

# Data Analysis Project #1

## Longitudinal Analysis of a Macular Measure in Glaucomatous Eyes

Please turn in on CCLE. Due date in syllabus and on CCLE.

People with glaucoma lose visual acuity. Glaucoma causes loss of cells/nerves in underlying macular structures, and it is thought that loss of thickness of some macular layers may precede or follow vision loss. The macular measure here is GCC thickness measured in microns. As GCC thickness decreases, vision gets worse. Subjects with glaucoma were enrolled and followed for 4 years. GCC was measured approximately every 6 months.

The macular thickness data set has four columns.

- Subject id,
- Time (in years) since initial visit,
- GCC (macular layer thickness) in microns,
- Subject's age (years) at the initial visit.

Please keep your report to at most 3 typed double spaced pages. Plots and tables (with captions that completely explain the plot/table) go in the appendix at the end of the text and do not count against the 3 page total. Refer to all plots and tables in the text.

Use the figure/table caption to explain what is in the table and define all entries (columns, rows, abbreviations) in your table. Describe the contents (symbols, lines, colors, points) of figures carefully and accurately in the figure captions.

In your main text, explain what conclusions you take from your tables and figures. Do not say “Here are the coefficients and standard errors from fitting the model.” which does not help the reader understand why they need to look at your table or figure. Rather, state something like: “Having A higher makes the response higher ( $p = xxx$ ), that B has no significant effect on response, and that C enters with a quadratic effect that is approximately level for  $C < .6$  but the response rises rapidly for  $C > .6$  (See table 2)”.

**Tasks.**

1. For this first part, do not use the age covariate yet. Report your methods and conclusions briefly with supporting documentation (figures/tables) in the appendix.
  - (a) Show your exploratory data analysis and initial conclusions/suspicions.
  - (b) Find a best population time trend.
  - (c) Find a best fitting covariance model.
  - (d) The investigators want to know how fast are patients losing macular thickness, both overall (population average) and how it ranges among individuals in the study.
  - (e) Ophthalmologists suspect that patients with greater GCC thickness may be healthier and that their GCC thickness decreases more rapidly than patients with lesser thickness who have already lost much thickness. Figure out if this is true in this data set, show your results and explain your conclusions.
2. For this second part, explore how age affects GCC and GCC trends in glaucomatous patients. No matter your findings in part 1, please use a model with a population intercept and slope only (before including age), and a random intercept and slope model for the covariance model.
3. Please show a few appropriate plots and present formal inferences to justify your conclusions.