

# Basic Course on R: Linear Regression Practical

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28 Oct - 1 Nov 2019

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# 1 Baby Data

1. Read in the data “R\_data\_January2015.csv” with a header and row names from the first column. Assign it to the object `babydata` and allow strings be converted to factors. Attach the data to the environment.
  
2. We previously saw that there was an association between `vitaminB12` and `homocysteine`. We will now quantify the magnitude of this relationship and see if we can explain the variability of `homocysteine` with values of `vitaminB12`. Answer the following questions:
  - (a) First plot the data: a scatterplot to visualize the association (should be linear) and a histogram of the dependent variable to check for normality (normal errors are required - checking the distribution of the dependent variable is good enough for now). Do these particular assumptions appear to hold?
  
  - (b) You should have noticed that the dependent variable `homocysteine` is right-skewed. We need to see if a log-transformation of the data is more normally distributed. Assign the log of `homocysteine` to `loghc` and make a histogram of `loghc`. Check that it is normal by plotting it against a normal distribution (use `qqnorm()`). How does it look? More normal?
  
  - (c) We'll just assume everything looks good. Set up (i.e. write down) the linear regression model for modeling `loghc` against `vitaminB12` and then run it in R. Check the assumptions by plotting the residuals (should be no patterns) versus the fitted values and looking at a QQ plot of the residuals (should be straight line). Do the assumptions hold?

- (d) Assuming the assumptions hold (even if they don't), we'll make inference on the slope. Is `vitaminB12` statistically significant in the model? What percent variability does it explain in `loghc`? Write down the model with the estimates.
- (e) What is the predicted `loghc` level for a person with `vitaminB12` equal to 650? What is this value when unlogged (exponentiated)? Does it fall within the original range of values of `homocysteine` (can you guess what the name of the function is to find the range of a vector?)?
3. Now let's consider a framework where we want to use more than one predictor. We want to build a regression model for `SAM` using `vitaminB12`, `cholesterol`, `homocysteine` and `folicacid_erys` (folic acid red blood cells). Answer the following questions:
- (a) Set up (i.e. write down) the linear regression model and then run it in R. Check the assumptions by plotting the residuals versus the fitted values and looking at a QQ plot of the residuals. Do the assumptions hold?

- (b) Assuming the assumptions hold (even if they don't), we'll make inference on the slopes. Are any of the variables statistically significant in the model? What percent variability do the variables explain in **SAM**? Write down the model with the estimates.

- (c) What is the predicted **SAM** level for a person with the following:

vitaminB12 = 650  
cholesterol = 17  
homocysteine = 16  
folicacid\_erys = 1340