Letter by Patel Regarding Article, “A Primer in Longitudinal Data Analysis”

To the Editor:

I read with great interest the article titled “A Primer in Longitudinal Data Analysis” by Fitzmaurice and Ravichandran.1 Focusing on longitudinal data, the authors highlighted the important chasm between advancements in statistical methods and the analysis of current biomedical studies. Furthermore, the pros and cons of 2 particular approaches (analysis of response profiles and linear mixed-effects models) were well explained through case examples of previous studies. However, with the exception of a passing mention of cited sources for further reading (references 7 and 9 in the original article), the authors did not explain another important approach for analyzing longitudinal data: generalized estimating equations (GEEs).2

GEEs can be used to model correlated data from repeated measures over the course of a longitudinal study. With respect to the defining features of longitudinal studies explained by Fitzmaurice and Ravichandran (eg, covariance structure and balanced versus unbalanced designs), GEEs have been shown to be more robust when missing data, imputation techniques, and other factors are considered.3 Of particular interest to longitudinal clinical studies is the use of GEEs to identify the best correlation structure and subset of covariates for a given model. Seemingly conflicting reports on the inefficiency of GEEs compared with independence estimating equations4,5 can be explained by differences in the type of data and covariate and correlation structures under study. The use of more recent models, such as the conditional second-order GEE estimator,6 has yielded improved efficiency. Furthermore, GEE models can be implemented in the software packages discussed by Fitzmaurice and Ravichandran.

Clinician investigators and article reviewers would benefit greatly from knowing which model for the analysis of longitudinal data (eg, analysis of response profiles, linear mixed-effects models, GEE, independence estimating equation, or conditional second-order GEE) is most apt given a study’s design, data structure, and other relevant factors. Moreover, and in line with Fitzmaurice and Ravichandran’s intent, such an understanding will lead to an improved interpretation of longitudinal study results. This would get us “closer to reality” in terms of understanding the true impact of devices, pharmaceuticals, and other interventions for improved care of patients with cardiovascular risk factors and disease.

Disclosures

None.

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References

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