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ANCOVA Model

A mathematical representation of the ANCOVA model is shown here: $Y_{ij} = \mu + \tau_i + \beta_1 X_{ij} + \phi_i X_{ij} + \varepsilon_{ij}$.

Let's define the components of this model for the clinical trial analysis. Remember that the continuous response variable is **BPChange**, the continuous predictor variable is **BaselineBP**, and the categorical predictor variable is **Treatment**.

Y_{ij} represents the observed response value of **BPChange** (that is, the change in blood pressure) for the j^{th} subject in the i^{th} treatment group.

μ is the overall intercept term.

τ_i represents the treatment effect—that is, the effect of the i^{th} treatment on the intercept. $\beta_1 X_{ij}$ represents the overall slope of **BaselineBP**, the continuous predictor (or, in other words, the covariate). X_{ij} represents the **BaselineBP** value of the j^{th} subject in the i^{th} treatment group. Notice that, here, the β has the subscript 1 because this equation is tailored to the clinical trial example, which has only one continuous covariate.

$\Phi_i X_{ij}$ represents the slope effect of **BaselineBP** for each value of **Treatment**. In other words, this is the effect of the i^{th} treatment on the slope of **BaselineBP**. So this term represents the potential interaction between the continuous predictor **BaselineBP** and the categorical predictor **Treatment**. We could have different values of Φ for different treatments.

Finally, ε_{ij} is the random error term, which represents the residuals—in other words, the deviation of the observed value from the predicted value of the change in baseline blood pressure.

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