CALIBRATING THE CONCENTRATION FROM A SERIAL DILUTION

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In a chemistry or biology laboratory, people often dilute the sample sequentially to obtain preparations. This serial dilution process usually generates dilution error which results in correlated concentrations. This kind of error is being neglected in current practice and it can lead to a biased estimate. In this paper, we propose a linear calibration with correlated covariates that takes this serial dilution error into consideration when estimating the concentration of the unknown sample. A consistent and asymptotically unbiased estimator with asymptotic normality is derived. One particular appeal of this approach is that the estimate can be obtained with existing SAS® procedures. A simulation study shows that the new approach performs much better than the current practice with respect to the bias, the mean squared error, and the coverage probability. It also indicates that the effect of the serial dilution is controlled by an index, which has a similar role as the signal-to-noise ratio in a simple regression. A real data set is used to demonstrate the advantage of the proposed approach.