0=female, 1=male)

- `dose`: dose of 1-bromopropane in ppm

- `event`: event indicator (1=death, 0=censored)

- `time`: time to death or end of study (730 days for males, 729 for females)

- `count`: frequency of observation

(a) How many events occur in each dose group, by gender.
   SPSS tip: Tell SPSS about the frequency with which each record occurred by clicking Data – Weight Cases and selecting the appropriate variable. Then click Analyze – Descriptive Statistics - Crosstabs and fill in the form.

(b) Determine the range of follow-up time.
   SPSS tip: Click Analyze – Descriptive Statistics – Descriptives and fill in the form.

(c) Prepare Kaplan-Meier curves for survival and one minus survival by gender and compare gender-specific survival times. Do male mice have a longer survival than female mice?
   SPSS tip: Click Analyze – Survival – Kaplan-Meier and fill in the form. Under Compare Factors, request a logrank test. Under Options, request a survival plot.

(d) Evaluate whether survival times differ by dose group and whether the association is confounded by gender.
   SPSS tip: Click Analyze – Survival – Kaplan-Meier and fill in the form. Under Compare Factors, request a logrank test. Under Options, request a survival plot. Do this again and add gender as stratification variable.

(e) Is demonstrating heterogeneity of survival among dose groups sufficient for a causal interpretation? How can the ordinal scale of the dose categories be used to make the statistical analysis more efficient? What is the conclusion from such an analysis?
   SPSS tip: As before, but request a linear trend test under Compare Factors. Use sensible scores to represent each category such as 0, 1, 2, 3 or 0, 125, 250, 500.