The Annals of Statistics
2006, Vol. 34, No. 5, 2113–2118
DOI: 10.1214/009053606000000669
Main article DOI: 10.1214/009053606000000623

DISCUSSION: CONDITIONAL GROWTH CHARTS

BY MATIAS SALIBIAN-BARRERA[1] AND RUBEN H. ZAMAR[2]

University of British Columbia

The authors are to be congratulated for a very important contribution with many practical applications. Including covariates in the construction of growth charts will undoubtedly lead to more informative tools for practitioners in many disciplines.

Growth charts are widely used in practice to monitor the evolution of particular univariate measurements over time. In some situations, a patient's evolution may be better described by the joint behavior of these variables of interest. For example, instead of using two univariate growth charts to map the weight and height of children, the physician may prefer to simultaneously locate the child's measurements with respect to the joint population distribution of weight and height for children of the same age cohort. It is well known that biological variables are generally correlated and that these correlations may be important to determine multivariate boundaries for the "normal" range of the response vector. When measurements are correlated, univariate growth charts may be unable to represent interesting combined features of the variables of interest.

We can identify the following challenges when one tries to develop multivariate growth charts:

(a) choosing an appropriate definition of multivariate quantiles;
(b) modeling multivariate quantiles to include the subject's prior development history and other covariates; and
(c) devising visualization tools to display individual trajectories with respect to the reference populations.

Regarding item (a), a nice unified presentation of several definitions of multivariate quantiles along with an insightful account of desirable properties is given in [2]. A proper extension of Wei and He's model to the multivariate setting [which would address (b) above] is of great interest but beyond the scope of this note. We will focus our discussion on item (c) for the simple case where the only covariate is time.

For simplicity of presentation, in what follows we will restrict our attention to the bivariate case and use quantiles based on Tukey's half-space depth [3]. For a

Received December 2005.
[1]Supported by an NSERC Discovery grant.
[2]Supported by an NSERC Discovery grant.