

## Comparing Least Squares Means at Different Values of the Covariate

In ANCOVA, your main interest is generally to compare group means. Specifically, you compare mean response values for different categories or groups of the categorical variable (or the CLASS variable) while holding the covariate X constant. For example, using this graph from the previous demonstration, you can compare the mean change in diastolic blood pressure (the response variable) for three treatment groups at a given value of the baseline diastolic blood pressure (the covariate). To generate least squares means, you can use the LSMEANS statement in PROC GLM.

However, the question arises as to where along the lines for the three groups you should compute and compare these least squares means. You can see that the slopes of the lines for the three treatments are not equal. If, for example, you compare the group means of *Placebo* (the dash line) with *Approved Drug* (the dash-and-dot line) at a **BaselineBP** value of 90, you will get different results than if you make the comparisons at a **BaselineBP** value of 100. In this situation, it is a good idea to compare the three treatments at multiple values of the covariate.

By default, the LSMEANS statement calculates the least squares mean of the dependent variable for each group at the mean value of the covariate. In this example, the mean value of the covariate **BaselineBP** is approximately 95. (Note that making comparisons at the mean value of the covariate eliminates inconsistent results. This action for ANCOVA models is equivalent to centering the continuous covariates for regression models with indicator variables.)

To compare the three treatments at a value of **BaselineBP** other than the mean, you can use the AT option in the LSMEANS statement. In the AT option, you specify a covariate (in the syntax shown here, this is referred to as variable), an equal sign, and a value of the covariate. As in ANOVA, you can use multiple comparison tests to determine which group means are different. So, you can specify multiple values of the covariate in your program.