LA CaTS
LOUISIANA CLINICAL & TRANSLATIONAL SCIENCE CENTER

Testing Differences in Glucose Profiles using AUC and Mixed Models

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Problem Overview

Oral Glucose Tolerance test

- Subjects are given a glucose solution
- Glucose levels are measured at four time points

Goal

- Determine if treatment groups have different glucose profiles

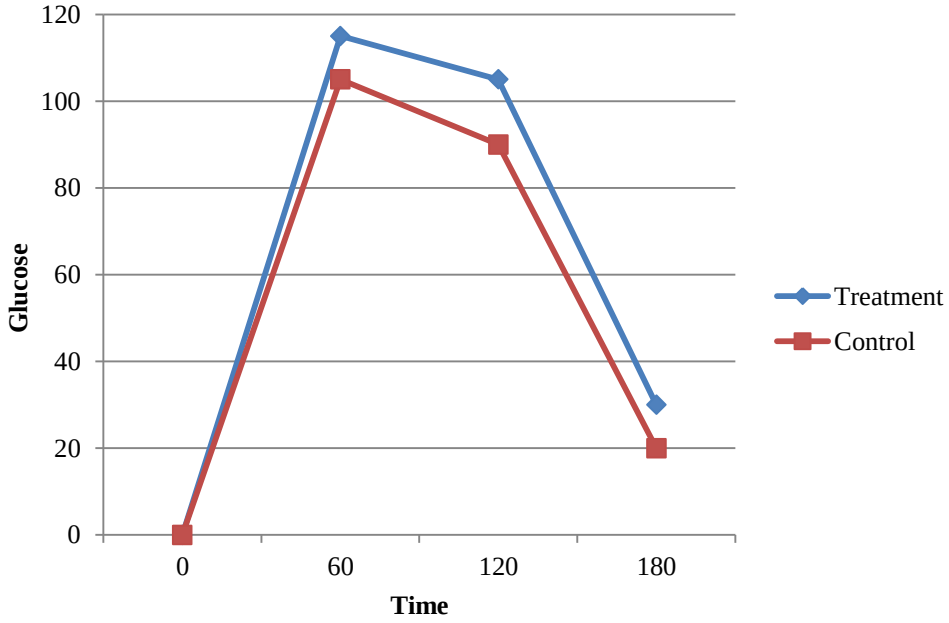
Notation

y_{itk} denotes the response for the i^{th} treatment at the t^{th} time for the k^{th} subject

- i=1, 2
- t=0, 60, 120, 180

Adjust responses using baseline values for each subject

- $y_{itk} - y_{i0k}$

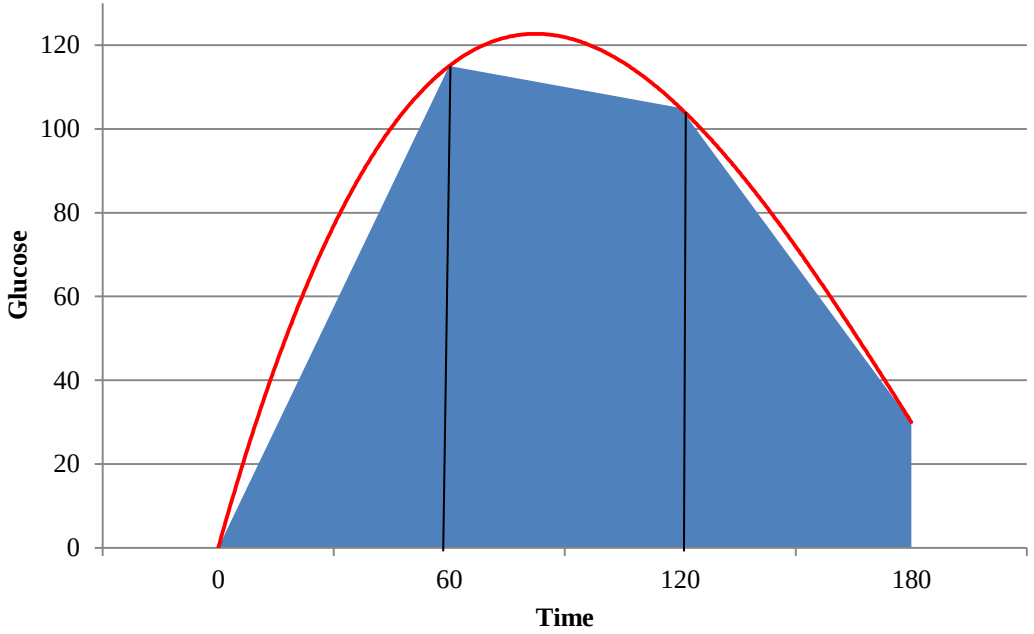


Area under the Curve

Area under the Curve
- Traditionally used to test differences in glucose profiles

Calculate AUC for each subject
- Trapezoid rule
- $z_{ik} \approx y_{i2k} + y_{i3k} + \frac{1}{2} y_{i4k}$

Test $\mu_{z_1} = \mu_{z_2}$
- Two sample t-test



Mixed Model

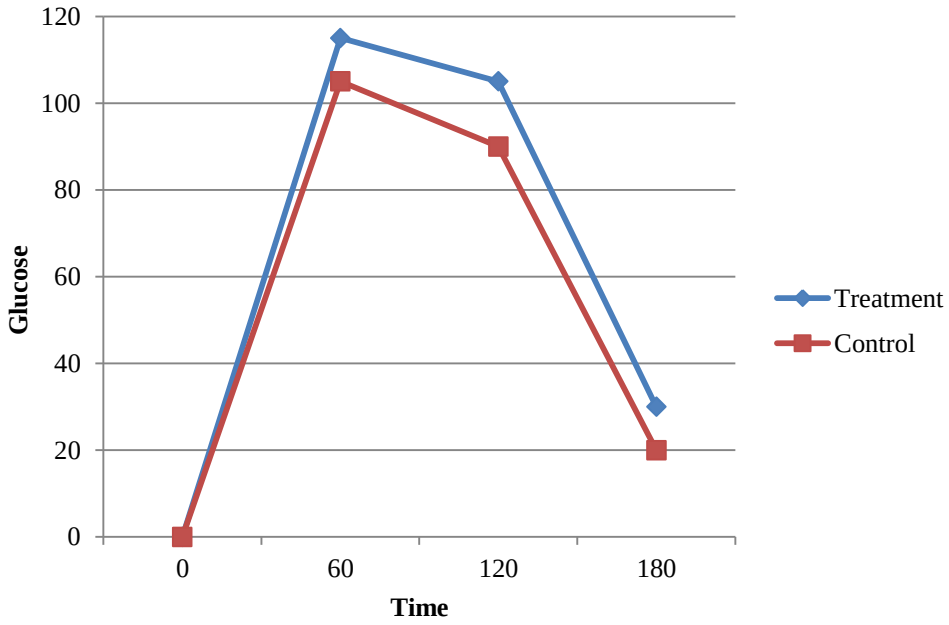
Consider only t =60, 120, 180

Mixed effect linear model

- $\boldsymbol{Y = \beta_0 + \beta_1(t) + \beta_2(trt * t) + \varepsilon}$
- Unstructured covariance matrix for each subject

Test $\boldsymbol{\beta_2 = 0}$

- F-test



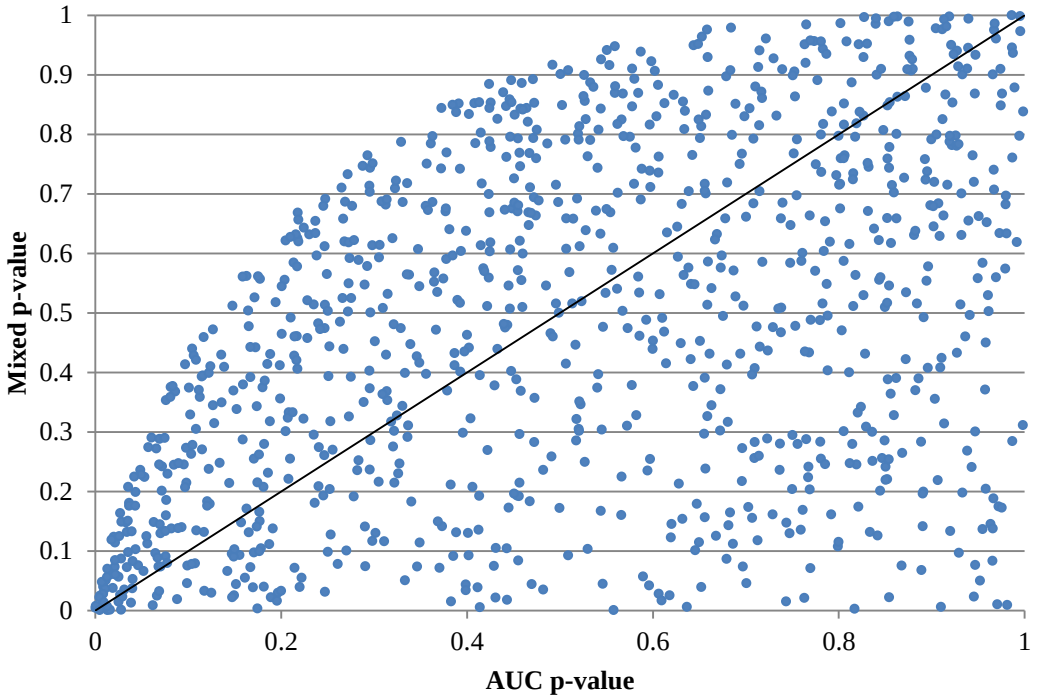
Simulations

Simulation conducted under H_0: $\begin{pmatrix} \mu_{160} \\ \mu_{1120} \\ \mu_{1180} \end{pmatrix} = \begin{pmatrix} \mu_{260} \\ \mu_{2120} \\ \mu_{2180} \end{pmatrix}$

- 25 subjects for each treatment
- 1000 replications
- Values for population mean and standard deviation at each time point based on data obtained from Pennington Biomedical Research Center

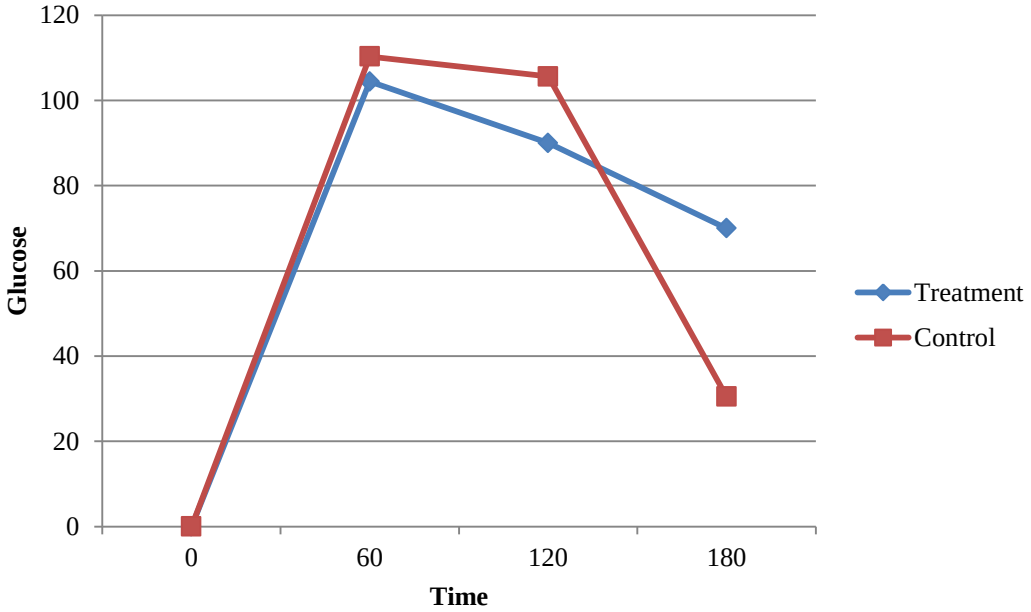
Simulations

	AUC	Mixed
Type I error	0.058	0.0062



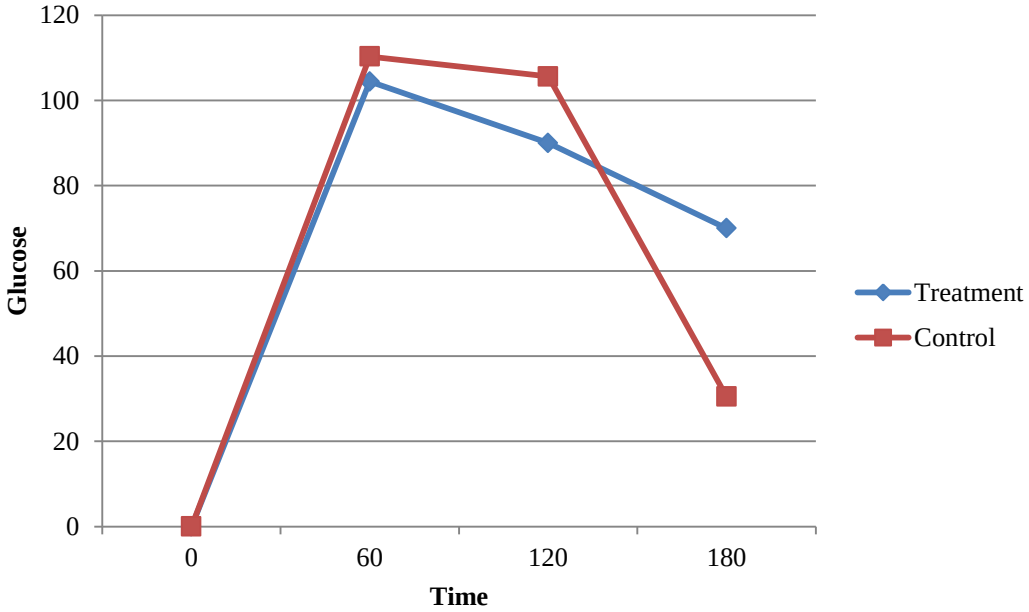
Crossing Profiles

t	Treatment	Control
0	0	0
60	104.4	110.3
120	90	105.6
180	70	30.5



Crossing Profiles

	AUC	Mixed
p-value	0.1978	0.0056



Conclusions

Both methods can give vastly different p-value

- No cases where mixed p-value is high and a AUC p-value is low

Crossing Profiles

- P-values from mixed procedure are generally lower than those from AUC procedure

Future plans include investigating the power of these tests when crossing profiles occur

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