In This Issue

No. 48, July 2003

Letter from the President

Time goes by quickly—too quickly. It has already been four years since you elected me to succeed Kirk Wolter as President of the IASS and two years since I actually took up my duties. And already I am writing you this fourth and final "Letter from the President," before I, in turn, yield my position to Luigi Biggeri at the ISI session in Berlin. This, then, is a letter of goodbye that I am sending you today. It is also a sort of summing up of these two years; it therefore includes topics that have already been discussed in previous issues.

During these two years that I was the president of our association, I believe that a number of things have been accomplished, while there has been little change for some others. What could be done was achieved in conjunction with not only the Council—in particular the Executive—but also the committee chairs, some especially active and devoted members, and the Secretariat. To all of them, I wish to express my warmest appreciation.

Survey Statistician

You have been regularly receiving our beloved *Survey Statistician*, of which this is the 48th issue. Somewhat irregular in its frequency and content at the beginning, it has gradually found its place. I wish to thank the editor, Leyla Mohadjer, who has accomplished, with consistency and discretion, a formidable task in terms of both format and content over the past four years. She has had her share of problems, and she has effectively surmounted a great many of them.

After these four years, Leyla is passing the torch, as was planned when she took on responsibility for the newsletter. This issue is the last under her watch. Our next editor will be Steve Heeringa (sheering@umich.edu). I thank him for agreeing to keep the *Survey Statistician* going for the coming years.

However, some problems remain. The country reports, overall, are the object of some criticism. Also, the "Questions-Answers" section has been inactive for several years now. There will be more to say about this in connection with the Web site.

I must once again thank those who are instrumental in bringing out this publication: for translations, Statistics Canada; and for printing and distribution, the Australian Bureau of Statistics for the English version and INSEE for the French version.

Web Site

Following a change in assignment, Fred Vogel has asked to be relieved of his responsibilities as Webmaster. His replacement is Eric Rancourt (eric.rancourt@statcan.ca).

Considering that the Internet is in general use throughout the entire world, I think that there should be a broad discussion as to the place and role of the *Survey Statistician* and the web site respectively, with a particular focus on the two problems mentioned above regarding the newsletter. This discussion could begin at the Berlin Session. Some have already given some thought to these topics, and the session will be an opportunity to exchange viewpoints on the matter. But what happens after that will be the responsibility of my successor, Luigi Biggeri.

Publications

In the last two years there have been more publications than usual.

Aside from the traditional publications—the *Survey Statistician*, which I have already mentioned, and the Proceedings of the Seoul Session, prepared by the then chair of the IASS Programme Committee for that session, David Binder, who is now Vice-President of the Association, and by Eric Rancourt—two exceptional works were published: the "IASS Jubilee Commemorative Volume – Landmark Papers in Survey Statistics," prepared by a committee chaired by Gad Nathan, and "Leslie Kish, Selected Papers," prepared by Graham Kalton and Steve Heeringa.

The latter work was published commercially by Wiley and Sons, and the Association purchased enough copies for all its members to receive one. The Proceedings of the Seoul Session and the Jubilee Volume, which the Association published on its own, were printed and distributed to the membership by the Australian Bureau of Statistics.

I want to express hearty thanks to all those involved in preparing these works, as well as to the ABS and its Director, Dennis Trewin.

The membership directory, which could not be produced in 2001, was distributed at the end of 2002, thanks to the contribution of INSEE. Also, the ISI has just brought out a directory that includes all members of the Institute itself and the members of thedifferent sections, including, for the first time, those who only belong to the IASS.

Cochran-Hansen Prize

The 2003 Cochran-Hansen Prize has been awarded to Krishna Mohan for his contribution on "A Multilevel Approach to Explore the Influences of Interviewers on Item Nonresponse in Complex Surveys". The jury assembled to analyse candidates' contributions was chaired by Chris Skinner. I wish to thank him and his entire team for their efforts.

Administrative Matters

The Secretariat has made new progress in overhauling its membership database. We hope to take this opportunity to make the database easier to manage, and also to bring ourselves more in line with the principles and practices of the ISI Permanent Office in the management of its file of members of the Institute and the other sections.

Berlin Session

The statutory meetings of the Association will take place at the Berlin Session:

- ◆ Council, August 14, 7:30 a.m. to 9:00 a.m.;
- ◆ General Assembly, August 14, 11:15 a.m. to 1:00 p.m.; and
- ◆ Executive Committee, August 19, 7:30 a.m. to 9:00 a.m.

I hope that all Association members present in Berlin will make a point of participating in the General Assembly.

Also, the Programme Committee for the Sydney Session, chaired by Pedro Luis do Nascimento Silva, will meet on August 15, from 11:15 a.m. to 1:00 p.m. As I indicated earlier, ad hoc meetings will be organized on the following two themes:

- ◆ the *Survey* Statistician and the web site; and
- ◆ the IAOS/IASS Joint Conference on Poverty, Social Exclusion and Development.

The place and time of these meetings will be announced on-site in Berlin.

Lastly, I would like mention here once again the "short courses" organized by our Scientific Secretary, Seppo Laaksonen. They were listed in the last issue of the *Survey Statistician*.

IAOS/IASS Joint Conference

I have already made several references in this column to the conference, organized jointly with the IAOS, to be held in 2004 in Abidjan, Côte d'Ivoire. Because of that country's internal situation, the IAOS President Paul Cheung and I have decided to postpone the Abidjan Conference. Also, the Chair of the Programme Committee, Alain Azouvi, who has devoted considerable personal effort, has not received the support needed to obtain truly international validation of his scientific programme or to identify leaders for meetings. We have not yet taken a definite position on where to go from here, but on this point too, we will have in-depth discussions in Berlin with the new Council and all those concerned with this conference.

I hope that I will see many of you in Berlin. For now, let me conclude by saying au revoir to all of you. I have been both honoured and happy to preside over the Association these past two years, and now I pass the torch to Luigi Biggeri and the Council that you have just elected, whose makeup is not yet known at the time of writing.

CHANGE OF ADDRESS

Members are encouraged to inform the IASS Secretariat of changes of address as soon as possible. Mailings of the proceedings of the IASS papers presented at the ISI sessions, and *The Survey Statistician* will be delayed and may be lost if the Secretariat does not have your correct address.

You may notify Ms. Claude Olivier of your change of address by completing and mailing the Change of Address form given at the end of this newsletter. Alternatively, you can provide the same information to Ms. Olivier by email to claude.olivier@insee.fr.

In Memoriam
Charles Alexander, Jr.
"Chip"
1947 - 2002

Chip Alexander, statistician at the United States Census Bureau and Fellow of the American Statistical Association, died on September 1, 2002 in a drowning accident. He is survived by his wife Diane and children David and Emily. Chip received his B.A. degree in Mathematics in 1965 from Princeton University. In 1974, he earned a Ph.D. in Statistics from the University of North Carolina at Chapel Hill. He taught Statistics at the State University of New York at Binghamton for five years. When his father became ill, he moved to Maryland and began his 23-year career at the Census Bureau.

Over the past decade, Chip Alexander developed the methodology for what is now known as the American Community Survey, using the rolling sample methods of Leslie Kish and others. He continued to shepherd all statistical aspects of the American Community Survey until it was adopted as the "key to the Census Bureau's future." When fully implemented, it will provide demographic, economic, and housing profiles of America's communities every year based on a national sample of 3,000,000 housing units and will eliminate the need for a long form in the 2010 census.

The development of continuous measurement methodology in the 1990s was one of the most significant contributions in census taking in several decades. This field of study involves integrating multipurpose survey designs with a variety of statistical methods for combining information from different sources, to create data products that simultaneously serve multiple purposes. Under the direction of Dr. Alexander, estimation methods were developed using multi-year moving averages integrated with the Census Bureau's annual population estimates.

Dr. Alexander was the Census Bureau's chief spokesperson on the American Community Survey methods. He was invited to speak at many statistical meetings in the United States and around the world. He was also a frequent speaker at data user groups, and at meetings with legislators and other policymakers. He had an unusual knack for presenting esoteric, technical, statistical information in a manner conducive to consumption by a broad constituency. According to two of his colleagues, Cynthia Taeuber and Paula Schneider, "He was patient and never condescending when we missed important points or didn't get things quite right. He politely but strongly suggested how we could improve our contribution to the goal. He wouldn't let us misrepresent, oversell, or undersell his concept and plan. His legacy to the nation is his contributions to the design of the American Community Survey."

A session on the American Community Survey in honor of Dr. Alexander will be held at the Joint Statistical Meetings in San Francisco, U.S., August 3-7, 2003. The participants include Jay Waite, Freddie Navarro, Debbie Griffin, and Sue Love from the United States Census Bureau, Joe Salvo from the NYC Planning Commission, Eric Slud from the University of Maryland, and Alan Zaslavsky from Harvard University.
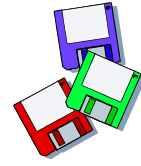
Al Tupek will include a tribute to Dr. Alexander in his presentation on "Combining Years of Data from a Rolling Sample Survey" by Alexander and Tupek at the ISI Meeting in Berlin, Germany, August 13-20, 2003 as part of an invited session on "New approaches to population censuses (a special memorial to Leslie Kish)."

Prepared by Alan R. Tupek, USA
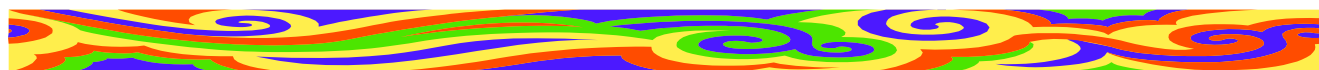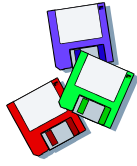
SOFTWARE REVIEW

IVEware: Imputation and Variance Estimation Software

John Van Hoewyk
Survey Research Center, University of Michigan

Overview

IVEware is an imputation and variance estimation software application developed by the Survey Methodology Program at the University of Michigan's Survey Research Center (SRC). The SRC makes *IVEware* available without charge.

*IVE*ware performs single and multiple imputations of missing values using the Sequential Regression Imputation Method (Raghunathan et al., 2001), analyzes multiply imputed data sets, and takes into account complex sample design features such as clustering, stratification, and weighting.

*IVE*ware's four modules are SAS$^®$ -callable applications; users work within the SAS system. *IVEware* setup files (command files) use keywords, commands, and instructions similar to those used in SAS. Setup files are submitted directly from the SAS program editor (or by way of a SAS batch file). *IVEware* imputation and analysis modules require SAS data sets. *IVEware* users are expected to have a moderate amount of SAS experience, including familiarity with basic file concepts, naming conventions, and command file structures.

IVEware is currently available for personal computers using the Microsoft Windows$^®$ or Linux operating systems, and UNIX workstations using Sun Solaris$^®$, IBM AIX$^®$, or Compaq/DEC Alpha Tru64Unix$^®$ operating systems. *IVEware* requires SAS version 6.12 or higher.

IVEware Modules

IVEware's four modules are IMPUTE, DESCRIBE, REGRESS, and SASMOD.

IMPUTE uses a multivariate sequential regression approach to imputing item-missing values. Imputations are draws from the predictive conditional distribution of the variable with missing values, given all other variables. Imputations are repeated over several iterations, each time overwriting previously imputed values, building interdependence among imputed values and exploiting the correlational structure among covariates.

IMPUTE can impute missing values for any of five variable types: continuous, binary, categorical, count, or mixed (continuous variables with a nonzero probability mass at zero), executing the appropriate regression model—linear, logistic, generalized logit, Poisson, or a mixed logistic/linear—once the type of variable type has been declared.

IMPUTE permits users to specify interaction terms in the imputation model and execute stepwise regressions.

IMPUTE can also accommodate two common features of survey data that add to the complexity of the modeling process: the restriction of imputations to subpopulations and the bounding of imputed values. IMPUTE can produce a single or multiply imputed data set. (A technical discussion of the sequential regression imputation procedure can be found in the appendix.)

The following illustration of the IMPUTE setup file and resulting printed output is abbreviated from a larger setup used in the imputation of the public use National Health and Nutrition Examination Survey III (NHANES).

Setup File

The input data file is identified by the keyword DATAIN. DATAOUT indicates the name of the output file that will contain the imputed data. ITERATIONS specifies the number of cycles of imputation to be undertaken; MULTIPLES indicates the number of imputations to be performed; and SEED specifies a seed for the random draws from the posterior predictive distribution.

```
DATAIN          ADULTXR;
DATAOUT         ADULTOT;

ITERATIONS      5;
MULTIPLES       5;
SEED            11111;

DEFAULT         CATEGORICAL;
TRANSFER        SEQN ADULT DMPFSEQ HFAGERR BMPTRI  BMPSUB BMPSUP;
CONTINUOUS      HFA8R HSAGEIR  DMPPIR HAM5S .  .  . ;
MIXED           HAN6HS  HAN6IS HAN6JS HAR15 .  .  . ;

BOUNDS          HFA8R (>=0,<=17), HAM5S (>=41 ),  HDP (>=8), . . . ;
RESTRICT        HAR3 (HAR1 =1),  FPPSUDRU (HSAGEIR >=40), . . . ;
RUN;
```

The keywords DEFAULT, TRANSFER, CONTINUOUS and MIXED identify the variables in the input data set. In this example, DEFAULT classifies undefined variables as categorical. Variables declared TRANSFER are carried over to the imputed data set but are not imputed or used as predictors in the imputation model. Continuous variables are identified by the CONTINUOUS keyword, while MIXED variables treat a value of zero as a discrete category and values greater than zero are considered continuous. The mixed variable HAN6HS (amount of beer consumed per month) will be imputed using a two-stage model. First, a logistic regression model is used to impute zero (nondrinker) vs. nonzero (drinker). Once a nonzero (drinker) has been imputed, a normal linear regression model imputes nonzero values (amount of beer consumed).

The BOUNDS statement restricts the range of the values to be imputed. HFA8R (Years of Education) will be imputed with values ranging between 0 and 17.

RESTRICT limits the imputation of a variable to a subpopulation within the data set. The imputation of HAR3 (currently smoke cigarettes) is restricted to those respondents who report having ever smoked 100 cigarettes in their lifetime—HAR1.

Printed Output

For each imputation, IMPUTE provides means (continuous variables) and proportions (categorical variables) for the observed cases, imputed cases, and all cases. The printed results for the variables HFA8R, HAR1, and HAR3 are shown below.

```
VARIABLE HFA8R       OBSERVED           IMPUTED          COMBINED
    NUMBER           19827                223             20050
    MINIMUM              0           0.323875                0
    MAXIMUM             17            16.9898               17
    MEAN           10.7901            9.36205          10.7742
    STD DEV        3.88592            3.48302          3.88448


VARIABLE HAR1        OBSERVED           IMPUTED          COMBINED
    CODE FREQUENCY PERCENT FREQUENCY PERCENT FREQUENCY PERCENT
       1      9799   48.91        10   62.50      9809   48.92
       2     10235   51.09         6   37.50     10241   51.08
   TOTAL     20034  100.00        16  100.00     20050  100.00


VARIABLE HAR3        OBSERVED           IMPUTED          COMBINED
    CODE FREQUENCY PERCENT FREQUENCY PERCENT FREQUENCY PERCENT
       1      4990   50.93         4    0.04      4994   24.91
       2      4807   49.07         8    0.08      4815   24.01
       3         0    0.00     10241   99.88     10241   51.08
   TOTAL      9797  100.00     10253  100.00     20050  100.00
```

For the continuous variable HFA8R (years of education), 223 observations were imputed. The setup called for the imputation of HFA8R to be bounded by the range 0 through 17. Accordingly, the resulting range of imputations is 0.323 to 16.98.

The categorical variable HAR1 (ever smoke 100 cigarettes) had 16 observations with missing data. Ten were imputed to the value 1 (yes), while the remaining 6 were imputed to the value of 2 (no).

The imputation of HAR3 (currently smoke cigarettes) is restricted to those observations with a value of 1 on HAR1 (yes to ever smoke 100 cigarettes). HAR3 had 12 observations with missing data. Ten of the 12 were first imputed to the value 1 on HAR1. The remaining 2 had an observed value of 1 on HAR1, but were missing on HAR3. Observations outside the restriction are given the value 3.

DESCRIBE estimates population means, proportions, subgroup differences, contrasts, and linear combinations of means and proportions. A Taylor Series approach is used to obtain variance estimates appropriate for a user-specified complex sample design (Kish and Frankel, 1974).

Under DESCRIBE, multiple imputation analysis can be performed. If multiple data sets are specified as inputs, DESCRIBE performs the analysis for each data set and combines the inferences (Rubin, 1987).

The following is an example of the DESCRIBE setup file and printed output.

Setup File

The DATAIN keyword identifies the five imputed data sets that are to be used in the analysis. The five were extracted from the file ADULTOT produced in the above IMPUTE example. The next three keywords—WEIGHT, STRATUM and CLUSTER—specify the survey design variables.

```
DATAIN      ADULTOT1
            ADULTOT2
            ADULTOT3
            ADULTOT4
            ADULTOT5;

  WEIGHT    WTPFHX6;
  STRATUM   SDPSTRA6;
  CLUSTER   SDPPSU6;

  TABLE     HAR1;
  MEAN      HFA8R;
  RUN;
```

TABLE produces estimates of population proportions for HAR1 (ever smoke 100 cigarettes) and MEAN estimates the population means for HFA8R (years of education).

Means and proportions can also be estimated for subpopulation with a BY statement. For example, BY GENDER would produce separate estimates for males and females in addition to estimates for males and females combined.

Printed Output

DESCRIBE provides weighted and unweighted estimates of the proportions and means, along with standard errors that take into account survey design features. The printed output for HAR1 and HAF8R appears below.

```
Problem  1

                Degrees of freedom
                    Infinite

      Factor    Covariance of denominator
       None        0.03317

      Table     Number of        Sum of       Weighted      Standard
      HAR1        Cases          Weights      Proportion      Error
        1          8850     9.882268e+007      0.52702       0.00771
        2          9312     8.869123e+007      0.47298       0.00771

                    Lower          Upper        T Test      Prob > |T|
                    Bound          Bound
        1          0.51189        0.54214      68.35834      0.00000
        2          0.45786        0.48811      61.35014      0.00000

                 Unweighted        Bias         Design
                 Proportion                     Effect
        1          0.48728       -7.53945       4.33045
        2          0.51272        8.40071       4.33045

All imputations

    Problem  2

                Degrees of freedom
                    Infinite

      Factor    Covariance of denominator
       None        0.03317

      Mean      Number of        Sum of       Weighted      Standard
      HFA8R       Cases          Weights         Mean         Error
                 18162     1.875139e+008      12.24597     0.08058174

                    Lower          Upper        T Test      Prob > |T|
                    Bound          Bound
                 12.08784        12.4041      151.96949      0.00000

                 Unweighted        Bias         Design
                    Mean                        Effect
                 10.77538      -12.00875      11.65533
```

REGRESS fits linear, logistic, polytomous, Poisson, Tobit, and proportional hazard regression models to survey data with complex sample designs. The jackknife repeated replication approach is used to estimate the sampling variances (Kish and Frankel, 1974).

REGRESS can output predicted values, model estimates, and variances/covariances into SAS-type output files. Another feature allows users to produce a series of plots—residuals, standard deviation and normal probability—that are useful for regression diagnostics.

If there are missing values, multiple imputation analysis can be performed. When multiple data sets are specified, REGRESS will perform the analysis for each data set and combine the inferences.

Setup File

The DATAIN keyword identifies the five imputed data sets; WEIGHT, STRATUM and CLUSTER specify the survey design variables.

```
   DATAIN      ADULTOT1
               ADULTOT2
               ADULTOT3
               ADULTOT4
               ADULTOT5;

   WEIGHT      WTPFQX6;
   STRATUM     SDPSTRA6;
   CLUSTER     SDPPSU6;

   PREDOUT     PRED_DIA;

   LINK        LINEAR;

   DEPENDENT   HDP;
   PREDICTOR   LDRINK    SMOKER ACTIVE BMI
               NONWHITE HISP    FEMALE
               AGE       HFA8R;
   CATEGORICAL SMOKER;
   RUN;
```

PREDOUT instructs REGRESS to output the predicted values to the file PRED_DIA. LINK defines the type of regression model to be fit.

Keyword DEPENDENT names HPD (serum cholesterol) as the outcome variable, and PREDICTOR identifies the independent variables. CATEGORICAL further defines the predictor SMOKER as a categorical variable. REGRESS will create dummy variables for each of the three categories of SMOKER.

(continued)

Printed Output

The results include the combined estimates of the imputed data sets and standard errors produced by the jackknife repeated replication approach.

```
NUMBER OF VALID CASES:   20050
SUM OF WEIGHTS:          187647206.32

DEGREES OF FREEDOM:      8.3107193138

SUM OF SQUARES:
   MODEL:                9634751445.5
   ERROR:                34344022347
   TOTAL:                43978773792
   R-SQUARE:             0.21908
   F-VALUE:              0.21195
   P-VALUE:              0.99009
```

VARIABLE	ESTIMATE	JACKKNIFE STD ERROR	T TEST	PROB > |T|
INTERCPT	55.096624473	1.4817833693	37.18264	0.00000
LDRINK	2.7560503214	0.15092331379	18.26126	0.00000
SMOKER.1	-3.2556773734	0.35164732811	-9.25836	0.00001
SMOKER.2	-0.54375056663	0.39316430078	-1.38301	0.20268
ACTIVE	1.0023113894	0.44933488718	2.23066	0.05502
BMI	-0.6443368471	0.032059454534	-20.09818	0.00000
NONWHITE	3.4416654566	0.50416970404	6.82640	0.00011
HISP	0.86577743998	0.5431173425	1.59409	0.14817
FEMALE	10.429910556	0.36754005066	28.37762	0.00000
AGE	0.057795637071	0.010428137771	5.54228	0.00048
HFA8R	0.09519964185	0.053121777683	1.79210	0.10948

VARIABLE	ESTIMATE	95% CONFIDENCE INTERVAL LOWER	UPPER
INTERCPT	55.096624473	51.701743978	58.491504968
LDRINK	2.7560503214	2.4102733173	3.1018273255
SMOKER.1	-3.2556773734	-4.0613286448	-2.4500261021
SMOKER.2	-0.54375056663	-1.4445204387	0.35701930545
ACTIVE	1.0023113894	-0.027149647717	2.0317724266
BMI	-0.6443368471	-0.71778754112	-0.57088615307
NONWHITE	3.4416654566	2.2865736059	4.5967573073
HISP	0.86577743998	-0.37854646775	2.1101013477
FEMALE	10.429910556	9.5878478257	11.271973286
AGE	0.057795637071	0.033903965554	0.081687308588
HFA8R	0.09519964185	-0.026506466241	0.21690574994

VARIABLE	DESIGN EFFECT	SRS ESTIMATE	% DIFF SRS V EST
INTERCPT	3.0504572909	56.550513434	2.6387986103
LDRINK	3.153969167	2.5549735698	-7.2958301989
SMOKER.1	1.7748105226	-2.4735989803	-24.021986929
SMOKER.2	2.0910889982	-0.37947585571	-30.211409606
ACTIVE	3.9332530261	0.53650958126	-46.472764161
BMI	2.7991974738	-0.66034405523	2.4842919052
NONWHITE	3.4890495224	5.350109188	55.451169074
HISP	3.2984201436	0.86321216685	-0.29629706448
FEMALE	2.0868771613	9.5436271006	-8.4975173115
AGE	2.2302588605	0.058163151143	0.63588549416
HFA8R	2.9480248483	0.041161687673	-56.762770455

SASMOD allows SAS users to take complex sample design features into account. Currently the following SAS PROCS can be called: CALIS, CATMOD, GENMOD, LIFEREG, MIXED, NLIN, PHREG, and PROBIT.

After specifying sample design features with *IVEware* commands, the user simply adds the SAS PROC statements to the setup file. SASMOD executes the user-specified SAS PROC for every replicate and combines the results to compute the proper variance estimates.

SASMOD, like DESCRIBE and REGRESS, is capable of accepting multiply imputed data sets. Each data set is analyzed separately and the results are combined.

The following example illustrates how to use SASMOD to account for survey design features when using the SAS CATMOD procedure.

Setup File

The five imputed data sets are identified with the DATAIN keyword and survey design variables are indicated by the WEIGHT, STRATUM, and CLUSTER keywords. The SAS CATMOD statements follow.

CATMOD calls for HAB1, a five category self- assessment of health status variable, to be regressed on respondent gender, smoking status (current, former, never), and race.

```
DATAIN      ADULTOT1
            ADULTOT2
            ADULTOT3
            ADULTOT4
            ADULTOT5;

 WEIGHT     WTPFQX6;
 STRATUM    SDPSTRA6;
 CLUSTER    SDPPSU6;

 PROC CATMOD;
   MODEL HAB1=FEMALE SMOKER NONWHITE;
 RUN;
```

(continued)

Printed Output

SASMOD produces the following output for the SAS CATMOD procedure.

```
Valid cases              14058
Sum weights         155428259.8

Degr freedom           Infinite

-2 LogLike          428649627.2

Variable              Estimate        Std Error        Wald test        Prob > Chi
[1]Intercept         1.8975252        0.0963519        387.84189         0.00000
[2]Intercept         2.2929562        0.0879903        679.08194         0.00000
[3]Intercept         2.5117710        0.0881987        811.02740         0.00000
[4]Intercept         1.5661782        0.0991464        249.53341         0.00000
[1]FEMALE.1          0.2137564        0.0833359          6.57921         0.01032
[2]FEMALE.1          0.1503387        0.0718700          4.37569         0.03646
[3]FEMALE.1          0.0783372        0.0748061          1.09663         0.29501
[4]FEMALE.1         -0.0239401        0.0918233          0.06797         0.79431
[1]SMOKER.1         -0.5242103        0.1358919         14.88072         0.00011
[2]SMOKER.1         -0.3006035        0.1347148          4.97918         0.02565
[3]SMOKER.1         -0.0838631        0.1339074          0.39222         0.53113
[4]SMOKER.1         -0.0739939        0.1433337          0.26650         0.60569
[1]SMOKER.2         -0.0983358        0.1331557          0.54539         0.46021
[2]SMOKER.2         -0.1725536        0.1190886          2.09946         0.14735
[3]SMOKER.2         -0.1382790        0.1172381          1.39115         0.23821
[4]SMOKER.2         -0.0335599        0.1199688          0.07825         0.77968
[1]NONWHITE.1        0.4142672        0.1078764         14.74716         0.00012
[2]NONWHITE.1        0.4785610        0.1059228         20.41249         0.00001
[3]NONWHITE.1        0.1833801        0.1132303          2.62288         0.10533
[4]NONWHITE.1        0.0383872        0.1146092          0.11218         0.73767

Variable                 Odds            95% Confidence Interval
                         Ratio         Lower            Upper
[1]Intercept          6.6693685        5.5203944         8.0574816
[2]Intercept          9.9041733        8.3335432        11.7708214
[3]Intercept         12.3267413       10.3676923        14.6559665
[4]Intercept          4.7883130        3.9417254         5.8167273
[1]FEMALE.1           1.2383210        1.0515049         1.4583277
[2]FEMALE.1           1.1622279        1.0093483         1.3382632
[3]FEMALE.1           1.0814873        0.9338323         1.2524891
[4]FEMALE.1           0.9763442        0.8153570         1.1691173
[1]SMOKER.1           0.5920227        0.4534468         0.7729483
[2]SMOKER.1           0.7403713        0.5683825         0.9644027
[3]SMOKER.1           0.9195571        0.7070626         1.1959128
[4]SMOKER.1           0.9286774        0.7009881         1.2303229
[1]SMOKER.2           0.9063445        0.6979320         1.1769919
[2]SMOKER.2           0.8415132        0.6661458         1.0630473
[3]SMOKER.2           0.8708557        0.6918812         1.0961269
[4]SMOKER.2           0.9669970        0.7641583         1.2236773
[1]NONWHITE.1         1.5132614        1.2245535         1.8700368
[2]NONWHITE.1         1.6137506        1.3108867         1.9865875
[3]NONWHITE.1         1.2012709        0.9619267         1.5001681
```

Availability

IVEware application files*,* Installation Guide, and User Guide, along with example setup and SAS data files can be downloaded at no cost from www.isr.umich.edu/src/smp/ive/.

Appendix: Sequential Regression Multiple Imputation

Imputation methods to replace item missing values in surveys have a long history, including a theoretically appealing Bayesian framework (Rubin 1976). The Bayesian approach requires an explicit model conditioned on the fully observed variables and unknown parameters, a prior distribution for the unknown parameters, and a model to impute the missing data mechanism.

But survey data sets have large numbers of variables with diverse distributional forms (such as continuous, dichotomous, and censored variables). Survey data have restrictions that define subsets of cases to receive imputations for a given variable. They also have logical or consistency bounds that must be incorporated into an imputation process. Developing a full Bayesian model in the survey setting is a difficult and complex task.

A general purpose multivariate imputation procedure has been developed for survey data with complex structure which develops full multivariate models that are fully conditional on the observed values (Raghunathan et al., 2001). The approach imputes through a sequence of multiple regressions, variable by variable, using as covariates all other variables observed or imputed for a given case. The imputed values are draws from the posterior predictive distribution given in the regression model, and multiple imputed values are drawn for each missing value. Survey variables can have a continuous, binary, categorical (more than two categories), count, or mixed (continuous with a mass at zero) distributions.

Let X denote a $n \times p$ matrix of p continuous, binary, nominal, count, or mixed variables, and let $Y_1, Y_2, \ldots, Y_k$ denote k variables with missing values ordered from least to most amount missing. The joint conditional density of the $Y_1, Y_2, \ldots, Y_k$ given X can be factored as $f(Y_1, Y_2, \ldots, Y_k \mid X, \theta_1, \theta_2, \ldots, \theta_k) = f_1(Y_1 \mid X, \theta_1) f_2(Y_2 \mid X, Y_1, \theta_2) \cdots f_k(Y_k \mid X, Y_1, Y_2, \ldots, Y_{k-1} \theta_k)$ where the f are conditional density functions and θ_j is a vector of parameters. Each conditional density is modeled through an appropriate regression model with unknown parameters θ_j, with a diffuse prior distribution for the parameters.

Each imputation consists of c rounds, starting by regressing Y_1 on X, imputing missing values under the regression model, using draws from a corresponding predictive posterior distribution. The matrix X is then updated by appending Y_1, and Y_2 is regressed on the updated X. The imputation is repeated for Y_2, and the regression and imputation process continues through $Y_3, Y_4, \ldots, Y_k$. The imputation process is then repeated in rounds 2 through c, modifying the predictor set X to include all Y_j except the variable being imputed. Cycles are repeated until stable imputed values occur.

The procedure is modified to incorporate restrictions and bounds. In addition, since it is difficult to draw parameter values directly from their posterior distribution with truncated normal likelihoods, a Sampling-Importance-Resampling algorithm (Raghunathan and Rubin, 1988) is used to draw from the actual posterior distribution.

The entire imputation process for k variables can be repeated m times, yielding m imputed values for each item missing value. Standard multiple imputation estimation procedures are then used to estimate the precision of values estimated from the imputed data set. For example, if $\hat{\alpha}^{(l)}$ denotes a vector of regression coefficients estimated in a regression model from the lth imputed data set, and $V^{(l)}$ denotes the corresponding covariance matrix, the multiply imputed estimate of α is $\alpha_{MI} = \sum_{l=1}^{m} \hat{\alpha}^{(l)} \Big/ m$, with covariance

matrix $V_{MI} = \sum_{l=1}^{m} V^{(l)} \Big/ m + \dfrac{m+1}{m} B_m$, where $B_m = \sum_{l=1}^{m} \left(\hat{a}^{(l)} - \hat{\alpha}_{MI} \right) \left(\hat{a}^{(l)} - \hat{\alpha}_{MI} \right)^t \Big/ m$.

References

Kish, L. and Frankel, M. R. (1974). Inference from complex samples. *Journal of Royal Statistical Society, Series B,* 36, 1-37.

Raghunathan, T. E., Lepkowski, J. M., Van Hoewyk, J., and Solenberger, P. (2001). A multivariate technique for multiply imputing missing values using a sequence of regression models. *Survey Methodology,* 29, 85-95.

Raghunathan, T.E., and Rubin, D.B. (1988) An application of Bayesian statistics using sampling/importance resampling to a deceptively simple problem in quality control. In G.E. Liepins and V.R.R. Uppuluri (Eds.), *Data quality control: theory and pragmatics.* New York:Marcel Dekker.

Rubin, D.B. (1987). *Multiple imputation for nonresponse in surveys.* New York:Wiley.

Rubin, D.B. (1976) Inference and missing data (with discussion). *Biometrika*, 63, 581-592.
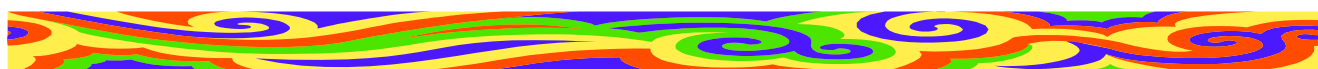
To All Members

◆ The IASS needs your contribution.

◆ Please do not forget to renew your membership.

◆ As of January 2002, French Francs are no longer accepted. As a consequence, the payment of dues and subscriptions must be made in either Euros or U.S. dollars.

Country Reports

ALGERIA
Nacer-Eddine Hammouda

Thus far, estimation of **infant mortality** remains a subject of controversy between Algerian statisticians and demographers, owing at least to two phenomena: the rate of coverage of vital events and the assumption of false stillbirths. Gross infant mortality rates based on vital statistics data are approximately 37 per thousand. Demographers subject this estimate to a double adjustment for coverage rates (births, and deaths under 1 year of age) and for the proportion of false stillbirths. This yields an infant mortality estimate greater than 50 per thousand. The two adjustment factors were themselves estimated on the basis of a sample survey dating back more than twenty years. An indirect estimate of the infant mortality rate based on data from the last census of population appears to support the demographers' estimate, since it is within the same ballpark. But does it apply to the Algerian context in which a drastic decline in fertility has been observed for more than a decade? Sample surveys conducted in the past fifteen years do not settle the matter, since they provide a median estimate which, moreover, is not very precise given the sample sizes used. For this reason, the WHO, as part of the family health project run by the Arab League, conducted a survey on a sample of 20,000 households in 2002. (SOUABER Hassen souaber@ons.dz).

For years, **child labour** has been a taboo subject in Algeria. Because of its nature and the method of collecting information about it, the phenomenon cannot be gauged adequately by the national statistics available. The Institut national du travail (INT) has arranged for a first survey of child labour, to be conducted in 2003. At the outset, the team responsible for technical aspects raised the problem of the objective pursued by this survey, since the sampling strategy depends on it. Estimating the extent of the phenomenon was ruled out at the outset so as to focus more on the forms that child labour takes and what it entails. Accordingly, researchers put forward certain hypotheses stating that these forms of labour differ according to at least two criteria: the sex of the child and where the child lives. Based on these two criteria, the sampling strategy will be to target areas with low school enrolment, since some form of child labour is more likely to exist among children who are unschooled or have left school. The target population would therefore be children of both sexes who are between 10 and 15 years of age and not in school. Age 10 is when school attendance starts to drop, and 15 is the age when compulsory schooling ends. (Kamel BOUCHERF kboucherf@hotmail.com).

AUSTRALIA
Geoff Lee

The **West Australian Aboriginal Child Health Survey** (WAACHS) is a large-scale epidemiological study of the health, development and well-being of aboriginal children and their families in Western Australia. It has been conducted by the West Australian (WA) Institute of Child Health Research (ICHR). The survey selected a 1 in 6 sample of families with aboriginal children under 18 years of age. In total, 2,000 families and 5,300 children have provided information for the survey. Interviews were conducted with both primary and secondary carers where possible, as well as with youths aged 12-17 years. For children attending school, schools were contacted to obtain information on academic competence and performance. The data have been linked with the WA Maternal and Child Health Research Database and the WA Linked Database system giving access to midwives records and records of all hospital admissions for survey children and hospital admissions for survey carers. The resulting dataset is complex, hierarchical and a valuable resource for many investigations into influences on the health of Aboriginal Children in WA.

Extensive consultation occurred with the indigenous communities to ensure their support for the survey. Wherever possible indigenous interviewers were recruited and trained to

enumerate the survey. Particular attention was paid to explaining the survey objectives and processes to selected respondents to ensure that their participation and agreement to the subsequent data linkages was genuinely an informed decision.

The survey design was an area-based clustered design with clustering within Census Districts and within families. The sample design was undertaken by the ABS, with the original sample selected from the 1996 census frame. ABS outposted officers have worked alongside ICHR for the duration of the project. A number of interesting lessons have been learnt about surveying the indigenous population, and will be discussed in future evaluation reports. Both the sample design clustering and the hierarchical data structure will need to be accounted for in the data analysis.

ICHR is collaborating with the ABS to produce a series of three publications reporting the results of the survey. The first publication is scheduled to be released in September 2003. There are several analytical challenges that need to be addressed within the timeframe of the first publication. Principal among these is the development of modelling techniques that can account for both the clustered survey design and the hierarchical data structure simultaneously. While techniques have been developed to address one or the other of these challenges individually, new methods need to be developed to address both problems simultaneously.

For more information about the survey contact Professor Steve Zubrick (steve@ichr.uwa.edu.au).

CANADA
John Kovar

The primary goal of the **Youth in Transition Survey** (YITS) is to provide policy-relevant information on the school-to-work transitions of Canadian youth. For the 2000 panel, this longitudinal survey comprises two target populations, represented by a cohort of 15-year-olds and a young adult (18-20 years old) cohort, while the 2003 panel comprises 15-year-olds only. The first survey cycle of both panels of the 15-year-old cohort is integrated with the OECD Programme for International Student Assessment (PISA).

Panel 2000

Cycle 1 data for both cohorts of this panel were collected in 2000. For the 15-year-old cohort the school participation rate (with replacements) was 96 percent; student participation among these schools was 87 percent. The final response rate for the 18-20 year-old cohort was 81 percent, reflecting differences in the target population, frame and method of collection.

Both cohorts have presented estimation challenges. Given multiple data collection vehicles of the 15-year-old cohort, several options were considered for defining a respondent and weighting the data. Ultimately a separate set of weights was created for analysis of parent characteristics, due to 11 percent parent nonresponse among responding students. For variance estimation, although PISA data for every participating country were released with a set of 80 BRR replicate weights, with the large number of PSUs in the Canada sample we opted instead for the bootstrap method. For the 18-20 year-old cohort, in addition to the normal types of weighting adjustments for surveys based on the Labour Force Survey frame, the initial YITS weights had to be modified to reflect a sample comprising 36 rotation groups with overlapping clusters.

Development of scales for both cohorts required extensive analysis using Item Response Theory and factor analysis. High-school engagement scales were developed for both cohorts. For the 15-year-old cohort, several scales of psychological and social functioning of the student as well as a parenting-style scale were created.

A preliminary data release of the 15-year-old cohort and a national report occurred in December 2001, which included all of the PISA data and most of the YITS student questionnaire variables. In January 2002 a national report on the 18-20 year-old cohort was released, accompanied by a preliminary file of variables. Final data for this cohort became available in March 2003; the final cycle 1 product for the 15-year-old cohort, which includes student and parent variables, was released later in the spring.

For cycle 2 of panel 2000, a single CATI questionnaire in BLAISE was developed and administered concurrently to the two cohorts in January to May 2002. Among the total sample of

52,000, all of whom were cycle 1 respondents, the overall preliminary response rate was 88.1 percent. However, split by cohort, the respective rates of 90 percent and 85 percent for 17-year-olds and 20-22 year-olds confirmed the challenge of tracing and contacting the more mobile older cohort.

Panel 2003

Although similar in design to the 2000 panel, the PISA 2003 cognitive tests will focus on the domain of mathematics rather than reading. A pilot survey was conducted in April-May 2002. A sample of 1,425 schools was selected for the main survey, which is designed to meet estimation criteria for PISA as well as the YITS longitudinal component. This is expected to yield a sample of approximately 37,000 students in participating schools. Data collection will occur in two phases, with the student component in May to June 2003, followed by CATI-administered parent interviews.

For more information on the survey methodology or data products, contact Johanne Denis (613-951-0402, e-mail: johanne.denis@statcan.ca), Social Survey Methods Division or Lynn Barr-Telford (613-951-1518, e-mail: lynn.barr-telford@statcan.ca), Centre for Education Statistics, Statistics Canada, Ottawa, Ontario K1A 0T6.

The annual **Survey of Household Spending** (SHS) collects detailed information on household expenditures, dwelling characteristics and household facilities from a sample of about 23,000 households. In the past, the survey weights were calibrated to population counts for three age groups and by household size. Two major considerations led to the revision of the calibration strategy. Studies on the representativeness of the sample suggested that the use of more detailed demographic controls and the addition of income-related controls would be beneficial. Furthermore a Task Force on Income Statistics identified the need to harmonize the calibration methods used by surveys on personal and household finance in order to reduce differences in estimates from different surveys as well as those from the System of National Accounts and administrative income files. As a result, demographic calibration was standardised. The use in calibration of tax data from the Canadian Customs and Revenue Agency was also assessed. The objective was to solve the problem of representativeness by income class observed in these surveys.

The statement of remuneration paid by an employer to an employee is called a T4 form. In the first step in the introduction of income data in calibration, wages and salaries from the T4 file have been added to the SHS calibration. The approach, which controls on the number of individuals within income intervals, has improved the income distribution and the precision of the estimates. A reduction of CVs was obtained for most expenditure estimates and this reduction is larger than 10 percent for one quarter of them. A few problems were experienced with the T4 files and a clean-up strategy had to be developed. A reconciliation exercise between the T4 file and the income tax and benefit returns file is in progress. This will improve the clean-up strategy and provide information on the coverage of these files. Investigations are still required on the use of other sources of income for SHS. Furthermore, for other surveys, additional work is needed before income component are introduced in their calibration.

For further information on the Survey of Household Spending, please contact Johanne Tremblay (Johanne.tremblay@statcan.ca or at 613-951-0682).

ITALY
Claudio Quintano and Linda Laura Sabbadini

From Claudio Qintano
The National Survey on violence against women originates from the need to disclose the problem on violence against women in Italy in terms of its prevalence, incidence rate and nature. This dedicated survey is the first one in Italy and will be conducted in its final phase in 2004 with a national representative sample of 30 000 women; all interviews will be done by adopting CATI (Computer Assisted Telephone Interview) method. The questionnaire that will be used aims to address several aspect of violence against women:

◆ Prevalence and incidence rate of different types of violence (physical, psychological and sexual). Specific attention will be addressed towards domestic violence by current or former partner;

◆ Characteristics of those involved and consequences of violence;

◆ Risk and protective factors related to individuals as well as to the socio-demographical domain. Special attention will

be paid to psychological/emotional and economical abuse which are usually difficult to reveal, disclose and assess.

Only a limited number of countries have implemented a dedicated survey like this one. Statistics Canada in 1993 has for the first time addressed this problem, at the end of the nineties, the UNICRI (United Nation Interregional Crime Research Institute) under the auspices of the United Nations started addressing the problem. Also the National Institute of Statistics in Italy (ISTAT) in the past years (97/98 and 2002) addressed the problem of victimization, and developed a survey on citizen's safety where attention is also paid towards measurement of sexual harassment and rape.

This project is the result of a joint agreement between the Department of Equal opportunities and ISTAT, under the auspices of United Nations, UNICRI, HEUNI, and Statistics Canada, which came up with a project that can be internationally comparable according to the International Violence against Women Survey.

This type of survey addresses several problems from the procedural and methodological point of view not faced before by ISTAT. The questionnaire has to be designed in such a way that helps the interviewee to disclose the violence. This means that it has to be easy to administer and to understand, not judgmental but clear in the aim it wants to reach and it has to tackle several aspects of the violence. For this reason, in order to undertake this complex type of survey, several phases are followed: 1- Qualitative research and 2- Quantitative research.

1) The Italian National Institute of Statistics, in preparation of the National Survey on violence against women, has conducted a series of *Focus Groups (FG)* with different groups of people working in the field: women working in shelters for battered women, social workers, women who have been abused, to learn from them the different patterns of such violence. The content analysis of the *FG* revealed different aspects of violence between intimates, especially in terms of the more subtle types of psychological violence. In addition, a Group Interview (Delphi) with experts working in the field (judges, lawyers, police officers) will help disclose further aspects of violence against women.

2) The International Team, consisting of experts from different countries (such as Canada, Poland, Denmark, Australia, Costa Rica, Italy) during the first semester of the year 2002, has tested, on a limited number of women, a first version of the questionnaire. This has been done in order to test the accuracy of the instrument and relevance of the issued addressed. A pilot survey with a sample of 1000 women will be interviewed in 2003 to test both the questionnaire and the procedure. In year 2004, the final survey will be conducted with a sample of 30000 women. Special attention will be dedicated to the selection and the training of the interviewers and to their supervision and follow-up. The relationship between the interviewee and the interviewer is essential in helping women disclosing the violence.

The 2004 final survey will become part of the integrated social system of multipurpose surveys on households. For more information on the above initiatives, please contact Muratore Maria Giuseppina (muratore@istat.it).

From Linda Laura Sabbadini
Official **poverty estimates** are calculated yearly using the data of the Household Budget survey. Studies and applications are in progress in order to: obtain reliable poverty values at regional level and evaluate the sampling errors of poverty estimates in the proper way.

According to the European Council Regulation, ISTAT is going to put in place a new **Continuous Labour Force Survey**. During 2003, ISTAT will carry out simultaneously the traditional quarterly survey and the continuous survey, in order to have the possibility to re-build time series for previous years. The new survey uses new techniques to gather data: a face to face interview with CAPI system for the first interview and a telephone interview (CATI) for the other three interviews with the same family. For the first time, ISTAT will use its own team of 311 interviewers for the CAPI interviews. The data are transmitted daily through internet connections.

Within the Italian Time Use Survey an innovating **monitoring system** of PAPI surveys has been tested. We have planned a small questionnaire, to be filled by interviewers, that contains some important information about each survey unit. In particular, on the designated date for the

conclusion of interview and diary collection, the interviewers communicate to ISTAT what is the situation about each household: has the household refused to collaborate, has it filled the diaries, has it postponed diary day and other specific information. The indicators derived from this information are updated weekly and analysed in order to have a complete picture of the fieldwork trend and, where or when it may be necessary to correct some problematic aspects. In this way we have monitored more than 90 percent of the sample units and we have offered to ISTAT regional offices some tools to better intervene in the field.

For more information please contact Linda Laura Sabbadini (sabbadin@istat.it).

PHILIPPINES
Gervacio G. Selda, Jr.

The Bureau of Labor and Employment Statistics (BLES) recently completed the conduct of a project entitled **"Development of a Design for the Conduct of a National Migration Survey"** under the Re-engineering the Government Statistical Services Project–Phase II. The project aimed to fill the data gaps on migration characteristics of the Philippine population including their inter-relationships with national and regional development patterns. It came up with a sample design that will generate reliable estimates on migration with concern for minimizing cost and maximizing comparability of estimates across time. In general, the activity's outputs were:

◆ sampling design;
◆ questionnaire design; and
◆ estimation procedure.

The proposed survey would shed light on the internal migration and international migrants in the country. Some of the information that would be collected in the proposed study are:

◆ migration history;
◆ education;
◆ training;
◆ income;
◆ occupation;
◆ industry;
◆ household characteristics;
◆ housing;

◆ asset ownership; and
◆ marriage and family.

However, the conduct of a migration survey in the magnitude proposed by this study is a difficult idea to sell at this time of dwindling government resources to finance statistical activities. Also, a full-blown migration survey is not in the priority list of government statistical offices. This is due mainly to the fact that there is no single government department or agency which deals directly with the issue of migration as this cuts across the concerns of local governments and national government agencies that deals with urban planning, population, labor and employment, and the delivery of basic needs such as housing, education, health, infrastructure, peace and order. This is why the study also included a list of proposed options to address the issue of funding support for the survey. For more details on the study, please contact: Ms. Editha B. Rivera, OIC-Director of BLES at dolebles@manila-online.net.

The Philippine National Statistics Office (PNSO) has completed the preparation for the conduct of a **National Time Use Survey (TUS)** to obtain information on how people aged 10 years old and over allocates their time to various activities. Specifically, the survey is geared towards:

◆ determining whether significant differences in time use exist between population groups;
◆ gathering data that can serve as basis for valuation of paid and unpaid work for men and women of the Philippines;
◆ providing inputs for the estimation of the contribution of women and men to country's economy;
◆ providing information of the informal sector, child work activities, etc.; and
◆ providing information for market research use.

The design of the survey was based on the results of the 2000 Pilot TUS and subsequent workshop conducted on October 1-2, 2002. The national TUS shall be a rider to the Labor Force Survey (LFS); hence, shall adopt the sampling design of the master sample using the multi-stage sampling for one panel or one replicate. One panel sample is about one-fourth of the expanded samples with around 12,500 households. Reliability of estimates is at the national level only. All sample households will be interviewed during survey period. The LFS questionnaire will be administered first followed by the TUS questionnaires. Demographic and socio-

economic characteristics, time-use diary portion, estimates of self-rated valuation of unpaid work and household time saving/devices/equipment will be among the major items that will be collected using personal interviews; self-administered questionnaires (SAQ) or left-behind diary method; and diary days. For more information, contact Administrator Carmelita N. Ericta, Philippine National Statistics Office, at C.Ericta@mail.census.gov.ph.

POLAND
Janusz Wywial

The survey research of the hog population was reorganized in Poland. The survey is evaluated every year in April, August and December by the Central Statistical Office. Mainly, the number of hogs is estimated in the population of Polish farms. The population consists of farms whose area is at least 15 hectares. The number of such farms is equal to 833,000. The size of the stratified sample is 15,000 farms. The sampling frame was constructed on the basis of the 2002 census. The number of hogs (on the farms in the year 2002) was used as an auxiliary variable to optimize the sample sizes drawn from the strata. The population of the farms was partitioned into 16 strata according to an administrative rule. Each stratum was a suitable region of Poland, partitioned into two parts. The first part consisted of large farms. The remaining farms were in the second part. All farms from the first part were selected in the sample. A simple sample without replacement was drawn from the second part of the strata. Hence, the sample drawn from the strata consisted of two sub-samples. The first one is the purposive sub-sample and the second one is the random sub-sample. The following allocation problem was evaluated. It was assumed that the sum of the sizes of samples selected from the strata was fixed. On the basis of the auxiliary variable the sizes of both sub-samples drawn from the appropriate strata were determined in such a way that the precision of the estimation of the total value in each stratum was the same. The ex-post analysis of the precision estimation will be evaluated. For more details, please, get in touch with Bronislaw Lednicki, B.Lednicki@stat.gov.pl, Central Statistical Office, 208 Niepodleglosci Street, 00-925 Warsaw, Poland, http://www.stat.gov.pl.

SPAIN
Montserrat Herrador

From 2002 the Spanish Statistical Office (INE) has started conducting a new annual **Survey of Information and Communication Technology** (ICT) which aims to collect information on the availability, distribution and utilisation of ICT among Spain households. This survey is adapted to the recommendations made by the European Statistical Office (EUROSTAT) which, in its turn, has followed the suggestions from the Organisation for Economic Co-operation and Development (OECD).

In June 2002 this survey was carried out for the first time using a subsample of 20,000 households corresponding to two rotation groups of the Labour Force Survey (LFS) sample. These households were interviewed in the LFS during six consecutive quarters and, in the first and second quarters of 2002, they were going out of the LFS sample. From the second quarter of 2003 the ICT survey is going to be implemented by using a new sampling design which is described below.

A rotation pattern will be used. Any household entering the sample is expected to provide information for four consecutive years, after which the household will leave the sample. For the selection of the sample, a stratified three-stage sampling will be applied and for each region a separate sample has been designed to enable the publication of regional data. The first-stage units are the census sections (geographical areas); the second-stage units are the households. In the third-stage, a person aged 15 years and over is selected from each household.

The sampling frame of geographical areas is built from the list of census sections dated at the first of January of 2001. For the second-stage sampling units, the Spanish Register of Population is used in order to obtain a list of households for each census section selected in the first-stage. Information on the household will cover all resident members with 10 years or more and be collected by telephone, whereas data on Internet use by household members will be obtained by personal interview. A matching process between the household frame and telephone directories is performed in order to include phone number in the household sample.

For those selected households without telephone, the data will be collected face-to-face.

The results of the survey will be made available by the end of every year. For more information, please contact Montserrat Herrador (herrador@ine.es).

UNITED STATES OF AMERICA
Ronald Fecso

The census of the United States' population and housing was conducted as of April 1, 2000. Well before then the United States Census Bureau initiated the **Census 2000 Testing, Experimentation, and Evaluation Program**, the most comprehensive research program in its history. This program is informing the Census Bureau and our customers about the effectiveness of Census 2000 and providing valuable information to plan the next decennial census in 2010, the American Community Survey, the Master Address File, and other Census Bureau censuses and surveys. The program consists of several tests and experiments and over 90 evaluations on the implementation of Census 2000. Relevant findings from this body of research will be synthesized in broader topical reports on key aspects of Census 2000. To assure the reporting of accurate results, the Census Bureau also initiated the *Census 2000 Quality Assurance Process* for all program reports.

Topic Reports summarize and integrate relevant findings from tests, experiments, evaluations, and other research on related census subjects, and make recommendations for the next decennial census in 2010. Reports will be prepared on the following subjects: Address List Development, Automation of Census Processes, Content and Data Quality, Coverage Improvement, Coverage Measurement, Data Capture, Data Collection, Data Processing, Ethnographic Studies, Partnership and Marketing, Privacy, Puerto Rico, Race and Ethnicity, Response Rates and Behavior Analysis, and Special Places and Group Quarters.

Tests and experiments were conducted during Census 2000 because the decennial census environment provided the best conditions to learn about new methodologies. As examples, the effects of the following were measured: a) questionnaire coverage questions and the "select more than one" race option; b) administrative records as a data collection tool and as a means to assess imputation methods; and c) alternative electronic mode options (with and without incentives), including the Internet and interactive voice recognition.

Evaluation reports assess the effectiveness of Census 2000 operations, systems, and processes. Evaluations on some of the newer programs or systems to the decennial census include: a) the national paid advertising campaign; b) Optical Character Recognition of the Data Capture System; c) address list development operations; d) field followup operations to improve coverage; and e) the new race reporting–this evaluation includes comparability issues to survey and pre-2000 census data.

The *Census 2000 Quality Assurance Process* was designed to meet overall guidelines established by the Census Bureau's quality assurance policy for report (evaluations and experiments) development, review, and writing. It involved building procedures into all stages of report writing, from project development through issuance of the final report, and providing a framework so reports have consistent designs and formats. To help make quality integral to every stage of an evaluation, tools such as checklists and templates were developed for project managers as they prepared study plans, specified programs and procedures, analyzed data, and prepared final reports for review by key operational customers and high-level managers.

For information on the *Census 2000 Testing, Experimentation, and Evaluation Program* Topic Reports, or to access reports currently available, visit: www.census.gov/pred/www.
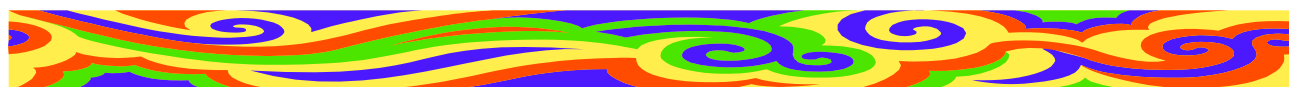
Training Needs for Survey Statisticians in Developed and Developing Countries

Graham Kalton
Westat, USA
Presented at an Invited Session, dedicated to the memory of Leslie Kish, Survey Research Methods Section, American Statistical Association, Joint Statistical Meeting, 2002

1. Introduction

The session in which this paper is presented is entitled "Training of Survey Statisticians: A Session Dedicated to the Memory of Leslie Kish." The topic of the session is highly appropriate given Kish's lifelong dedication to training survey statisticians, especially those from developing countries. It is also appropriate that the session is cosponsored by the International Association of Survey Statisticians (IASS) and by four ASA sections—Health Policy Statistics, Survey Research Methods, Government Statistics, and Social Statistics. Kish was a key member of the committee that founded the IASS, and he served as President of both IASS and ASA.

Kish established a major program for training survey statisticians from developing countries at the Survey Research Center of the University of Michigan in 1961. That highly successful two-month summer Sampling Program for Survey Statisticians (SPSS) continues to this day and has now trained more than 500 survey statisticians from more than 100 countries. Kish's choice of "Developing Samplers for Developing Countries" as his topic for the fourth Morris H. Hansen Memorial Lecture is an indicator of the importance that he attached to this activity (Kish, 1996). His paper contains many valuable observations on the training needs of survey statisticians in developing countries.

This paper considers the training needs for survey statisticians in both developed and developing countries. The term "survey statistician" refers in this paper to those engaged in the statistical design and analysis of surveys, primarily survey samplers, rather than to the broader interpretation of the term that encompasses those engaged in any aspect of survey methodology. For those in developed countries, the focus here is on the education needed to prepare them for careers as survey statisticians, mainly in terms of a master's degree. For those from developing countries, the focus is on short-term programs that can provide applied training in survey sampling, programs like the SPSS and shorter programs. Throughout the emphasis is on training in applied sampling rather than in sampling theory.

Educational needs for survey statisticians in developed countries are discussed in Section 3, and the training needs for survey statisticians in developing countries are discussed in Section 4. As preparation for the discussion in those sections, Section 2 contains observations about general training needs in survey research.

2. Training in Survey Research Methods

Survey research is by its nature an interdisciplinary activity. It is generally conducted as a team operation, with the team members providing expertise in the survey's subject matter, questionnaire design, survey sampling, survey operations, data collection, computing, data processing, and statistical analysis. In large-scale survey organizations, the survey team may be composed of specialists in each of the separate components of the survey procedures. In small-scale survey organizations, however, team members may need to cover more than one component. For example, the team member who designs the questionnaire may also manage the data collection, and the team member who selects the sample may also direct the data processing and survey analysis. Regardless of whether team members have responsibility for one or more than one of the survey components, they need to have a basic understanding of all components. Designing and implementing an effective survey requires a careful blending of its various components. Thus the members of the survey team need to be able to work together to formulate a survey design that can be implemented successfully. They should fashion their individual components to be the best in the context of an overall design, rather than optimal in some narrower sense. To interact effectively with the other members of the survey team, each member needs to appreciate the issues involved in the overall design of the survey.

An alternative way of demonstrating this need for survey team members to understand the whole survey process is through the widely used concept of total survey error. Kish (1965, Chapter 13) describes the diverse sources of error in survey estimates, including sampling error and the nonsampling errors that arise through nonobservation (noncoverage and nonresponse) and through observation (data collection and processing errors). Survey design often requires trade-offs to be made between different sources of error. For instance, a larger sample size will reduce sampling error but perhaps at the cost of more error from nonresponse and data collection, or a more burdensome data collection protocol may lower measurement error at the cost of greater nonresponse error. All members of a survey team need to appreciate such interrelationships. Thus, an important part of training for all survey researchers should be to show them how their specialist area fits into the big picture.

There is a notable lack of educational and training programs in survey research around the world. Few universities provide, or are equipped to provide, these programs. They seldom have the full range of faculty needed, and most lack instructors with the wealth of experience required to teach the applied aspects of survey research effectively. In recognition of the shortage of such programs in the United States, in 1992 the Federal statistical agency heads, the head of the Office of Management and Budget Statistical Policy Office, and the chair of the Council of Economic Advisors initiated the establishment of a center for survey methods that would provide graduate education and research to serve the needs of the Federal agencies. As part of the development of that initiative, the Committee on National Statistics (CNSTAT) at the National Research Council convened a workshop on the proposed center. The summary of the workshop (Wolf, 1992) provides many important ideas about the training needs for survey researchers from the perspectives both of those working in survey research in Federal agencies and of faculty involved in teaching survey research. Here are a few of those ideas:

◆ There should be a focus on the interdisciplinary nature of survey research and training for it, along the lines discussed earlier.

◆ The center should engage in both degree and nondegree programs.

◆ Training could include core courses, specialty courses, and electives.

◆ Apprenticeships or practicums are important in providing real-world experience.

◆ A mechanism to respond to new training needs will be necessary.

◆ A wide variety of courses might be part of the center's curricula.

The center was established at the University of Maryland in 1992 after an open competitive process. It involves a collaboration of the University of Maryland, the University of Michigan, and Westat and is known as the Joint Program in Survey Methodology (JPSM). The ways that JPSM has instituted the ideas given earlier are on its web site: http://www.jpsm.umd.edu. The JPSM has set up PhD and MS degree programs, Citation and Graduate Certificate nondegree programs, and noncredit short courses. The JPSM MS degree program requires 46 credit hours. It has two areas of concentration, statistical science and social science, with all students taking certain core courses.

It is instructive to make note of the collaboration involved in JPSM. The three-way collaboration brings together the range of faculty and experience needed to run the program and, in addition, the program is supported by teaching contributions from staff in the Federal agencies. Collaborations in training in survey research between a university, a survey research organization, and government also occur in the United Kingdom. The Department of Social Statistics at the University of Southampton offers Diploma/MSc programs in Social Statistics and in Official Statistics, the latter offered in collaboration with the Office for National Statistics. The department also collaborates with a survey research organization—the National Centre for Social Research—and the University of Surrey in the Centre for Applied Social Surveys (CASS), which offers short courses in survey methods. See http://www.socstats.soton.ac.uk for details.

3. Education for Survey Statisticians

This section focuses on graduate-level education for survey statisticians, mainly survey samplers and, in particular, on the issues involved in setting a curriculum for a master's level program. Like Kish (1996), the focus here is on survey sampling and sample design, not the foundations of sampling theory.

In general, also like Kish, I favor a flexible program to accommodate the needs of a variety of students. Some may want to concentrate specifically on survey sampling, others may want to take a more general program in survey methodology with a special emphasis on sampling, while yet others may want to combine survey sampling with a particular subject-matter area (e.g., agriculture,

education, health, economics). Some may plan to move into managerial positions as their careers progress, whereas others may want an education that prepares them for a lifetime career in survey sampling. The MS education for this latter group needs to provide a firm foundation in the subject on which they can build as new developments occur.

My criteria for a master's program for survey statistics are the following:

◆ Strong foundation in statistical theory and methods,

◆ Specialized training in the theory and practice of survey sampling,

◆ Broad knowledge of the whole survey process,

◆ Development of good computing skills, and

◆ Training in oral and written communication.

Statistical theory and methods are listed first because they provide the basic foundation for survey sampling. Students need a strong foundation in this area to be able to read the current sampling literature. They will no doubt have even more need for this foundation to upgrade their skills as advances in survey sampling occur in the future. As an illustration, consider the recent developments in small area estimation and in variance estimation with data sets containing imputed values. Both of these areas illustrate how new methods in survey sampling are using more high-powered statistical methods. A strong foundation in statistical theory and methods today requires at least four courses (two in probability and statistical theory and two in statistical methods), and that already seems inadequate to provide the foundation needed to cover the newer techniques in survey sampling. To prepare for the future, more courses are likely to be needed.

Survey sampling is now a highly developed field with a rich literature and a wide range of methods. A practicing survey statistician needs at least three basic courses in this area (e.g., applied sampling methods, basic theory, and variance estimation), and then there are many special topics that should ideally be covered in some fashion. The following is a partial list of important topics that cannot be adequately covered, if mentioned at all, in the basic courses:

◆ Nonresponse and calibration weighting adjustments

◆ Edit and imputation methods

◆ Design and estimation for surveys over time

◆ Measurement error models

◆ Sampling rare populations

◆ Small area estimation

◆ Sampling for establishment surveys

◆ Design and analysis of observational studies

◆ Disclosure avoidance

◆ Treatment of outliers

◆ Sample coordination over time

A selection of these topics can appear in a fourth sampling course, but not all of them can be covered, and those that are covered cannot be treated in depth. Several of these topics warrant one (or even more) three-credit courses for a full treatment, and others warrant one or two credits. Additional courses could be considered, but they are likely to run up against the constraints on the acceptable maximum number of credit hours for an MS program. With only one course on these topics, a difficult choice has to be made between whether to attempt to make the students aware of all the areas of survey sampling methods that they may need in their work, or whether to let them chose a small number that they will study in somewhat more depth.

The justification for the need for all survey researchers to acquire a broad knowledge of the whole survey process has been made in the previous section. That justification clearly applies to survey statisticians, who must design samples that meld with the other survey design features in an effective manner. A broad knowledge of the survey process requires at least two or three 3-credit courses (e.g., data collection methods, sources of error in surveys), and one or two more courses if a survey practicums is included. Carefully chosen apprenticeships that give exposure to the whole survey process may also serve the important requirement of giving students an appreciation of the overall design considerations that apply in survey practice.

The need for computing skills, particularly the use of statistical software packages, is clear. Computing features in most modern courses in statistical methods, and it can also be included in relevant sampling courses. That should in general suffice, provided that attention is given to computing in course development.

A widely acknowledged weakness of much statistical training is a lack of attention to oral and written communication. Strong communication skills are essential for applied statisticians in general, and this is certainly so for survey statisticians. In a paper on preparing statisticians for careers in the Federal Government, an ASA

Committee cited the need for communication skills: "The need for writing skills cannot be overemphasized. As statisticians move into managerial positions, communication—both written and oral—becomes a vital ingredient of a successful performance." (Eldridge et al., 1982, p. 76). A paper entitled "Preparing Statisticians for a Career at Statistics Canada," by Denis et al. (2002) contains recommendations for universities in preparing students to work in a statistical agency that are in line with the criteria proposed earlier, including again a call for writing skills:

◆ "Provide students with a solid grounding in statistics";

◆ "Give students the opportunity to work on 'real' problems";

◆ "Generate interest in learning to use statistical software"; and

◆ "Put more emphasis on writing skills".

Training in oral and written communication can best be achieved by requiring presentations and reports in many courses. Assignments of 15-minute presentations supported by well-prepared slides in several classes can help students develop their oral communication skills and prepare them for making presentations at professional meetings. Training in report writing can be obtained through course assignments, but to be effective, instructors or writing experts must spend adequate time on the writing rather than on the technical aspects of the reports. In some cases, a separate course on the principles of report writing may be advisable.

The challenge in developing an MS program for survey statisticians is to accommodate all these objectives within a reasonable course load. Given the unavoidable constraints on the length of an MS program, some priorities need to be established. The initial set of priorities noted earlier is a solid grounding in statistical theory and methods (at least four to six courses), an extensive coverage of sampling methods (at least four courses), and a basic overview of the whole survey process (at least two courses). After that, I favor flexibility to allow choices of additional topics in any of these areas or in other relevant areas, such as a substantive area of application. As a rule, students wishing to embark on careers as specialist samplers and those wishing to pursue PhD degrees in survey sampling would be advised to elect more courses in statistical theory and methods and in topics in survey sampling.

However an MS course is structured, it cannot be expected to provide a detailed coverage of all the survey sampling topics that a survey statistician will encounter at work. Also, as the field of survey sampling continues to advance, new methods will emerge. As a consequence, I see a strong need for continuing education programs for survey statisticians to develop their range of skills. Advanced short courses are helpful in exposing participants to specialized techniques, but they lack the means to ensure that the participants undertake the supplementary study needed to fully master the material. I believe that longer term formal courses, with assignments and examinations, are required, together with some form of certification for successful performance. This kind of continuing education, which is required in some other disciplines, is now needed for survey sampling. Hopefully employers will recognize the benefits of such continuing education, encourage staff to participate, and reward those who complete the courses successfully. It is of interest to note that Statistics Canada invests a good deal in professional training. It has established its own Training Institute to offer courses in-house, and it expects supervisors and employees to discuss a training plan for the coming year during the annual performance meeting (Denis et al., 2002).

4. Training Courses for Survey Statisticians from Developing Countries

This section addresses the training needs for survey statisticians from developing countries. The MS programs described earlier can serve the educational needs for survey statisticians from developing countries well. However, it is expensive and time-consuming to send persons from developing countries to MS programs abroad. Alternative shorter training programs are, therefore, much needed.

One model for such a training program is the SPSS that Kish developed over 40 years ago, as mentioned earlier. Another long-term program for training staff from national statistical offices is that run by the International Program Center at the U.S. Census Bureau. The center now runs workshops from two to six weeks in length on a variety of topics, including survey sampling (http://www.census.gov/ipc).

The IASS has successfully run short courses in survey sampling and other aspects of survey research in association with the biennial sessions of the International Statistical Institute for many years. Kish initiated short half-day meetings in 1973, and these were expanded into longer workshops in 1987. At the ISI session in Seoul in 2001, the IASS offered the following courses: Workshop on Survey Sampling, Variance Estimation in Complex Surveys, Introduction to

Small Area Estimation, Nonsampling Error Research, and Edit and Imputation of Survey Data. The workshop on survey sampling is specifically designed for survey statisticians from developing countries. Together with the course on variance estimation, it provides an overall introduction to the subject.

Courses like those offered by the IASS serve a valuable role both by providing training in survey sampling and also by bringing together survey statisticians from different countries to share their experiences. Such courses should emphasize survey sampling practice and introduce basic theory only to the extent necessary. They should cover basic sampling techniques (e.g., systematic sampling, stratification, multistage sampling, PPS selection) and also nonresponse, noncoverage, weighting, and the use of software for variance estimation. They should also include illustrations from developing countries. Simple exercises can be helpful in reinforcing key points being made. Where possible, hands-on use of computer software should be included.

The key problem with providing training courses for survey statisticians from developing countries, whether longer courses like the SPSS or shorter courses like those of the IASS, is that of funding. The SPSS was started with funds from the Ford Foundation and now is supported in part by the Leslie Kish International Fellows Fund. Many statisticians from developing countries have been able to attend the IASS courses with fellowship support from the UN Statistical Division. In both cases these sources of funding support have provided the core basis for maintaining the courses, with other support coming from various other sources.

When training persons from different countries, language becomes an important issue. The above courses are generally given in English and require participants to understand English. However, at least when there is only one other major language in addition to the language of instruction, a translation of presentation slides—or at least key terms—into the other language can be valuable. The use of two projectors for the two languages can then help those who are not so fluent in the language of instruction.

A type of training program that seems particularly desirable is one that is given in a developing country for statisticians in that country and neighboring countries. A one- or two-week regional program could be a very effective use of limited resources. In his invited discussion of this paper, Hermann Habermann suggested an enhancement to this scheme that would extend the program to a series of training activities over a period of several years. I thoroughly endorse this extension, which I see as a way to develop the internal training resources in the region, with local instructors taking over in later years.

In earlier years the World Fertility Survey directed by Sir Maurice Kendall for the International Statistical Institute and the UN Statistical Division's National Household Survey Capability Program made major contributions to establishing survey infrastructures in many developing countries. Since that time, a sizable number of international survey programs have begun, but unfortunately none of them has a training mission in survey statistics or survey methodology. Much would be gained if they could be persuaded to devote small proportions of their budgets to training and capacity building.

The programs listed in this section play a very valuable role in training survey statisticians in developing countries. Yet much more needs to be done. Might ASA and IASS collaborate in fostering such training programs? Both associations are concerned with improving the use of statistics, and efforts in this area would serve that objective well.

References

Denis, J., Dolson, D., Dufour, J., and Whitridge, P. (2002). Preparing statisticians for a career at Statistics Canada, (Working Paper No. HSMD-2001-006E/F). Ottawa: Statistics Canada.

Eldridge, M.D., Wallman, K.K., Wulfsberg, R.M., Bailar, B.A., Bishop, Y.M., Kibler, W.E., Orleans, B.S., Rice, D.P., Schaible, W., Selig, S.M., and Sirken, M.G. (1982). Preparing statisticians for careers in the Federal Government: Report of the ASA Section on Statistical Education Committee on Training of Statisticians for Government. *American Statistician*, 36, 2, 69-89.

Kish, L. (1965). *Survey sampling*. New York: Wiley.

Kish, L. (1996). Developing samplers for developing countries. *International Statistical Review*, 64, 143-162.

Wolf, F. E. (Ed.). (1992). *Center for Survey Methods: Summary of a workshop*. Washington DC: National Academy Press.

The Possible Impact of Question Changes on Data and Its Usage:

A Case Study of Two South African Censuses (1996 and 2001)

Maurius Cronjé
Statistics South Africa

Disclaimer: The views expressed in this paper represent those of the author and do not necessarily reflect the views of Statistics South Africa.

The supply of accurate data is very important in a fast moving society. Policy makers, planners, business people, and many others make use of data provided to them, on a daily basis. The application of this data directly impacts our daily lives. It is for this reason that all people who make use of any sort of data should have a clear understanding of the data and its limitations. This process starts right at the beginning, when the instrument for data gathering is developed.

Bradburn (2000) states that "since the beginning of scientific surveys, researchers have been sensitive to the fact that changes in the wording of questions could produce dramatic changes in the distribution of responses." This article sets out to explore briefly the impact of differences in questionnaire wording, order, and topics on the final data that will be produced. It also explores other factors that might play a role in eliciting differential responses to a questionnaire. These issues are discussed in the context of the recent South African Census (2001), as compared to the South African Census of 1996.

Background

Data that are gathered over time will be used to draw a comparison to determine change, establish trends, and predict the future. For this reason, the compatibility of different data sets is very important. Researchers need to be made aware of the differences between two data sets and the possible effect of these differences on the quality of the data. Differences in methodologies used to gather the data might have an impact on the measurement of a certain variable or the application of the data to small areas. Differences in the measurement of the variables might also be due to differences in instrument design. It is therefore essential that a study be conducted where these differences are highlighted and the implication shown. This type of research would lay the foundation for the work of other researchers utilizing the data. If major problems exist with the data, prospective users should be made aware so that they can decide for themselves whether they would like to use it or not (Jaffe, 1951).

Statistics South Africa (Stats SA) is the official agency responsible for conducting the National Population Censuses in South Africa. Stats SA is required, under the terms of the Statistics Act, No. 6 of 1999, to conduct a census every five years. In October 2001, Stats SA conducted the second population census since the first democratic elections of 1994. The first census was conducted in October 1996. Before any person can start to use the two data sets, a careful analysis should be made to establish differences between them. There are many factors that might affect this comparison. This paper will, however, focus on issues relating to the questionnaires used.

Questionnaire Wording and Order

McLaughlin (1999) argues at length about how item context can affect answers. She mentions that the context of an item, including format, wording, response option, and order of questions, can have an unintended (or intended) effect on the answers.

One of the most important factors in soliciting proper responses from respondents is the wording of the questions. For instance, the questions "How old are you?" and "In what year were you born?" have only one word in common but are understood as calling for the same information. The questions "When were you born?" and "Where were you born?" share all the same words except for one. They will, however, result in two totally different responses. The wording of the questions is what the respondent must process in order to understand what information is sought. In general, wording should use simple language, be clear, and avoid phrasing in the negative.

One needs to establish that the respondents will understand the wording that is used. Questions using slang, culture-specific, or technical words might not measure what the researcher intended at the beginning of the study. The wording might lead the respondent to answer in a certain manner. The use of "and" in a question must be avoided so that a double question is not asked. The use of the word "not" should also be avoided, especially if the respondent is to answer "yes" or "no."

Survey processing is often easier with close-ended questions, where respondents are given options from which they can choose. Such questions can be answered more quickly, but, on the other hand, respondents may rush through the questions too quickly and make mistakes. The answers provided might also not be what the respondents preferred. For close-ended questions, the choices must exhaust the entire range of possible answers and must be mutually exclusive. For open-ended questions, no options are provided for the respondents. It is left to them to think and fill in their own responses in their own words. This might lead to more meaningful information and to dissimilar but intelligent opinions. The processing of these questions is often more difficult, with a lot of problems experienced in the coding of the answers.

In addition to questionnaire wording, the positioning of the actual questions can affect responses. People are often influenced by visual and other stimuli, and it is therefore important to place the questions in an order that will result in a positive response. It has also been established that people remember the first and the last items on a list much better than the middle items. This can lead to a false impression when it comes to issues such as agree/disagree or like/dislike. Bradburn (2000) discusses the Tourangeau and Rasinski model, which conceptualises the question/answer process as one of stages that require different processing and may be susceptible to different types of context effects. The focus in this model is on interpretation, retrieval, judgement, and response. An interesting example that is mentioned is the question "How many children do you have?" when asked of teachers. In the first case, it was preceded by questions related to their families, and they then interpreted this question as relating to their families. In the second case, the question was preceded by questions relating to the school, and they interpreted it as referring to the number of children they had in their class. The question got a response of 0-4 in the first instance and 25-40 in the second instance, although the question was exactly the same.

Two types of order effect can be identified, namely assimilation and contrast effects. The first happens when respondents adjust their responses to later questions so that their responses to a set of questions are consistent. Contrast effect happens when respondents discount or subtract information from a previous question when answering a subsequent question (Gendall, Carmichael, & Hoek, 1997).

Design and layout were traditionally determined by whether a questionnaire would be self-administered or interviewer administered. Although these aspects still guide the design, the design and questions are now also influenced by the technology used for the processing of the results, specifically whether one might use scanning and optical character recognition, optical mark reading, and image recognition software. These modern techniques sometimes guide the development of the questionnaire in terms of layout and order. Careful consideration should be given to the wording and the order in conjunction with the use of modern technology to ensure that the questions measure what the researchers set out to measure at the initiation of the research.

Topics Covered

Sometimes the topics covered can have an effect on responses. In censuses, for instance, questions on income are usually associated with a lot of controversy. The data related to these questions are also usually suspect. The questions are placed near the end of the questionnaire so that they do not influence the frame of mind of the respondent. Debates take place on a regular basis as to whether questions of this nature should be included. Another issue usually hotly debated is questions about ethnicity or population group. Hurst (2000) has described at length the whole debate that Statistics Canada went through on the question of ethnicity. Similar problems were experienced in the United States, which prompted that country to change the question after the 1990 census; this resulted in a situation where straightforward comparison between censuses is not possible.

Topics are covered by making use of several types of questions. These are filtering questions (also known as skip questions), where respondents are directed towards relevant questions; binary questions, in which respondents choose one of two answers; and categorical questions, in which a list of options is given to respondents. Ordinal questions consist of scaled responses such as the 5-point Likert scale, while linked questions have the same style of question and use a matrix to record responses.

Other Factors Influencing Responses

Bradburn (2000), in collaboration with Sudman, designed a model for understanding the sources of response effects. The model is based on the view that the survey interview is a special kind of conversation between individuals who speak the same language. It is seen as a micro-social system consisting of three roles held together by a common task reflected in the questionnaire. One person (interviewer) has the role of asking the questions, a second person (respondent) has the role of answering the questions, and a third person (researcher) defines the tasks. All three of these

role players have an effect on the responses received.

The process of answering a questionnaire item evokes a number of cognitive processes (comprehension, information retrieval, judgment and evaluation of retrieved information, and the selection of an appropriate response), each of which can lead to variation and erroneous responses by the respondent. The manner in which these various processes operate will depend on the nature of the response task, the mode of administration (self or interviewer), and characteristics of the respondent.

Variation and errors in response to questionnaire items can be due to a number of factors, including the respondent's confusion, ignorance, carelessness, or need for social desirability; ambiguous wording of the items and response categories; the order or context in which questionnaire items are presented; the choice and presentation order of response categories; and the method of administration (Meadows, Abrams, & Greene, 1998).

The social context in which the interview takes place also plays a vital role in interview outcome and the accuracy of the data. Social context is related on one level to the physical environment in which the interview is conducted. For instance, respondents might feel more comfortable if a questionnaire is completed in their home as opposed to completing it in a work environment.

Another factor influencing responses might be the characteristics of the respondent and the interviewer. Aspects such as race, gender, and age may influence the willingness to express attitudes. The way in which the interview is conducted might also have an influence. For instance, the interview might be conducted by telephone, might be self-administered, or might be performed by using various forms of computer assistance (Bradburn, 2000).

The South African Perspective Questionnaires

It is not unusual for the number and types of questions included in the census questionnaire to change from census to census in response to new policy initiatives, a review of redundant questions, other user needs, society in general, and public perception. The look and feel of the census questionnaire has also changed in response to design techniques.

For both South African censuses, the questionnaire was developed with active participation by users and the census advisory committee. Items to be considered were suggested by various

stakeholders. International consultants also provided expert assistance in the design and layout of the questionnaires. In both cases, behind-the-glass and field testing were done to ensure that a user-friendly instrument was developed. Test results facilitated the development of appropriate wording for questions and provided qualitative and quantitative feedback on the reliability of responses and the acceptance of questions.

Other factors that played a role in the development of the questions were decisions on processing methodologies. For instance, technological advances in scanning and image recognition, as well as automatic and computer-assisted coding, guided the actual layout and design of the questionnaire.

For both censuses, the questionnaire was translated into all 11 official languages. The application and availability of the translations differed between the two censuses. For Census 96, all 11 languages were available in the field. For Census 2001, every enumerator carried a translation booklet that could be used by the respondent to read the questions in his or her preferred language. The answers would then be transcribed onto the English version of the questionnaire. However, for Census 2001 the translated questionnaire was also available on request. For Census 96, every language had a different colour. For Census 2001, all the different translations came out in the same colour.

In Census 96, the following questionnaires were used:

Questionnaire 1 (Household questionnaire): This questionnaire was used in private households and in hostels that provided family accommodation. It contained 50 questions for each person and 15 for each household. A total of nine people could be included on the questionnaire.

Questionnaire 2 (Summary book for hostels): This questionnaire was used to list all persons/households in the hostel and included 9 questions about the hostel.

Questionnaire 3 (Personal questionnaire): This questionnaire was used for individuals within hostels and contained 49 questions (the same as on the household questionnaire, with the exception of relationship).

Questionnaire 4 (Enumerator's book for special enumeration): This questionnaire was used to obtain very basic information for individuals within institutions such as hotels, prisons, and hospitals, as well as for homeless persons. Only 6 questions

were asked of these people. The questionnaire also included 9 questions about the institution.

For Census 2001, three different questionnaires were used. The first questionnaire (questionnaire A) was used for all households, including single-person households, and in workers' hostels, university student residences, and residential hotels. This questionnaire was designed to collect information about each person in a household (41 questions) and information about the household as a whole (1 question), including services (13 questions).

The other two questionnaires were used for institutions, tourist hotels, and the homeless. Institutions included hospitals, childcare institutions, boarding schools, convents, defence force barracks, prisons, community and church halls, and refugee camps. One questionnaire (questionnaire B) was used to capture personal information about individuals (40 questions), whilst the other (questionnaire C) contained questions that applied to the institution as a whole (8 questions). Again, the personal questionnaire omitted the questions on relationship and the household.

One of the major changes from Census 96 to Census 2001 was the introduction of barcodes on the Census 2001 questionnaire. Every questionnaire for Census 2001 was uniquely identified by a barcode printed on every page of the questionnaire.

Topics Covered

Both censuses covered basic demographic, social, and economic topics. Some questions applied to each individual in the household; for example, respondents were asked to indicate the age, gender, population group, home language, education level (people over age 5 years), occupation (age 5 years and older), and income of each person present in the household on census night. Other questions dealt with the circumstances of the household as a whole, for example, whether or not the household had access to electricity and piped water.

For Census 2001, there was a coordinated effort to harmonize census questions across the Southern African Development Community member states. A number of meetings and workshops were held to discuss a set of core questions. The main aim was to have compatible data across the region. Stats SA included these core questions in the questionnaire and supplemented them with some specific questions pertaining to South African data needs.

The 2001 questionnaire included a total of 14 questions that were not asked in the 1996 census. There were also 9 questions that were asked in 1996 but not repeated in 2001. This means that there are 23 questions that cannot be used for comparing the data between the two censuses. Issues to be debated are whether the inclusion or exclusion of certain questions adds value or takes value away from the census data set. Some of the reasons for the exclusions might also be investigated. Sometimes questions are redundant, and sometimes new research shows that a change of focus might be needed. The usage of the data might also result in a question being dropped or included in the next census.

The Way Forward

Much research must be conducted to determine the impact on the data of the differences described above. Some of these issues might be resolved with proper data editing. This can be done as soon as the data sets become available. In addition, studies are needed on the effect of other factors, such as cultural differences, responses, and, ultimately, on data.

All of the issues discussed above lead to a direction in which the selection of the topics and the design of the questionnaire will become a full blown interdisciplinary exercise, with inputs from fields as far apart as psychology, linguistics, information technology, graphic design, and statistics.

It is especially important that societies with a large mixture of cultures give special attention to aspects of questionnaire design and question wording. This is to ensure that the data from different cultural groups are consistent and comparable.

References

Bradburn, N.M. (2000). Questionnaire design: from art to science. Paper delivered at the Fifth International Conference on Social Science Methodology, Cologne, Germany.

Gendall, P., Carmichael, V., and Hoek, J. (1997). A test of the conversational logic analysis model of question order effects. *Marketing Bulleting,* 8, pp. 41-52.

Hurst,L. (22, January 2000). *The politics of people-counting.* Question on ethnicity haunts census-takers. *Toronto Star.*

Jaffe, A.J. (1951). Handbook of statistical methods for demographers. Washington, DC;U.S. Government Printing Office.

McLaughlin, M.E. (1999). Controlling method effects in self-report instruments. *Research Methods Forum*, Vol. 4.

Meadows, K. A., Abrams, C., and Greene, T. (1998). The application of cognitive aspects of survey methodology (CASM) in the development of HRQOL measures. *Quality of Life Newsletter,* [Online]. Available: http://www.mapi-research-inst.com/index02.htm

To Contact the Author:

Maurius Cronjé
Statistics South Africa
mariusc@statssa.govza
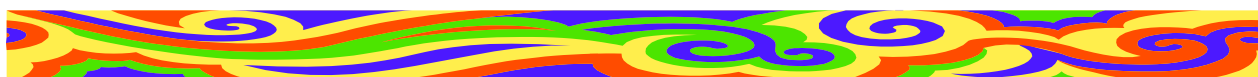
To Substitute or Not to Substitute—
That is the Question
David W. Chapman

Nonresponse in surveys is generally classified as one of two types: unit or item nonresponse. With unit nonresponse, no usable survey information is obtained from an eligible sample unit. With item nonresponse, some of the survey items are not obtained from the respondent (which could include edit failures), but enough items are obtained to include the sample participant as a unit respondent.

To account for unit nonresponse, there are three methods that I am aware of that are used by survey practitioners:

◆ Adjusting the weights of the respondents;

◆ Imputation of entire records; and

◆ Substitution (or field substitution).

Based on my experience, weight adjustment is by far the method used most often to account for unit nonresponse, at least for U.S. surveys. With this method, the respondents in a weighting class (which may be a stratum or cluster) are "weighted up" to the full sample of eligible units in the weighting class.

I am not aware of many instances where imputation is used, though I believe that this is done for the short form component of the U.S. Decennial Census (essentially "hot decking" entire records). Although this method may be acceptable for addressing nonresponse bias, it would increase the variance of survey estimates because, in effect, the weights of the "donor" respondents are at least doubled.

By substitution, or field substitution, I am referring to the method of substituting for each sample nonrespondent a population unit that was not originally selected for the sample, and treating the substitute as though it had been selected for the original sample. The goal is to select substitutes that have survey characteristics that are similar to those of the nonrespondents. My experience has been that most statisticians view substitution as an inferior (or even unacceptable) method of accounting for nonresponse.

The purpose of this article is to describe the basic types of substitution, and to discuss the advantages and disadvantages of the use of substitution. Much of the material here has been abstracted from an earlier document I wrote as a chapter in the book, *Incomplete Data in Sample Surveys* (Chapman, 1983). I hope that this article generates some interest and discussion of substitution as a method for accounting for unit nonresponse.

I believe that, because it has been misused in the past, substitution is an underrated method. I am not suggesting that it is the best method to use for all surveys, but one that may be appropriate in many applications. My impression is that substitution is not used often to account for unit nonresponse for U.S. surveys. However, it may be used more frequently in other countries. In his excellent article on substitution, Vehovar (1999, p. 377) reports that "…although it is rarely recommended in textbooks…," "…we can observe a relatively widespread use of this procedure in many probability sample surveys."

There are two basic types of substitution methods that are used in applications:

◆ Selection of a specially designated substitute; and

◆ Selection of a random substitute

The first method involves a purposive selection of a substitute, one that that matches closely the sampling frame characteristics of the nonrespondent. For example, for an establishment survey, the substitute could be defined as the establishment (of those not selected for the sample) that comes closest to matching the nonresponding establishment on frame characteristics such as type of business, geographic location, degree of urbanization, public vs. private, for profit vs. nonprofit, number of employees, and revenues or profits.

The second method uses a random selection to obtain a substitute from among those establishments not selected for the sample. Typically, the substitute is selected randomly from a subpopulation (e.g., the same stratum or cluster as the nonrespondent) to improve the chances of selecting a substitute that has survey characteristics that are similar to those of the nonrespondent. For the case of randomly selected substitutes, Vehovar (1999) derives expressions for the impact on bias and variance of the use of substitution.

Of these two substitution methods, random selection of substitutes is the method probably used most often in practice, at least for probability sampling (which is the context of this article). This is because random selection would appear to be more scientific and avoids additional biases that might occur with purposive selection. However, in terms of obtaining replacement data for a nonrespondent, a specially selected substitute that matches the nonrespondent on all the relevant frame characteristics may be superior to a randomly selected replacement from a subpopulation defined by some of the frame characteristics.

Developing statistical expressions that characterize the impact on bias and variance of substitution can only be done (without creative modeling) for the method of selecting substitutes randomly. For random substitution, Vehovar (1999, p. 238) points out that any additional bias associated with substitution would arise from differences in the procedures used to contact and recruit respondents. For example, there may be more call attempts to reach initial sample units than for substitute units. He concludes that, although there are likely to be such difference in the data collection procedures, the bias is likely to be "relatively small."

Regarding variance comparisons, Vehovar (1999, Section 2.2) develops an expression for the increase in variance for weight adjustment compared to substitution for the case of two-stage cluster sampling. He concludes that "…we can benefit from substitution only in very specific circumstances which are not encountered very often." His conclusions are similar for multi-stage cluster designs and for stratified sampling.

In terms of empirical studies of the impact of substitution, I summarized the results of four studies that I identified in my earlier research (Chapman, 1983, Section 3). Also, while I was at the U.S. Census Bureau, I participated in an empirical study of substitution for an RDD (random digit dialing) survey (Chapman and Roman, 1985).

In addition, Vehojar (1999, Section 2.3) described an empirical investigation that he had conducted. For these empirical studies, there were no decisive results in terms of the value of the use of substitution as a method of accounting for unit nonresponse.

So, the decision as to whether to use substitution may rely mostly on judgment and practical considerations relating to the specific survey. For example, in a survey of elementary and secondary schools I worked on while at Westat in 1971-72, an important goal of the study was to develop equivalence relationships between several national achievement tests. To do this, the analysts needed a precise number of schools participating in the study, with exactly two schools from each stratum. Substitution was the only approach to achieve the type of sample needed for the analysis. In my earlier research on substitution (Chapman, 1983, p. 47), I described the substitution procedure used for that study, which was a combination of using a specially designated substitutes (first priority) and randomly selected substitutes.

There are two major advantages to the use of substitution that I want to mention. First, to the extent that substitutes can be made for all of the nonrespondents, the original sample design and sample size will be preserved. Thus, if the design was one with uniform selection probabilities (and therefore "self-weighting"), the final sample will still have those properties. This will simplify the analysis of the survey results. In addition, the variances of survey estimates are likely to be about the same as would have been realized had the response rate been 100 percent.

The second advantage is the potential for bias reduction in a case where there are a lot of frame characteristics available, as there are for many establishment surveys. In this type of situation, if substitutes can be identified that match (or nearly match) those of the survey nonrespondent on several frame characteristics, the nonresponse bias could be reduced, compared to that associated with weight adjustments, where the missing survey values are effectively imputed by a blend of the survey values of respondents in the same weighting class. Of course, the frame variables must be highly correlated to the survey variables for such benefits to be realized.

There are several potential disadvantages to the use of substitution that need to be considered. First, there is the potential to introduce bias in survey estimates from the way substitutes are selected, especially if interviewers are allowed to choose substitutes. To avoid such biases, well-defined criteria for identifying substitutes must be

developed. Ideally, substitutes would be selected as an office procedure, and the interviewer would not know whether he/she was attempting to interview an initial sample unit or a substitute unit. This type of control should be easy to establish with random digit dialing telephone surveys, using CATI (computer-assisted telephone interviewing).

Second, there may be a tendency for less effort to be made to contact and recruit initial sample units, when substitutes are available. To some extent, substitutes may be viewed by interviewers, and perhaps by some survey practitioners, to be nearly as good as the original sample units. This will reduce the response rate and increase the potential for nonresponse bias.

A related difficulty with the use of substitution is the limitation associated with it because of the sequential aspect of the implementation process (i.e., a substitute would not be called until attempts to recruit the initial sample unit failed). For a fixed data collection period, the time allowed to contact and recruit initial sample units would have to be reduced to allow adequate time to recruit substitutes. More likely, a longer data collection period would be used to allow sufficient time to try to recruit original sample units and substitutes. This would probably increase data collection costs (as compared to a weight adjustment approach), even for comparable numbers of completed interviews.

An approach to partially resolve the problem of the sequential nature of the use of substitutes is to begin attempts to contact a substitute before all planned attempts have been made to recruit the original sample unit. Then, simultaneous attempts would be made to contact both the original and substitute units. Of course, a weakness with this approach is that you may waste interviewer time contacting the substitute unit, and may even end up with interviews with both the original and substitute sample units, in which case the data from the substitute unit should not be used.

Another disadvantage of substitution is the problem of identifying the substitute respondents sufficiently in the final database so that the true response rate can be calculated. There may be a tendency to compute the response rate as though the substitutes were initial sample units.

A final weakness with the use of substitution that I want to mention is that a substitute may not be recruited for every nonrespondent. This will certainly be true if only one substitute is selected for each nonrespondent. (For this reason, I recommend that multiple substitutes be selected for

each nonrespondent, preferably as part of the sample selection process.) In those cases where substitutes are not obtained for every nonrespondent, some other method of accounting for the residual nonresponse (like weight adjustment) would still have to be applied.

In conclusion, the fundamental question is whether it is better to use a substitute unit for a survey nonrespondent, rather than imputing nonrespondent data from a blend of the data reported by respondents in the same weighting class. I think that in many applications it would be better to use a substitute unit, as long as the disadvantages of implementing a substitution procedure discussed above can be sufficiently addressed.

I would appreciate any feedback from readers that have used substitution in surveys, including the specific procedure(s) used, the success rate in terms of obtaining cooperating substitutes for unit nonrespondents, and any observations regarding how well the procedure worked, or didn't work. Of course, any views on whether substitution should be used at all to account for unit nonresponse in surveys are also welcome.

References

Chapman, D. (1983). The impact of substitution on survey estimates. In W. Madow, I. Olkin, and D. Rubin (Eds.). *Incomplete data in sample surveys, vol. II, Theories and bibliographies*, (pp. 45-61), Academic Press: New York.

Chapman, D. and Roman, A. (1985). An investigation of substitution for an RDD survey. *Proceedings of the Survey Research Methods Section,* ASA, 269-274.

Vehovar V. (1999). Field substitution and unit nonresponse. *Journal of Official Statistics*, 15, (2), 335-350.

To Contact the Author:

David W. Chapman, Chief Statistician
Federal Deposit Insurance Corporation
Room 2022, 550 17th St. N.W.
Washington, DC 20429
USA
(202) 898-7280
dachapman@fdic.gov

Field Substitutions Redefined

Vasja Vehovar

Introduction

The term "field substitution" usually refers to the popular practice of replacing the nonresponding unit with another unit during the fieldwork stage of the survey. As mentioned by Chapman (2003) this practice was "misused" in past decades and obtained a bad reputation. Overview in Vehovar (1999) shows that, in general, substitutions gain only small improvements in sampling variance, that is outweighed by numerous practical drawbacks, particularly the lack of control over the interviewers and the delays due to the sequential nature of the substitution (as the status of replaced units must be clarified first before the substitute units can be used). It is also true that none of the examples from the literature properly demonstrated that this practice was justified. We could conclude that substitutions are often applied only due to the ignorance of the practitioners. The relatively strict rejection of this practice in probability samples in many face-to-face surveys in the U.S. thus seems to be the proper attitude.

The (false) justification of this procedure usually comes from comparisons with the plain alternative of taking no action to deal with nonresponse. More sophisticated justification also arises from the (never proven) belief that substitutions outperform alternative weighting adjustments. This is, in fact, a very tricky intuitive misconception, because it is somehow strange that by obtaining optimal structure of the sample we get almost no gains in precision compared to the unbalanced sample of responding units without substitutions. In the case of two-stage cluster sample with $n = 100 \times 10$ units it thus seems much better to get the designed structure of respondents (i.e., 100 clusters of 10 units each) with substitutions, than the same 1,000 units with 100 clusters of varying sizes (e.g., 5-15 units) without substitutions. The reason that the difference is rather small is the fact that the well-known Kish formula for the increase in variance due to weighting does not hold for nonresponse weights in cluster samples. This fact is also somehow surprising, because it confronts another intuitive conviction of the practitioners—the belief that the Kish's formula is extremely robust.

Defining Substitutions

However, despite the above theoretical objections, a much more profound criticism relates to the interviewer's influence on the selection of the substitutes. This also includes the situation where the interviewer may declare a certain difficult-to-

deal unit as nonresponding and then obtain some random substitute from the management. Nevertheless, the interviewer's influence—although one of the key disadvantages—is not a necessary part of the procedure. In Vehovar (1999) this basic distinction was not recognised, so some confusion remained throughout the paper about the exact type of substitutions being discussed. Let us draw this distinction here. To start improving the definition, we should separate two components, (a) the interviewer influence on selection and (b) the sequential nature of replacing the missing unit with the substitute one. Only the latter is the necessary and essential component of the substitutions. There are also no reasons to restrict substitutions to nonresponse, as we may sequentially substitute also for noneligible units (e.g., noneligible units).

Figure 1. Types of substitution procedure
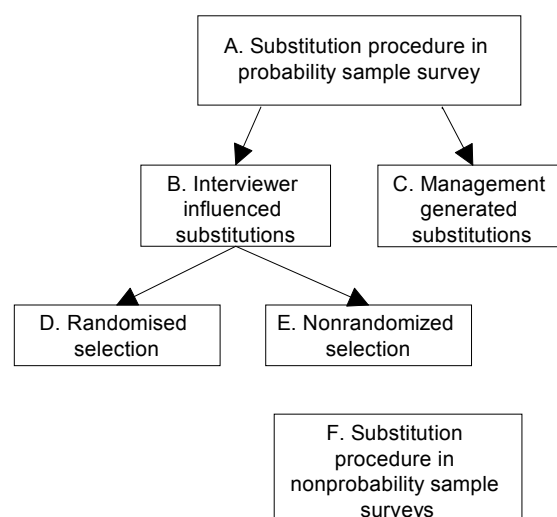
Definition: Substitutions relate to sequential replacing of the missing unit with another unit during the field stage of the survey. Two types should be distinguished:

◆ Interview influenced substitutions. Here, the interviewer may impact whether substitute unit will be applied. It is true that in face-to-face surveys it is impossible to completely eliminate this impact; we can only approximate it with strict field controls. With respect to how the substitution is selected, we have two further options:

- randomised selection, where the substitute units are selected from some pre-prepared list based on a strictly controlled probability sampling mechanism;

- nonrandomised selection, where the substitution are selected either with some purposive selection criteria, or, with some freedom of the interviewer.

◆ Management-generated substitutions. Here, the interviewer has no impact on whether or how to select the substitute. Even when he declares a unit as nonresponding, he doesn't know, whether this will lead to substitution. This situation is very close to what Kish (1965) calls "supplement sample"—a list of pre-prepared units applied when survey management decides to do so. However, with supplements, no sequential one-to-one replacement is performed, which is the essence of substitutions. The most typical example for this type is the full CATI environment, where the telephone interviewer has no awareness that management actually applies substitutions. On the other hand, when interviewer knows the situation within his cluster (i.e., how far he is towards meeting the criteria of completing the "take" *b* of eligible or responding units) or he even decides whether and how to select the substitute unit, this becomes the interviewer-influenced type of substitutions. Obviously, we substitute also in the standard Waksberg-Mitofsky procedure, however, only the noneligible units are substituted there, as it was somehow agreed in this procedure not to replace for nonresponse, despite some attempts to do so.

Figure 2 below illustrates some typical examples of substitutions in probability samples. If we do not explicitly distinguish among them, we easily end up with a communication mismatch, which also exists in Vehovar (1999), where the bulk of the treatment is devoted to type D (Figure 1), with occasional comments that actually refer to types E and C. As these are all different types, much different criticism refers to each one of them.

Classic Substitution Example

There exists a top substitution-preferred example of a face-to-face survey with 2 units (e.g., schools, household) per stratum, or per cluster. With this case, both, Chapman (1983) and Vehovar (1999) basically agree that substitutions are the preferred option. Should we really allow the interviewer to take the advantage of being in a certain location and let him take a substitute, so that he brings a needed piece of information from this specific geographical segment included into the sample? Or, should we apply the alternative:

◆ let the initial sample size be inflated with anticipated nonresponse. If it is 20 percent let all or a portion of the clusters/strata be of the increased size (3 instead of 2),

◆ let there be supplement samples ready in case that nonresponse exceeded our expectations. In cluster samples these may be additional units within existing clusters, or in the case of

specific costs structures, the fresh clusters may be prepared,

◆ the problem of one or no unit per strata/cluster can be solved with some collapsed sampling techniques or with imputation/weighting.

In the above case, substitutions seem very "natural" and advantageous to common sense and also to statistical intuition. However, only profound (and complicated research) can find the proper answer to this problem. The same is true for other apparently advantageous situations, particularly for the Waksberg-Mitofsky procedure, where the past research is not yet exhaustive (Chapman and Roman, 1985). This substitution procedure is still slightly overestimated compared to the modified one without substitutions (Brick and Waksberg, 1992). Of course, it is also true that the Waksberg-Mitofsky procedure was frequently abandoned in recent years in the United States because of good list assisted samples and also due to the drawbacks of its sequential nature. However, with mobile phone surveys, at least in Europe, this may dramatically change.

Figure 2. Examples of substitution procedure in probability samples

	Mode	
Selection	Telephone	Face-to-face
Management generated substitutions (C)	Waksberg-Mitofsky in fully automated CATI procedure	Supplements (only conditionally)
Interviewer influenced substitutions (B→D)	Standard randomised substitution procedures in telephone surveys	Standard randomised substitution procedures in face to face surveys

Substitutions in Nonprobability Samples

So far, the discussion concentrated only on probability samples. However, today it is becoming increasingly important to acknowledge the problems of nonprobability samples. We may keep saying that there cannot be any modification in the notion of scientific sample, nevertheless, we are faced with a sharp increase of nonprobability components in all samples. Is it thus final that nothing can be done with these samples, except that each practitioner develops his own local arts and tricks for drawing and adjusting his nonprobability sample?

Two directions are worth mentioning here. One is the use of substitutions with additional application of multiple imputations (Rubin and Zanutto, 2002). The basic idea is to obtain information from the

substitutes at certain locations (cluster, strata, family) while the interviewer is there and use it within the multiple imputation strategy. The strict rules of probability samples are slightly abandoned, however, cost-error advantages are obtained in exchange.

Another direction relates to quota samples and to the contemporary flow of nonprobability samples on the Web (Vehovar et al, 2002), where the demand for some theory guidance is particularly strong. The question is whether nothing can be added to Kish (1965, 1999), who declared these samples simply as the object of art with no scientific substance. On the other hand, for the majority of market researchers, particularly those working on household or Internet panels, the notion of "sampling's dead" has already been true for decades. Careful pre-selection together with sophisticated post-survey adjustments often provide data suitable for the majority of their needs. Yet, there exists a feeling that we are still not able to take the whole potential of the information hidden in these nonprobability samples. Propensity score weighting is an example of an attempt to obtain better inference from such data. Here, the substitutions (type F and E) share the same quest with other nonprobability samples for more research efforts elaborating the corresponding cost-error strategies (Vehovar et al, 2001).

Conclusions

The very essence of substitutions is the sequential replacements of missing units. On the other hand, the interviewer's impact on selection of the substitutes exists only in some specific types of substitutions. There, the substitutions cannot be justified. The only possible exception is the extreme case with only few units per strata/cluster, where the situation is still unclear and more research is needed. However, none of this criticism hits the management-generated substitutions, including the Waksberg-Mitofsky procedure in telephone surveys. There, the substitutions face—besides general disadvantage arising from their sequential nature—another problem: they provide a very small gain in precision, which makes them much less favourable than they seem. When substitutions are applied in nonprobability samples they share the general destiny of this growing family of nonscientific surveys: they outperform probability samples very often (if judged from overall cost-error considerations), yet little research has been

performed to elaborate on this advantage and help the practitioners.

References

Brick, J. M. and Waksberg, J. (1991). Avoiding sequential sampling with RDD. *Survey Methodology,* 17(1), pp. 27-41.

Chapman, D. W. (2003). To substitute or not to substitute-that is the question. *Survey Statistician*, 48, 32-34.

Chapman, D. W. and Roman, A. (1985). An investigation of substitution for an RDD survey. *Proceedings of the Survey Research Methodology Section*, ASA, 269-274.

Chapman, D. W. (1983). The impact of substitutions on survey estimates. In Meadow et al.: *Incomplete data in sample surveys, vol. II,* National Academy of Sciences and Academic Press.

Kish, L. (1965). *Survey sampling*. New York:Wiley.

Kish, L. (1999): *Quota* sampling*: Old plus new thought*. Available on http://ris.org/vasja/kish.doc.

Rubin, D. B. and Zanutto, E. (2002): Using matched substitutes to adjust for nonignorable nonresponse through multiple imputation. In Groves et al (Eds): *Survey nonresponse*. New York:Wiley.

Vehovar, V. (1999). Field substitution and unit nonresponse. *Journal of Official Statistics.*

Vehovar V., Lozar, Batagelj & Zaletel (2002). Nonresponse in web surveys. In Groves et all (Eds): *Survey nonresponse*. New York:Wiley.

Vehovar, V., Lozar, K. and Batagelj, Z. (2001). Sensitivity of e-commerce measurement to survey instrument. *International Journal of Electronic Commerce*, 2001, 6/1.

To Contact the Author:

Vasja Vehovar
University of Ljubljana, Slovenia
vasja@ris.org

Announcements

IASS General Assembly

The next General Assembly of IASS members will take place during the ISI meetings in Berlin on **Thursday, August 14 from 11:15 a.m. to 1:00 p.m.** All IASS individual members, as well as the representatives of institutional members, are warmly welcomed to participate in this meeting. For additional information, please see the web site: http://www.isi-2003.de/.

IASS Elections

In February, ballots were distributed to members of the IASS for the election of a President-Elect, two Vice-Presidents, a Scientific Secretary, and six Council Members. Results of the election will be announced and the candidates terms will begin at the end of the General Assembly.

Joint IMS-SRMS Mini Meeting on *Current Trends in Survey Sampling and* Official *Statistics,* Calcutta, India, January 2-3, 2004

The Institute of Mathematical Statistics (IMS) and the Survey Research Methods Section (SRMS) will jointly sponsor a mini meeting on *Current Trends in Survey Sampling and Official Statistics* to be held near Calcutta, India, January 2-3, 2004. This will be co-sponsored by the U.S. Census Bureau, Gallup Research Center at the University of Nebraska-Lincoln and the Department of Statistics, University of Calcutta. The mini meeting is intended to serve as a bridge between mathematical statisticians and practitioners working on sample surveys and official statistics either in government or private agencies.

The following researchers have tentatively agreed to present their papers:

Arijit Chaudhuri (India), William Bell (USA), Heleno Bolfarine (Brazil), Jay Breidt (USA), Daniela Cocchi (Italy), Stephen E. Fienberg (USA), David Findley (USA), Marco Fortini (Italy), Wayne Fuller (USA), Malay Ghosh (USA), J.K. Ghosh (India/USA), Pilar Iglesias (Chile), Michael Larsen (USA), Brunero Liseo (Italy), Viviana Lencina (Argentina), Michel Mouchart (Belgium), S. James Press (USA), J.N.K. Rao (Canada), Stuart Scott (USA).

The meeting web page http://www.jpsm.umd.edu /ims contains relevant information concerning registration, the program, and other topics. If you are interested in presenting your paper at the meeting, please contact Partha Lahiri at plahiri@survey.umd.edu. Local information can be obtained from Tathagata Banerjee at btathaga@yahoo.com.

IASS Program Committee for the Sydney ISI Session (2005) Invites Suggestions

By the time you read this, our committee will be in the process of completing the short-listing of topics for the invited paper sessions to be held during the Sydney ISI for the IASS part of the program. The discussions to reach a final decision will take place during the Berlin ISI Session in August. If you would like to propose a topic, please do so by sending a title and short abstract (up to 100 words) as well as any other comments and suggestions to the chair of this committee at the address below. Last minute suggestions are still welcome, provided they reach our committee before July 31.

Pedro Silva
Rio de Janeiro – Brazil
Phone: 55-21-25144548
Fax: 55-21-25140039
E-mail: pedrosilva@ibge.gov.br

Exercises on Survey Methods with Solutions Editions Ellipses, 2003

There are very few works containing survey exercises with solutions. In an effort to foster solid understanding of the discipline, Pascal Ardilly (INSEE, France) and Yves Tillé (Université de Neuchâtel, Switzerland) offer a selection of 116 exercises, each accompanied by a detailed solution. These exercises are grouped in chapters and cover the main aspects of survey theory. The initial chapters are devoted to sampling methods: simple random sampling, stratified sampling, unequal probability sampling, multi-stage sampling, balanced sampling, and quota sampling. The next chapters deal with adjustment methods: ratio estimator, regression estimator, poststratified estimator, generalized calibration. One chapter is devoted to variance estimation. The book concludes with exercises on nonresponse.

This work (300 pages, 25 Euros) contains exercises at all levels, some developing theoretical aspects, others dealing with more applied problems with numeric applications. Each chapter begins with a brief course reminder specifying the notations and the main findings.

Pascal Ardilly is the head of Sampling and Statistical Data Processing at INSEE in France. Yves Tillé holds a Ph.D. in statistics from Brussels Université Libre and is currently a professor at the Université de Neuchâtel in Switzerland. Both authors have already published textbooks in French:

- ◆ Les techniques de sondage (Sampling Techniques) P. Ardilly, (1994). Technip;

- ◆ Théorie des sondages, échantillonnage et estimation en population finie (Sampling Theory, Finite Population Sampling and Estimation) Y. Tillé, (2001). Dunod.
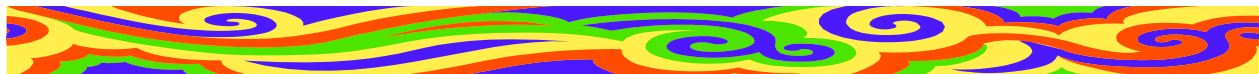
1992..... 1996..... 1999.....
ASC2003

THE IMPACT OF TECHNOLOGY ON THE SURVEY PROCESS

The Association for Survey Computing
announces its
**Fourth International
3 - day Conference**

ASC2003 – What is it ?

The Fourth International Conference on Survey and Statistical Computing, hosted by **The Association for Survey Computing**. It follows on from similar events presented by the ASC in 1992 *(Bristol University, England)*, in *1996 (Imperial College, London, England)* and in 1999 *(Edinburgh University, Scotland)*.

ASC2003 – When is it ?

Wednesday 17th to Friday 19th September 2003.

ASC2003 – Where is it ?

Ideally located for a residential conference, **The University of Warwick, England, UK**, is situated in the heart of England on a large and pleasant campus, close to the City of Coventry and the historic towns of Warwick, Kenilworth, Stratford-upon-Avon and Royal Leamington Spa. Delegates will be accommodated close to the University's Central Campus and main Conference areas.

ASC2003 – Who is it for ?

The Conference targets practitioners across all aspects of the survey research process. These are likely to be drawn from across the UK, Europe, North and South America and Australasia. The Conference's central theme will be **The Impact of Technology on the Survey Process**, and with contributions from commissioners, producers, and consumers of survey research alike. It will explore the often complex relationships between the push and pull of technological change and the expectations and demands created by them. It will also seek to examine how outcomes feed back to affect the processes which initially gave rise to them. Although a conference about technology, the topics to be discussed will appeal to everyone with an interest in survey design, data collection, analysis, reporting, or statistical computing.

ASC2003 – Conference Proceedings

A bound volume of **Proceedings**, incorporating all the papers presented to the Conference, will be published prior to the Conference and distributed to all delegates.

ASC2003 – What does it include ?

THE CONFERENCE IS BASED ON FIVE ELEMENTS

Plenary Sessions
The following Invited Speakers will address the Conference:

Norman Glass
(Chief Executive, National Centre for Social Research)
Denise Lievesley
(Director, UNESCO Institute for Statistics)
Peter Mouncey
(Cranfield University School of Management)
David Pullinger
(Head of National Statistics Online, ONS)

Themed Streams of Contributed Papers
Some 40 Papers will be presented within six streams:

Data Dissemination
Organisational Behaviour
Survey Development
Survey Modalities
Survey Software
The Effectiveness of the Internet

Poster Sessions
Providing an additional way of demonstrating the variety of developments in the field covered by the Conference.

The Conference Exhibition
An essential element at all ASC Conferences, providing opportunities for companies to meet the delegates.

The Social Programme
A number of social events have been arranged to enable delegates to meet together in a more informal setting.

ASC2003 – What is the ASC ?

The Association for Survey Computing is a not-for-profit organisation based in the United Kingdom but drawing significant international membership and support. It provides a valuable forum for those concerned with survey research and statistical computing. Its many activities and links to other organisations are publicised through its web site (**www.asc.org.uk**) including the many conferences and workshops it runs, the register of available software it maintains and its support of other initiatives in the survey and statistical field. Over the past thirty years, the ASC has organised many one-day conferences and workshops, mainly in London but also occasionally in Edinburgh. ASC membership is wide-ranging at both individual and corporate level. It aims to keep its members up to date with developments in the application of computers to all aspects of the survey process. It has links with the British Computer Society, the International Association for Statistical Computing, the Market Research Society, The Royal Statistical Society and the Social Research Association.

ASC2003 – More information ?

Contact The Administrator
ASC, PO Box 60, Chesham, Bucks, HP5 3QH, England.
Tel/Fax: 01494 793033 (International +44 (0)1494 793033);
e-mail: **admin@asc.org.uk**

Visit The Web Site at www.asc.org.uk
The ASC web site provides the latest Conference updates, including titles of Papers and delegate fee structures.

**Visit the new and improved IASS web site and
read *The Survey Statistician* on line!**

www.isi-iass.org

International Association of Survey Statisticians (IASS)
The Premier World Organization representing who's who in Sample Survey and Census Methodologies

FOUNDATION AND OBJECTIVES:

Founded in 1973, the International Association of Survey Statisticians (IASS) has as its charge and mandate to promote the study and development of the theory and practice of sample surveys and censuses. It also aims to increase interest in surveys and censuses among statisticians, governments, and the public the world over.

MEMBERSHIP AND EXECUTIVE:

At present the IASS has approximately 1,200 members from 130 countries and 38 institutional members.

IASS headquarters are situated in Libourne (FRANCE) and operate, to a large extent, under the auspices of the French statistical agency INSEE, which lends its expertise and status to aid and promote the association's work.

The society is run by an Executive Committee, elected for a period of 2 year and a Council, elected for a four year period.

Anyone interested in learning more about IASS should contact
Christophe Lefranc
IASS Executive Director
INSEE
18, Bd. Adolphe Pinard
75675 PARIS, France
e-mail: christophe.lefranc@insee.fr

Navigation: More about the IASS / Becoming a member / Services for members / Survey Statistician / Publications / IASS Conferences / Cochran-Hansen Prize / Ask the experts / Links / What's new

Association Internationale des Statisticiens d'Enquête (AISE)

Important Notices

◆ A PDF file of the newsletter is available on the IASS web site. Very few members no longer wish to receive the hard copy, but simply to be notified when a new issue is posted. Currently, we do not have a process in place to support this option. A process will be developed when an adequate number of members choose the above. Until that time, all members will continue to receive hard copies of the newsletter. Please send an e-mail to LeylaMohadjer@Westat.com if you would like to take advantage of the option mentioned above.

◆ Members are encouraged to view the IASS website (www.isi-iass.org) and provide comments or suggestions to Eric Rancourt: eric.rancourt@statcan.ca.

In Other Journals

Survey Methodology

**A Journal Published
by Statistics Canada**

Contents Volume 28, Number 2, December 2002

Contents Volume 18, Number 4, 2002

JOS is a scholarly quarterly that specializes in statistical methodology and applications. Survey methodology and other issues pertinent to the production of statistics at national offices and other statistical organizations are emphasized. All manuscripts are rigorously reviewed by independent referees and members of the Editorial Board.

Journal of Official Statistics

An International Review Published
by Statistics Sweden

Contents Volume 19, Number 1, 2003

All inquires about submissions and subscriptions should be directed to jos@scb.se

Statistics in Transition

Journal of the Polish Statistical Association

Contents Volume 5, Number 5, October 2002

Statistics in Transition

Journal of the Polish Statistical Association

Contents Volume 5, Number 6, December 2002

Statistics in Transition

Journal of the Polish Statistical Association

Contents Volume 5, Number 6, December 2002 (cont)

Economic and Social Trends in Transition Countries

Obituary

Acknowledgements

The Allgemeines Statistisches Archiv (AStA), Journal of the German Statistical Society is edited by Prof. Dr. Karl Mosler, University of Cologne. It provides an international forum for researchers and users from all branches of statistics. The first part (Articles) contains contributions to statistical theory, methods, and applications. A focus is on statistical problems that arise in the analysis of economic and social phenomena. The second part (News & Reports) consists of news, reports, and other material that relates to the activities of the Society. Book reviews are published in the third part (Books). Invited papers which have been presented to the Annual Congress of the Society are regularly published in the second issue of a volume. All papers in the first part are anonymously refereed. In order to be acceptable, a paper must either present a novel methodological approach or a result, obtained by a substantial use of statistical method, which has a significant scientific or societal impact. Occasional review papers are also encouraged. Authors of contributions are requested to mail three copies to the editor for refereeing. The journal publishes original contributions in English and German language, articles preferably in English. After acceptance the author has to provide a LaTeX- or ASCII file of the final manuscript that follows the style of the Allgemeines Statistisches Archiv in citation and layout. For submissions, please contact:

Petra Sablotny
Allgemeines Statistisches Archiv (Prof. Mosler)
Universität zu Köln
Albertus-Magnus-Platz
D-50923 Köln
e-mail: sablotny@marge.statistik.uni-koeln.de

Contents Volume 87, Issue 1, 2003

Articles

News and Reports

The Allgemeines Statistisches Archiv (AStA)

Contents Volume 87, Issue 1, 2003, (cont.)

Books

Contents Volume 87, Issue 2, 2003

Articles

The Allgemeines Statistisches Archiv (AStA)

Contents Volume 87, Issue 2, 2003, (cont.)

INTERNATIONAL ASSOCIATION
OF SURVEY STATISTICIANS

CHANGE OF ADDRESS FORM
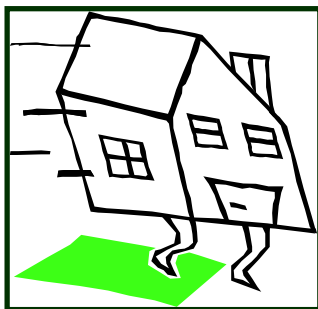
If your home or business address has changed, please copy, complete, and mail this form to:

IASS Secretariat
c/o INSEE-CEFIL
Att. Ms. Claude Olivier
3, rue de la Cité
33500 Libourne — France

Last name: Mr./Mrs./Miss/Ms. _____   **First name:** _____

E-mail address *(please just indicate one)***:** _____

May we list your e-mail address on the IASS web site?

Yes ☐   **No** ☐

Home address

Street: _____

City: _____

State/Province: _____   **ZIP/Postal code:** _____

Country: _____

Telephone number: _____

Fax number: _____

Business address

Company: _____

Street: _____

City: _____

State/Province: _____   **ZIP/Postal code:** _____

Country: _____

Telephone number: _____

Fax number: _____

Please specify address to which your IASS correspondence should be sent:

Home ☐   Business ☐

IASS Officers and Council Members

President (2001-2003):	Xavier Charoy (France), xavier.charoy@libertysurf.fr
President Elect (2003-2005):	Luigi Biggeri (Italy), pres@istat.it
Vice Presidents (2001-2003):	David Binder (Canada), binddav@statcan.ca
	Anders Christianson (Sweden): anders.christianson@telia.com
Scientific Secretary (2001-2003):	Seppo Laaksonen (Finland): seppo.laaksonen@stat.fi
Council Members (1999-2003):	Florentina Alvarez (Spain), falvarez@ine.es
	Cynthia Clark (USA), cclark@census.gov
	Pedro Do Nascimento Silva (Brazil), pedrosilva@ibge.gov.br
	Jean Martin (UK), jean.martin@ons.gov.uk
	Vitalis Muba (Tanzania), eastc@ud.co.tz
	Bhagwan Tikkiwal (India), bdtikkiwal@rediffmail.com

Council Members (2001-2005):	Kari Djerf (Finland), kari.djerf@stat.fi
	David Fitch (USA-Guatemala), dfitch@uvg.edu.gt
	Lidija Gligorova (Croatia), lgligor@dzs.hr
	Langhui Huang (China), huanglh@stats.gov.cn
	Moshe Sicron (Israel), sicron@internet-zahav.net
	Awa Thiongane (Senegal-Ethiopia), athiongane@uneca.org

Committees Chairs:	
Berlin 2003 Program Committee:	Danny Pfeffermann (Israel), msdanny@mscc.huji.ac.il
Sydney 2005 Program Committee:	Pedro Do Nascimento Silva (Brazil), pedrosilva@ibge.gov.br
2003 Election Nominations Committee:	Oladejo Ajayi (Nigeria), ooajayi@infoweb.abs.net
Jury of 2003 Cochran-Hansen Prize:	Chris Skinner (UK), c.j.skinner@soton.ac.uk

The Secretariat:	
Executive Director:	Alain Charraud (France), alain.charraud@insee.fr
Treasurer:	François Fabre (France), francois.fabre@insee.fr
Executive Secretary:	Anna Maria Vespa-Leyder (France), vespa@cepii.fr
Secretary:	Claude Olivier (France), claude.olivier@insee.fr

Institutional Members

4 international organizations

AFRISTAT
CICRED
EUROSTAT
UNITED NATIONS STATISTICAL DIVISION

31 bureaus of statistics

ARGENTINA - INSTITUTO NACIONAL DE ESTADISTICA Y CENSOS - INDEC
AUSTRALIA - AUSTRALIAN BUREAU OF STATISTICS
BELGIUM - INSTITUT NATIONAL DE STATISTIQUE
BRAZIL - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATISTICA - IBGE
CANADA - STATISTICS CANADA
CHINA - GOVERNO DE MACAU
CÔTE D'IVOIRE - INSTITUT NATIONAL DE LA STATISTIQUE
CZECH REPUBLIC - CZECH STATISTICAL OFFICE
DENMARK - DANMARKS STATISTIK
FINLAND - STATISTICS FINLAND
FRANCE - INSTITUT NATIONAL DE STATISTIQUE ET D'ÉTUDES ÉCONOMIQUES - INSEE
GAMBIA - CENTRAL STATISTICS DEPARTMENT
GERMANY - STATISTICHE BUNDESAMT
GREECE - NATIONAL STATISTICAL SERVICE OF GREECE
IRAN - STATISTICAL CENTER OF IRAN
ITALY - INSTITUTO CENTRALE DI STATISTICA - ISTAT
MEXICO - INSTITUTO NACIONAL DE ESTADISTICA, GEOGRAFIA E INFORMATICA - INEGI
NETHERLANDS - CENTRAL BUREAU OF STATISTICS
NEW ZEALAND - STATISTICS NEW ZEALAND
NIGERIA - FEDERAL OFFICE OF STATISTICS
NORWAY - CENTRAL BUREAU OF STATISTICS
PORTUGAL - INSTITUTO NACIONAL DE ESTATISTICA - INE
REPUBLIC OF KOREA - NATIONAL STATISTICAL OFFICE - NSO
SPAIN - INSTITUTO NACIONAL DE ESTADISTICA
SWEDEN - STATISTICS SWEDEN
SWITZERLAND - OFFICE FÉDÉRAL DE STATISTIQUE
TANZANIA - BUREAU OF STATISTICS
UNITED KINGDOM - OFFICE FOR NATIONAL STATISTICS
USA - BUREAU OF THE CENSUS
USA - DEPARTMENT OF EDUCATION
USA - DEPARTMENT OF HEALTH AND HUMAN SERVICES

6 universities, research centers, private firms of statistics

ARGENTINA - UNIVERSITAD NACIONAL DE TRES DE FEBRERO
DENMARK - SFI
EUROPE - A.C. NIELSEN MANAGEMENT SERVICE
FRANCE - INSTITUT NATIONAL D'ÉTUDES DÉMOGRAPHIQUES - INED
USA - RESEARCH TRIANGLE INSTITUTE
USA - WESTAT