Possible Relationships in an ANCOVA Model

Let's look at possible outcomes of ANCOVA for the clinical trials scenario. This scenario uses the simplest possible ANCOVA, with one continuous predictor (**BaselineBP**) and one categorical predictor (**Treatment**).

We will explore five different relationships between the variables, as represented in the following models:

- equal slopes and intercepts
- equal intercepts but unequal slopes
- equal slopes but unequal intercepts
- unequal slopes and intercepts, and
- equal slopes where all slopes are zero

One possible relationship between variables is that both the slopes and the intercepts for the three treatments are the same. In this scenario, the change in blood pressure is the same across the three treatments when the baseline blood pressure is zero and the change in blood pressure increases or decreases at the same rate for the treatments at different values of **BaselineBP**. In other words you can say that the type of drug has no significant impact on the change in blood pressure. In this example, the point of origin is not in its typical location at the bottom of the Y axis. Because blood pressure change and baseline blood pressure have an inverse relationship, the point of origin is higher up on the Y axis. In other words, the relationship between **BPChange** and **BaselineBP** is graphed in the fourth quadrant.

In this second possible model, the three levels of the classification variable **Treatment** have the same intercept, but different slopes. This means that the change in blood pressure is the same for the treatments when the baseline blood pressure is zero (equal intercepts), but the change in blood pressure increases or decreases at a different rate for at least two of the treatments when there is a change in baseline blood pressure (unequal slopes). The graph shows that, as the value of **BaselineBP** (on the X-axis) increases, the rate of change of the Y-axis variable (**BPChange**) varies for at least two treatments.

In the third possible model, the slopes are the same but the intercepts are different for the treatments. As this graph shows, when the baseline blood pressure is zero, the change in blood pressure is different for at least two of the treatments—these are the unequal intercepts. However, the change in blood pressure increases or decreases at the same rate for the three treatments as the value of baseline blood pressure changes—that is, all the slopes are equal.

Another possibility is that both the slopes and the intercepts are different for at least two of the treatments. In this case, the change in blood pressure is different for at least two of the treatments when the baseline blood pressure is zero. Also, the change in blood pressure increases or decreases at a different rate for at least two treatments with a change in baseline blood pressure.

Finally, this graph shows a special case of the equal slopes model, where all of the slopes are zero. In other words, the rate of change of the Y variable (**BPChange**) is zero for all three treatments with a change in the X variable (**BaselineBP**). In this case, the continuous variable (that is, the covariate) makes no contribution to the model, so ANOVA could be used instead of ANCOVA.
