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Census Adjustment to be Topic at Sept. 11 Luncheon

The focus for this year's luncheon program is the role of statistics in public policy issues. We are fortunate to have Dr. Kirk Wolter as our kickoff speaker to address the volatile issue of census adjustment. The luncheon will be held on Tuesday, Sept. 11, 1990 at the Midland Hotel, 172 W. Adams at LaSalle in downtown Chicago and will start at 11:45 a.m.

In this nontechnical talk, Dr. Wolter will describe the history of undercounting in U.S. Decennial Censuses and will provide a brief description of the current proposal to move the 1990 enumeration closer to truth by means of statistical and demographic methodology. He will also describe some of the latest developments regarding the proposal from his perspective as a member of the Secretary of Commerce's Special Advisory Panel.

Dr. Kirk M. Wolter is Vice President, Director of Statistical Design for the A.C. Nielsen Company. He is responsible for professional leadership and direction to the company's scientific development programs, especially in mathematical statistics, applied mathematics, survey design, and data analysis. He initiates and directs research on methodology for collecting, processing, and interpreting statistical data. He represents the company as a leading technical authority in dealings with client companies, professional associations, the Federal statistical system, and the statistical offices of other counties in which the company does business.

Prior to joining the A.C. Nielsen, Dr. Wolter worked for 14 years at the U.S. Bureau of the Census, most recently as Chief of the Statistical Research Division. In this post, he served as the Census Bureau's head of research and methodological development, directing a staff of about 100 M.S. and Ph.D. scientists in broad areas of statistics, mathematics, computer science, artifical intelligence, and selected social sciences. During his tenure at the Census Bureau, he gained extensive experience testifying on technical issues in Federal court, the Congress, advisory panels of the National Academy of Sciences, and other such groups, and in establishing policy for the nation's statistical systems.

Concurrently with the Census post, Dr. Wolter served as Adjunct Professor at George Washington University (GWU). There he developed and taught graduate-level courses in survey sampling, an area in which he is an acknowledged world expert. In addition to the work at GWU, he has extensive international teaching experience, including Beijing, Shanghai, The Hague, Stockholm, Ottawa, and Paris.

Dr. Wolter is the author of more than 30 professional articles and of one book. He has received extensive recognition for his work, including the U.S. Department of Commerce's silver and bronze medals. From his alma mater, Iowa State University, he received the 1973 George W. Snedecor Award, signifying the most outstanding Ph.D. candidate, and the 1980 Outstanding Young Alumnus Award. In recognition of his outstanding scientific accomplishments, he was elected Member, International Statistical Institute, and Fellow, American Statistical Association.

To make reservations, call Kenneth Wollenberg, (312) 727-7575 by Friday, Sept. 7. The cost is $20 for members and $22 for non-members. If you make reservations and then are unable to attend, please let Kenneth know, since the Chapter must pay for luncheons prepared for no-shows.

Reducing Sample Size Through Sequential Analysis

Contributed by Albert Madansky
University of Chicago

The usual contexts in which one weighs the issue of what is the appropriate sample size are the classic statistical contexts of parameter estimation and hypothesis testing. In both, the unsaid but understood assumption was that the researcher had to specify a sample size, then go out into the field and get the appropriate number of respondents, and finally analyze the data as a batch. But in this era of Computer Assisted Telephone Interviewing (CATI), this assumption can go by the boards. The computer can analyze the data seriatim, as each respondent's data arrives. Thus, if one were collecting data for hypothesis testing and the evidence in favor of a given hypothesis were overwhelming at, say, the halfway point in the study, there would be no need to continue asking the questions relating to that hypothesis in the remaining interviews. (I presume that the interview was designed to elicit information about many matters, not just the one which got resolved early on in the sampling, so one would not terminate the project. But with the flexibility of CATI systems such as ACS-QUERY and A&S-CATI, one could shorten the interview by exising these questions from the questionnaire and blithely continue the project at lower cost per interview.)

To obtain these efficiencies from a CATI system, one must set up a statistical monitoring system which amalgamates each respondent's data with those of all the previous respondents and analyzes the combined data each time a new respondent's data is added to the sample data set. Fortunately, the statistical technology to do this, Sequential Analysis, has been around since the mid-1940's and has been extensively used in quality control applications. In essence, the principle underlying sequential analysis is that one samples the population by drawing observations one at a time and continually calculates a sample statistic whose outcome will determine *(a)* whether or not we continue sampling, and *(b)* whether we accept or reject the null hypothesis if we determine that we need not continue sampling. Since the sample size in this applications is a random variable, depending on our data and the decision rule for determining when to stop sampling, one cannot make direct comparisons with fixed sample size procedures. We can, though, calculate the expected sample size required to reach a decision, and compare this with the fixed sample size required for the same level of significance and probability of type II error.

Suppose we are testing a hypothesis about the parameter Θ of a binomial distribution. Let our null hypothesis be that $\Theta = \Theta_0$, and let us suppose that we wish to control the probability of accepting that hypothesis when $\Theta = \Theta_1$. Let alpha (a) be our level of significance and beta (b) be the probability of a type II error.

TABLE 1
SAMPLE SIZES FOR FIXED SAMPLE
HYPOTHESIS TESTING OF Θ_0 = .5 WHEN a = .05

Θ_1/b	.05	.10	.15	.20
.55	1077	852	719	616
.60	266	211	178	153
.65	115	92	78	67
.70	63	50	43	37
.75	38	31	26	23

By contrast, Sequential Analysis would produce a procedure whose average sample size depends on the true value of Θ. Table 2 gives the largest value of E_n, the average sample size, for the values of Θ_1 and b used above when $\Theta = \Theta_0$.

TABLE 2
AVERAGE SAMPLE SIZES
FOR SEQUENTIAL ANALYSIS
HYPOTHESIS TESTING OF Θ_0 = .5 WHEN a = .05

Θ_1/b	.05	.10	.15	.20
.55	864	648	521	431
.60	214	160	129	107
.65	93	70	56	47
.70	51	38	31	26
.75	31	24	19	16

We can also calculate E_n specifically when $\Theta = \Theta_1$. These calculations are given in Table 3.

TABLE 3
AVERAGE SAMPLE SIZES WHEN $\Theta = \Theta_1$

Θ_1/b	.05	.10	.15	.20
.55	530	475	426	381
.60	132	119	106	95
.65	58	52	47	42
.70	33	29	26	24
.75	21	19	17	15

We see from these tables, especially in contrast with Table 1, the table of sample sizes for fixed sampling, what potential reduction in sample size can occur using sequential sampling.

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