INFERENCE FOR PRACTICAL PROBLEMS USING DESIGN-BASED PREDICTION- A NEW APPROACH

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Practical problems commonly involve a finite population, where response (possibly including measurement error) is only observed on some subjects, a sample. The population may have a hierarchical structure; there may be longitudinal measures; treatments may be given. For the layman, statistical inference boils down to a strategy of guessing some 'target parameter', often not clearly defined. Although the sample is usually selected randomly (possibly with clustering), inference is typically not based solely on the sampling design. Different models and assumptions result in different guesses. We present methods for inference that enable clear definition of the 'target parameter' and depend only on the sample design. An attractive feature of the approach is that the focus is on prediction of values that are not known because they are not in the sample, or because the individual values are observed with error. The formulation bridges the gap between the so-called model and design-based inference. We review recent results obtained by applying this strategy to problems such as sampling in the presence of response error, prediction of random effects in equal and unequal size clustered populations, and estimation accounting for auxiliary variables or in factorial experimental designs. The review highlights short-comings of model based approaches, and identifies strategies for overcoming these short-comings with the design-based prediction approach.