Chapter 30

Latent Curve Modeling of Longitudinal Growth Data – Supplementary Text

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Analysis of Accelerated Longitudinal Study Data

The logistic growth model (Equation 30.4) was fit to the data using biological age as the time metric. Model fit and parameter estimates from the model are similar to those obtained when we analyzed the full dataset; however, it is clear that the statistical information obtained from analyzing these data is impoverished. For example, we fixed the variance of the change to the upper asymptotic level to zero to aid model convergence. Thus, we allowed for between-person differences only in the lower asymptotic level, which is related to pre-puberty differences in height. The fixed-effects parameter estimates are similar to those obtained when we analyzed the full dataset; however, their standard errors are larger. Although we could not estimate the variance in the main change component (i.e., change to the upper asymptotic level), estimating nonlinear models with only two occasions of measurement is possible (cf. McArdle, Ferrer-Caja, Hamagami & Woodcock, 2002). Importantly, McArdle et al. (2002) varied the amount of time between assessments; this can aid the estimation of variance components for growth models.

Analysis of Pubertal Differences in Height Changes

We analyzed Bell's physical height data generated to mimic an accelerated longitudinal study (e.g., Figure 30.7). Given the consistent time-lag between the assessments, the model in Equation 30.10 was fit with the variance of $u[t]_i$ set to zero and $(age_{1i} - ageM_i)$ included as the predictor of the latent variable intercept and slope, where age_{1i} is the participants' age at their first measurement occasion and $ageM_i$ is the participants' age at menarche. Thus, $age_{1i} - ageM_i$ represents the *biological age* at the participants' first assessment. We focus on the parameter estimates from the regression-like equation with biological age at the first assessment (based on the accelerated longitudinal nature of the data) predicting the intercept and slope. Biological age significantly predicted the intercept with an estimated regression weight of 2.01 ($se = 0.27$, $t = 7.34$, $p < .01$), indicating that participants who were further past menarche tended to be taller – approximately two inches for each additional year past puberty. Biological age did not significantly predict the slope with an estimated regression weight of -0.11 ($se = 0.08$, $t = -1.29$, $p = ns$). The nonsignificant effect of biological age highlights a potential challenge, which is modeling this association when the association is not linear. That is, we know the rate of change was most rapid approximately a year before menarche and the rate of change was slower before and after this point in the individuals' lives. Thus, the association between age and the rate of change is not linear. One approach to handing this situation is to consider a quadratic effect of biological age. Adding a squared term leads to a significant prediction of the rate of change from biological age. The association between the rate of change and biological age is plotted in Figure 30.8. The predicted association follows our expectations where the rate of change peaked approximately one to two year prior to menarche. Thus, researchers should carefully consider the nature of the association between baseline covariates regarding time (e.g., age, biological age) when using this approach to analyzing accelerated longitudinal data.

Figure 30.8. Predicted Rate of Change in Height as a Function of Biological Age