University of York

Department of Health Sciences

Applied Biostatistics

Exercise: Correlation and Regression

Question 1

In a study of blood pressure during pregnancy and foetal growth, 209 healthy women having their first pregnancy had 24 hour blood pressure readings taken in mid-pregnancy. The size of the baby was recorded at birth. The abstract included the following: 'It was found that a 5 mm Hg increase in mean 24 hour diastolic blood pressure at 28 weeks' gestation was associated with a 68 g (95% CI 3 - 132) decrease in birth weight . . . Maternal mean 24 hour diastolic blood pressure at 28 weeks' gestation was also inversely associated with the infant's ponderal index (weight/height^3) at birth . . . (P=0.06).' (Churchill and Beevers 1996). (N.B.: weight/height^3 is the usual ponderal index for infants, rather than weight/height^2 as is used for adults and older children.)

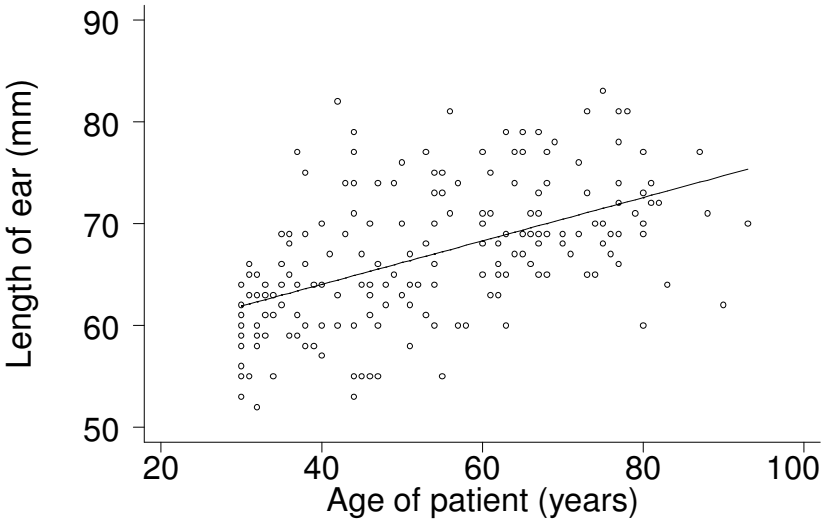
a) What method would be used to calculate the 68g per 5 mm Hg?

b) What assumptions would the method require?

c) What is meant by 'increase' and 'decrease' here? Do they mean that when a woman's blood pressure went down her baby's weight went up?

Question 2

A general practice based study sought to find out if people's ears increase in size as they get older. 206 patients were studied with ear size being assessed by the length of the left external ear from the top to the lowest part. Measurements were made simply, using a transparent plastic ruler. The relation between the patient's age and ear length (see graph below) was examined by calculating a regression equation.



The mean age of the patients was 53.75 years (range 30 - 93) and the mean ear length was 675mm (range 520 - 840mm). The linear regression equation was

$$\text{ear length} = 55.9 + 0.22 \times \text{age}$$

with the 95% confidence interval for the *b* coefficient being 0.17 to 0.27. The author concluded that 'It seems therefore that as we get older our ears get bigger (on average by 0.22 mm a year)' (Heathcote 1995).

a) What are the interpretations of the numbers 55.9 and 0.22 in the regression equation?

b) Are the assumptions about the data are required for the regression analysis satisfied here?

c) Are the conclusions justified by the data?

Question 3

The birth weights of 1,333 fifty-year-old Swedish men were traced through birth records. Adult height and birth weight were significantly correlated ($r = 0.22$, $P<0.001$) (Leon *et al.*, 1996).

a) What is meant by 'correlated' and '$r = 0.22$'?

b) What assumptions are required for the calculation of the P value?

c) What can we conclude about the relationship between adult height and birth weight?

References

Churchill, D. and Beevers, D.G. (1996) Differences between office and 24-hour ambulatory blood pressure measurement during pregnancy. *Obstetrics and Gynecology* **88**, 455-61.

Heathcote, J.A. (1995) Why do old men have big ears? *British Medical Journal* **311**, 1668.

Leon, D.A., Koupilova, I., Lithell, H.O., Berglund, L., Mohsen, R., Vagero, D., Lithell, U.B., and McKeigue, P.M. (1996) (Failure to realise growth potential in utero and adult obesity in relation to blood pressure in 50 year old Swedish men. *British Medical Journal* **312**, 401-6.

Questions from Martin Bland and Janet Peacock: *Statistical Questions in Evidence-based Medicine*, Oxford University Press, Oxford, 2000.