PhD Course in Basic Biostatistics
Exam (J.nr.: 1050/21)

Practical information

Submission options and deadline

Individual solutions should be handed in as a single pdf-file by email to the following email-address:

BBEKSAMEN@BIOSTAT.AU.DK

The pdf-file should be named: fullname.pdf. The file must contain both your written answers and the appendix (see below). If more than one pdf-file is submitted, neither of them will be considered in the evaluation.

Regardless of format, your solution has to be submitted no later than Friday May 2, 2014, at 9 AM.

Guidelines, requirements, and hints for preparing solutions

- Answer all questions. In particular, be aware that some questions comprise several subquestions that all must be addressed.
- Plot the data whenever reasonable using scatter plots, histograms, Q-Q plots, etc.
- Always specify the statistical model used in the analysis. This can either be done using Greek letters or in a verbal description, although in the latter case care should be taken to avoid ambiguity.
- Any quantification of the findings of a statistical analysis in terms of estimates should be accompanied by confidence intervals. Any comparative statement should be backed up by a test and a p-value.
- Model validation is an integral part of any statistical analysis. It is not necessary to ask for relevant model validation to be performed, this should always be done.
- Include the Stata/SPSS commands used for the analysis (the do/syntax-files) and log/output-files in appendices.
- No Stata/SPSS code or output (except graphs) outside the appendix!
- Formulate the conclusions using relevant terms from the context of the study (it is important to be able to translate the findings from the statistical analysis into conclusions regarding the initial scientific question).

Background information on the data

We will consider an intervention study on the possible effect of vitamin and mineral supplement on the verbal and non-verbal IQ for children aged 11-13. Eighty-six children were randomly assigned to getting one vitamin and mineral tablet or a placebo tablet each morning. Their verbal and non-verbal IQ were measured before randomization and at the end of the study nine month later. Just before the final IQ test each child was asked to guess whether he or she was randomized to the active or the placebo group.
Here will only touch upon some of the statistical analyses in the study. Here is a short summary of a part of the data:

```
Variable    Obs Unique      Mean  Min  Max  Label
-------------------------------------------------------------
id           86     86      43.5    1   86  Unique identifier
group        86      2  .4883721    0    1  Randomization group
guess        72      2  .3472222    0    1  Guess of group
nvinit       86     46  100.5349   69  137  Initial non-verbal IQ
nvfinal      86     48  103.2093   74  135  Final non-verbal IQ
vbinit       86     43  88.77907   57  130  Initial verbal IQ
vbfinal      86     37  91.66279   63  126  Final verbal IQ
-------------------------------------------------------------
```

The data is found in the files *iq.dta*, *iq.sav* and *iq.xls*. A more detailed description is found in *iq_codebook.pdf*.

The purpose of the study was to compare the final IQ in the two groups. The choice was between three different strategies/methods:

    A. To consider and compare only the final IQ in the two groups.
    B. To compare the change in IQ.
    C. To analyze the final IQ, but adjust linearly for the initial (baseline) IQ.

Part A
Analyze the final non-verbal IQ scores in order to

1. Give a 95% prediction interval for the final non-verbal IQ scores in the placebo group.
2. Estimate the effect of the intervention.
3. Write a short conclusion on the effect of vitamin and mineral supplementation on non-verbal IQ

Part B
The second strategy was to consider the change in non-verbal IQ:
Analyze the data using this strategy in order to.
1. Give a 95% prediction interval for the change in non-verbal IQ scores in the placebo group.
2. Estimate the effect of the intervention.

3. Write a short conclusion on the effect of vitamin and mineral supplementation on non-verbal IQ

Part C

The third strategy was to consider the final non-verbal IQ, adjusted linearly for initial non-verbal IQ scores. Analyze the data using this strategy in order to:
1. Give a 95% prediction interval for the final non-verbal IQ scores in the placebo group for a child with an initial non-verbal IQ score equal to 100.
2. Estimate the effect of the intervention.
3. Write a short conclusion on the effect of vitamin and mineral supplementation on non-verbal IQ

Part D

None of the three strategies above are wrong – they have different focuses, strengths and weaknesses.
1. Discuss briefly the similarities and differences in the findings above.
2. If you were to choose between them - which would you choose and why?

Part E

The study was intended to be blinded, i.e. neither the teacher, who handed out the tablets each morning, nor the school children were supposed to know to which group the individual child was randomized. The only thing they knew was that "half of the children will get a supplement and the other a cheating tablet".
The information on the true randomization and the guess of the child are found in the two variables `group` and `guess`. Note that only 72 children were willing to give a guess. Make a statistical analysis of the data for these 72 children in order to answer the following questions.
1. When comparing the active and the placebo group:
   How do they differ with respect to what the children guess?
   Is there statistical significant different in what they guess?
2. Do the children guess differently than what would be expected from the design and the information they had?
3. Based on these results, write a short conclusion on whether or not the study seems to be blinded.