DISCUSSION

Harold Nisselson, Westat, Inc.

When survey data are subject to correlated response error (CRE), estimates of the variances of survey estimates should properly reflect the correlated response variance (CRV) component of the total variance. They will not do so unless provided for in the design of the survey data collection and variance estimators. In the survey design this requires inter-penetration of the data collection assignments (e.g., interviewer assignments), which will increase data collection costs, and perhaps substantially so if personal interviews are involved. With regard to variance estimation, if a complex sample design has been used, the computing cost may also be substantially increased. As a result, most surveys ignore the problem posed by the CRE of varinace, and in many surveys even the sample design is ignored in computing sampling errors or statistical analyses. Contributions to methodology which permit reducing data collection and/or computing costs are important because they can contribute to the widerspread use of sound statistical methods by survey practitioners.

The Richards-French paper addresses the problem of variance estimation. They propose to carry out an empirical comparison of balanced repeated replication and replicated surveys for variance estimation using Koch's extension of Bureau of the Census response error models and data from a multi-stage survey designed to provide a limited number of replicate samples. Their findings should provide useful information, particularly (as they note) for designs with a small number of replicates. I believe that their study could be made even more useful if they also used the data to evaluate Fellegi's improved method for estimating the CRV (JASA, 69 (1975), 496-501). While the design matrix for interviewer assignments in the survey is not described, I believe that the randomization will make this possible. Fellegi's method is of special interest since it requires only partial inter-penetration of interviewer assignments. Thus, if the assumptions of Fellegi's model are sufficiently well approximated, substantial savings in the field costs of personal interview surveys can be realized while still preserving the ability to estimate the total variance and its components. The interest in this subject is shown by the fact that several papers either extending or evaluating Fellegi's method are being presented at these meetings (Biemer; Hartley and Monroe; Krotki and McLeod).

The Clarridge-Palit paper also deals with the problem of reducing computation costs. Their objective is to develop methods applicable to public use tapes from the Census Bureau's Current Population Survey (CPS), with computation costs at a level which will make the methods feasible for wide use by researchers who may have access to only small computers. This objective is very worthwhile. However, I have some reservations about what was done and I wish that the authors had consulted more closely with Census Bureau staff. The Census Bureau's BRR scheme requires 243 replicates. Clarridge and Palit investigated approaches to reducing computer time based on collapsing the CPS design into fewer strata, which would thus require fewer replicates for BRR. They collapsed the CPS design by establishing three groups (the one-third samples) of self-representing (SR) PSUs and three groups of non-self-representing (NSR) PSUs, and then collapsing the CPS design into the desired number of strata with 3 PSUs per stratum -- one from each of the 3 groups. The CPS design in March 1973 was based on the combination of two stratified samples, the A-design and the C-design. The A-design consisted of the 156 SR PSUs in the A-design, and 110 NSR PSUs selected by pairing the 220 NSR strata in the A-design, randomly selecting one stratum from each pair, and then sampling one PSU with replacement from the selected PSU. Because the PSU selection was with replacement, 25 of the 110 A-design NSR PSUs were selected in the C-design, so that these 25 strata had only one PSU (with a double within-PSU sample) in the CPS sample; in the other 85 NSR strata a different PSU was selected in the C-design, so that these strata each had two PSUs in the CPS sample. This design seems to have been misunderstood by the authors. The method of setting up the one-third samples introduced a between SR-PSU variance which is not present in the CPS. Also, the collapsing of the 22D CPS NSR strata into the much smaller number used by the authors -- for example, 17 strata of NSR PSUs in their 40-stratum design -- introduced a larger between-stratum contribution from the NSR strata then is in the Census BRR scheme. The effect of the between-stratum component of variance is to lead to overestimates of the total variance. One improvement to the author's scheme would have been to divide the SR PSUs into as many groups as the number of strata assigned to the SR PSUs and then to create one-third samples for each such group by taking one-third samples from all PSUs in the group. However, I believe that subsampling the desired number of replicates from the Census BRR scheme would be competitive with the approach investigated in the paper. In any event, because of the tradeoffs of bias and variance estimates from the three alternatives investigated in the paper with estimates from the Census BRR scheme. This would permit an assessment of the 81-replicate design. It would also be of interest to compare the empirical results with theoretical results using Gurney's model cited in Bureau of the Census Technical Paper No. 40. Finally, I hope that the authors will continue to work toward their objective because it is an important one.

The Krewski-Rao paper continues the investigation of the properties of linerization, jackknife and BRR methods for estimation and variance estimation in stratified sampling which the authors reported at the ASA meetings last year. Specific theoretical results are given for sampling with proportional allocation under a regression model for the relationship between the numerator and denominator variables which may differ from stratum to stratum. An interesting result is that the mean square error of the linearization estimator of variance is less than that of the BRR estimator. The mean square error of either estimator decreases as the number of strata increases, and as the CV of the denominator decreases. The theoretical results are compared with empirical studies by Kish and Frankel, Bean, and Lemeshow and Levy, and shown to explain their findings. We are all indebted to the authors for tackling a formidable task, and will benefit from the insights provided by their research.