

AMERICAN STATISTICAL ASSOCIATION  
PROCEEDINGS OF THE SOCIAL  
STATISTICS SECTION  
PART 1  
1977

*Published on demand*

UNIVERSITY MICROFILMS INTERNATIONAL  
*Ann Arbor, Michigan, U.S.A. · London, England*

8260886

CO. 84919  
10046 Part 1, 1977

C8-2  
S  
1977  
Pt. 1  
C8-53  
A512  
1977  
V. 1

# AMERICAN STATISTICAL ASSOCIATION

## PROCEEDINGS

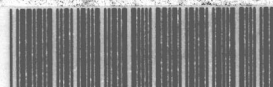
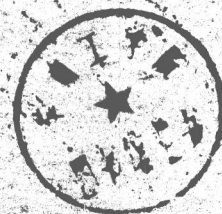
*of the*

SOCIAL STATISTICS SECTION

1977  
Part I

Papers presented at the Annual Meeting of the American Statistical Association, Chicago, Illinois, August 15-18, 1977 under the Sponsorship of the Social Statistics Section.

Price: \$22.00



E8260886

AMERICAN STATISTICAL ASSOCIATION

806 15th Street, N.W. Washington, D.C. 20005

8260886

# **AMERICAN STATISTICAL ASSOCIATION**

## **P R O C E E D I N G S**

*of the*

**SOCIAL STATISTICS SECTION**

**1977  
Part I**

Papers presented at the Annual Meeting of the American Statistical Association, Chicago, Illinois, August 15-18, 1977 under the Sponsorship of the Social Statistics Section.



**AMERICAN STATISTICAL ASSOCIATION**

**806 15th Street, N.W.      Washington, D.C. 20005**

Copyright 1978 by the American Statistical Association

## FOREWORD

This is the twentieth annual edition of the Proceedings of the Social Statistics Section of the American Statistical Association.

This 1977 issue is in two volumes and includes nearly all of the papers and discussions that were presented in the sessions sponsored by the Social Statistics Section at the Annual Meeting of the American Statistical Association in Chicago, August 15-18, 1977. The pages in these volumes are photographic reproductions of standard-format typescripts provided by the authors. Their specific contents have been edited only by the authors, and may be in a form preliminary to formal publication elsewhere.

The Chairman of the Joint Program Committee was Gary G. Koch. Monroe Lerner, Vice Chairman of the Social Statistics Section, served as Chairman of the Program Committee and was responsible for developing the program of sessions sponsored by the Social Statistics Section. Acknowledgment is due to the participants in the sessions for their cooperation in providing the materials and to the ASA office staff for its work in compiling and arranging for the printing.

Paul C. Glick  
Chairman, Social Statistics Section 1977

Edwin D. Goldfield  
Proceedings Editor



# INDEX OF PARTICIPANTS

PART I (Pages 1-547) and PART II (Pages 548-1048)

Adamchak, Donald J. ....	11	Dippo, Cathryn .....	486
Allen, I. Elaine .....	372	Butka, Solomon .....	186
Al-Marayati, M. S. ....	460	Eckerman, William C. ....	360
Andrews, Frank M. ....	133	El Attar, M. E. ....	460
Archer, Claude O. ....	880	El Attar, S. ....	460
Aroian, Leo A. ....	987	Ericksen, Eugene .....	183
Atkinson, Tom .....	123	Esimai, Grace O. ....	854
Avery, Roger C. ....	372	Evers, Mark .....	887
Bailar, Barbara A. ....	26	Farnsworth, David L. ....	543
Baldus, David C. ....	465	Fay, Robert E. III .....	418
Banks, Martha J. ....	291	Feldt, Leonard S. ....	921
Barker, Barbara M. ....	710,720	Fellegi, I. P. ....	762
Barker, Harry R. ....	710,959	Ferriss, Abbott L. ....	653,1045
Bateman, David V. ....	53	Fireworker, Robert B. ....	352
Bean, Judy A. ....	858,938	Fischer, Elizabeth M. ....	953
Beckett, James III .....	983	Ford, Barry L. ....	892
Bell, Richard .....	735	Frazier, Emma L. ....	980
Bendel, Robert B. ....	870	Freeman, Daniel H., Jr. ....	913
Beniger, James R. ....	771	Frese, W. ....	460
Benson, Purnell H. ....	729	Frey, William H. ....	454
Berry, Charles C. ....	682	Friedman, Hershey H. ....	352
Bishop, John .....	848	Fuller, Wayne A. ....	217
Bohannon, Tom .....	865	German, Jeremiah J. ....	970
Bonham, Gordon Scott .....	583	Gerzowski, Michele .....	572
Bridges, M. P. ....	347	Gillings, Dennis B. ....	97
Brock, Dwight B. ....	1017	Ginsburg, Alan .....	409
Brooks, Camilla A. ....	26	Glick, Paul C. ....	1041
Bryk, Anthony S. ....	639	Goldfield, Edwin D. ....	219
Burdick, Richard K. ....	798	Grahn, D. ....	672
Bush, James W. ....	682	Gray, George H. ....	396
Butler, Edgar W. ....	443	Grob, George .....	409
Cahoon, Lawrence .....	314	Groves, Robert M. ....	232,321
Campbell, Angus .....	120	Hadler, Nortin M. ....	97
Campbell, Cathy .....	800	Han, Chien-Pai .....	854
Campbell, Don B. ....	987	Hauser, Philip M. ....	46
Cannell, Charles .....	1042	Henry, Alice .....	249
Capps, Grant .....	153,301	Henry, Neil W. ....	249
Carlton, Betty .....	723,959	Herzog, Thomas N. ....	326
Casterline, John B. ....	448	Hess, Irene .....	1042
Chakrabarty, R. P. ....	296,812	Hidiroglou, M. A. ....	903
Chand, Lal .....	927	Higgins, James E. ....	974
Chapman, David W. ....	526	Hillson, Roger .....	694
Chen, Martin K. ....	678	Hirschberg, David .....	70
Chen, T. Timothy .....	765	Hogan, Dennis P. ....	598
Chow, L. P. ....	614	Hogan, Timothy D. ....	701
Ciancio, Nicholas J. ....	337,909	Hsieh, John J. ....	425
Cicchetti, Domenic V. ....	1028	Huang, H. ....	793
Clogg, Clifford C. ....	874	Hubbard, Robert L. ....	360
Cochran, Robert S. ....	270	Huitema, Bradley E. ....	1004
Coder, John .....	402	Hutcheson, John D., Jr. ....	279
Cohen, Steven B. ....	781	Huynh, Huynh .....	921
Cohn, Elchanan .....	646	Inglehart, Ronald F. ....	133
Cole, James W. L. ....	465	Irvine, Russell W. ....	1034
Cole, John E. ....	1008	Isaki, Cary T. ....	308
Coleman, John .....	486	Jabine, Thomas B. ....	173,744
Cowan, Charles D. ....	219,498	Jacobs, Curtis .....	486
Cox, Lawrence H. ....	750	Johnson, Kathleen M. ....	563
Curtin, Lester R. ....	618	Johnston, Denis F. ....	215
Dalenius, Tore .....	21,230	Jung, Tae Hwan .....	443
David, Martin .....	517	Juster, F. Thomas .....	504
Dawson, Beth K. ....	897	Kalsbeek, William D. ....	781
Dayton, C. Mitchell .....	991	Kaplan, David L. ....	1040
Deighton, Richard E. ....	995	Kaplan, Robert M. ....	682
Denby, L. ....	634	Katz, James E. ....	644
Denker, M. W. ....	554	Katz, Jerrold P. ....	628
Devlin, S. J. ....	634	Keats, John B. ....	1008

Kerachsky, Stuart H. ....	867	Ono, Mitsuo .....	1046
Kimball, A. W. ....	614	Palit, Charles .....	243
Kish, L. ....	321	Passel, Jeffrey .....	81
Klebba, A. Joan .....	594	Patrick, Clifford H. ....	666
Klein, Bruce W. ....	245	Pearl, Robert B. ....	492
Koch, Gary G. ....	205,974	Pick, James B. ....	443
Korns, Alexander .....	60	Pigman, Nathaniel M., Jr. ....	173
Kovar, Mary Grace .....	1	Pinciario, Susan J. ....	308
Kripalani, G. K. ....	382,388	Pitts, Alfred M. ....	694
Krishnan, P. ....	437	Placek, Paul J. ....	608
Krotki, K. P. ....	321	Poe, Gail S. ....	578
Krute, Aaron .....	1043	Poiani, E. L. ....	634
Lancaster, Clarise .....	530	Poland, James R. ....	995
Lannom, Linda Bean .....	511	Prather, James E. ....	279,932
Laurenti, Ruy .....	90	Pratt, W. F. ....	1047
Lee, Che-Fu .....	393	Preston, Samuel H. ....	20
Lee, Joe Won .....	813	Proctor, Charles H. ....	284
Legarreta, Adela .....	107	Rachal, J. Valley .....	360
Lemeshow, Stanley .....	831,837,843	Radner, Daniel B. ....	756
Lerner, Frances M. ....	482	Rana, Dharam S. ....	806
Lerner, Monroe .....	708	Rao, J. N. K. ....	335
Levy, Paul S. ....	963	Rashid, Ali .....	378
Lilienfeld, Abraham M. ....	83	Reccius, Norman W. ....	880
Lilienfeld, David E. ....	83	Regal, Ronald .....	944
Lin, Y. S. ....	967	Resha, William H. ....	714
Liu, Ben-Chieh .....	476	Rice, Dorothy P. ....	1042
Liu, P. T. ....	614	Richman, Alex .....	557
Luery, Donald M. ....	143	Rives, N. W., Jr. ....	688
Lunde, Anders S. ....	192	Robinson, JoAnn .....	1028
Lundy, R. T. ....	672	Rosenberg, Harry M. ....	192
Lyberg, Lars .....	354	Royston, Patricia N. ....	347
Lynch, G. W. ....	884	Rubin, Ernest .....	536
Macready, George B. ....	991	Russell, I. T. ....	548
Madow, Lillian H. ....	35	Rustemeyer, Anita .....	341
Magidson, Jay .....	947	St. Louis, Alfred .....	520
Mahoney, Bette S. ....	118	Sakoda, James M. ....	777
Makuc, Diane .....	97	Sanathanan, L. ....	471
Makuch, Robert W. ....	913	Sater, Douglas K. ....	264
Mallar, Charles D. ....	867	Savage, I. R. ....	45
Markovits, Andrei S. ....	628	Schaible, Wesley .....	1017
Marks, Eli S. ....	414	Scheuren, Frederick J. ....	70,530
Massey, James T. ....	578	Schieber, Sylvester J. ....	422
Mazurkewycz, Alexander .....	441	Schnack, George A. ....	938,1017
McCann, Shana .....	787	Schwanz, Dennis J. ....	163
McDonald, J. ....	471	Scott, John C. ....	219
McElroy, Michael P. ....	378	Selvage, Rob .....	919
McNeil, John M. ....	264	Shapiro, Gary M. ....	143,943
McPheeters, Lee R. ....	701	Shih, Ko Ching .....	258
Metcalf, Charles E. ....	110	Shih, Sun-Fu .....	1022
Michael, John A. ....	744	Shih, Wen-Fu P. ....	1022
Mier, Robert .....	825	Shimizu, Iris M. ....	589
Miller, M. C. ....	980	Sielken, Robert L., Jr. ....	798
Minder, Carolyn .....	723	Simmons, Walt R. ....	578
Minder, Charles .....	723	Sirken, Monroe G. ....	347
Mindlin, Albert .....	200	Smith, Rodney .....	382
Mitra, S. ....	1012	Smith, T. L. ....	554
Montie, Irene C. ....	163	Smith, W. B. ....	865
Mooney, Anne .....	688	Spiers, Emmett .....	252
Moore, Maurice J. ....	623	Srinath, K. P. ....	903
Morgan, J. Michael .....	646	Stallard, Eric .....	694
Morris, S. C. ....	655	Stanek, Edward J. III .....	837
Mugge, Robert H. ....	744	Stockwell, Edward G. ....	11
Mukherjee, Ajit K. ....	726	Stolwijk, Jan A. J. ....	913
Muller, Hans J. ....	756	Stone, Vernon W. ....	1034
Myers, George C. ....	694	Stover, John L. ....	337
Nambodiri, N. K. ....	431,887	Stratton, Michael G. ....	543
Nisselson, Harold .....	242,414	Strenio, Judith F. ....	639
O'Brien, Dennis M. ....	270	Stubbs, Joel R. ....	995
O'Connell, Martin .....	623	Suchindran, C. M. ....	366,431,618
Oliver, Julia D. ....	567	Sudman, Seymour .....	511
O'Neill, W. ....	471	Sukhatme, B. V. ....	333,927

Suter, Larry E. ....	819	Wasserman, Stanley S. ....	860
Sweet, Phyllis R. ....	563	Weed, James A. ....	1
Taeuber, Conrad ....	51	Weisberg, Herbert I. ....	639
Talwar, Prem P. ....	603	Welch, R. L. W. ....	554
Tamhane, Ajit C. ....	273	West, K. K. ....	431
Taneja, Vidya ....	987	Westphal, M. C. ....	980
Taucher, Erica ....	109	Wicks, Jerry W. ....	11
Teddlie, Charles ....	366	Williams, Jay R. ....	360
Thompson, Marvin M. ....	396	Williams, Nancy G. ....	720
Tolley, G. S. ....	388	Wolter, Kirk M. ....	787
Tortora, Robert D. ....	909,995	Wyzga, Ronald E. ....	660
Turner, Anthony G. ....	219	Yuskavage, Robert ....	70
Udry, J. Richard ....	366	Zeisset, Paul ....	739
Vietorisz, Thomas ....	825	Zemach, Rita ....	203
Waksberg, Joseph ....	189		

# TABLE OF CONTENTS

## PART 1

### INVITED PAPERS

#### I

#### MEASUREMENT AND ANALYSIS OF SOCIOECONOMIC DIFFERENTIALS IN MORTALITY IN THE UNITED STATES

Chairman: ROBERT A. ISRAEL, Nat. Center for Health Statistics

Considerations in Using Individual Socioeconomic Characteristics in the Analysis of Mortality - MARY GRACE KOVAR and JAMES A. WEED, Nat. Center for Health Statistics.....	1
Research on the Relationship Between Socioeconomic Status and Mortality in the United States: 1960-1975 - EDWARD G. STOCKWELL, JERRY W. WICKS and DONALD J. ADAMCHAK, Bowling Green State University.....	11
Discussion - SAMUEL H. PRESTON, United Nations.....	20

#### II

#### NONSAMPLING ERRORS IN SURVEY STATISTICS

Chairman: MONROE SIRKEN, Nat. Center for Health Statistics

Strain at a Gnat and Swallow a Camel: Or, the Problem of Measuring Sampling and Non-Sampling Errors - TORE DALENIUS, University of Stockholm.....	21
An Error Profile: Employment as Measured by the Current Population Survey - CAMILLA A. BROOKS and BARBARA A. BAILAR, U.S. Bureau of the Census.....	26
An Error Profile: Employment as Measured by the Current Employment Statistics Program - LILLIAN H. MADOW, U.S. Bureau of Labor Statistics.....	35
Discussion - I. R. SAVAGE, Yale University.....	45

#### III

#### SOCIAL STATISTICS IN THE YEAR 2000

Chairman: PAUL C. GLICK, U.S. Bureau of the Census

Social Statistics in 2000 - PHILIP M. HAUSER, University of Chicago.....	46
Discussion - CONRAD TAEUBER, Georgetown University.....	51

#### IV

#### SOME COVERAGE ISSUES WITH THE CURRENT POPULATION SURVEY

Chairman: NORFLEET W. RIVES, University of Delaware

Analysis of Census Bureau National Housing Inventory Estimates - DAVID V. BATEMAN, U.S. Bureau of the Census.....	53
Coverage Issues Raised by Comparisons Between CPS and Establishment Employment - ALEXANDER KORNS, U.S. Dept. of Commerce.....	60
The Impact on Personal and Family Income of Adjusting the Current Population Survey for Under- Coverage - ROBERT YUSKAVAGE and DAVID HIRSCHBERG, Bureau of Economic Analysis and FREDERICK J. SCHEUREN, Social Security Admin. ....	70
Discussion - JEFFREY S. PASSEL, U.S. Bureau of the Census.....	81



# V

## HEALTH STATISTICS: APPLICATIONS IN EPIDEMIOLOGY

Chairman: BERNARD G. GREENBERG, University of North Carolina

The Foundations of Epidemiology: The French Connection - DAVID E. LILIENTFELD and ABRAHAM M. LILIENTFELD, Johns Hopkins University.....	83
Special Investigations on Mortality - RUY LAURENTI, Sao Paulo University.....	90
Multivariate Analysis of Hand Usage on Structure and Function - DENNIS B. GILLINGS, DIANE MAKUC and NORTIN M. HADLER, University of North Carolina.....	97
Discussion - ADELA LEGARRETA, Universidad de Chile.....	107
Discussion - ERICA TAUCHER, Latin American Demographic Center.....	109

# VI

## THE INCOME MAINTENANCE EXPERIMENTS: THE ROLE OF THE STATISTICIAN IN SOCIAL EXPERIMENTATION

Chairman: RICHARD C. TAEUBER, Commission on Fed. Paperwork

The Social Experiments: Statistical Issues and the Role of Statisticians - CHARLES E. METCALF, Mathematica Policy Research.....	110
Discussion - BETTE S. MAHONEY, U.S. Dept. of HEW.....	118

# VII

## MEASURES OF SUBJECTIVE QUALITY OF LIFE

Chairman: ROBERT PARKE, Social Science Research Council

Poor Measurement of the Right Thing - ANGUS CAMPBELL, University of Michigan.....	120
Is Satisfaction a Good Measure of the Perceived Quality of Life? - TOM ATKINSON, York University	123
The Structure of Subjective Well-Being in Nine Western Societies - FRANK M. ANDREWS and RONALD F. INGLEHART, University of Michigan.....	133

# VIII

## SURVEY DESIGN INNOVATIONS AT THE BUREAU OF THE CENSUS

Chairman: CHARLES D. JONES, U.S. Bureau of the Census

Innovations in the Sample Design for the Survey of Income and Education - DONALD M. LUERY and GARY M. SHAPIRO, U.S. Bureau of the Census.....	143
Voting Rights Survey - GRANT CAPPS, U.S. Bureau of the Census.....	153
Coverage Improvement in the Annual Housing Survey - IRENE C. MONTIE and DENNIS J. SCHWANZ, U.S. Bureau of the Census.....	163

# IX

## IMPROVING THE QUALITY OF FEDERALLY SPONSORED CONTRACTS

Chairman: GEORGE E. HALL, Ofc. of Management & Budget

Some Lessons Learned from SSA Experience in Contracting for Surveys - THOMAS B. JABINE, Social Security Admin. and NATHANIEL M. PIGMAN, Jr., Health Care Financing Admin. ....	173
--	-----

Some Lessons Learned from Conducting Federally Sponsored Surveys - EUGENE P. ERICKSEN, Temple University.....	183
RFP, Government, How to Live With - SOLOMON DUTKA, Audits & Surveys, Inc. ....	186
Discussion - JOSEPH WAKSBERG, Westat, Inc. ....	189

## X

### PROFESSIONAL STANDARDS OF STATISTICIANS IN STATE AND LOCAL GOVERNMENT

Chairman: ANDERS S. LUNDE, Consultant, Chapel Hill, N.C.

Professional Standards of Statisticians in State and Local Governments - HARRY M. ROSENBERG and ANDERS S. LUNDE, University of North Carolina.....	192
Discussion - ALBERT MINDLIN, District of Columbia Gov't. ....	200
Discussion - RITA ZEMACH, Michigan Dept. of Public Health.....	203

## XI

### THE INTERFACE BETWEEN STATISTICAL METHODOLOGY AND STATISTICAL PRACTICE

Chairman: WILLIAM KRUSKAL, University of Chicago

The Interface Between Statistical Methodology and Statistical Practice - GARY G. KOCH, University of North Carolina.....	205
Discussion - DENIS F. JOHNSTON, Ofc. of Management & Budget.....	215
Discussion - WAYNE A. FULLER, Iowa State University.....	217

## XII

### PRIVACY AND CONFIDENTIALITY AS FACTORS IN SURVEY RESPONSE

Chairman: A. L. FINKNER, U.S. Bureau of the Census

Privacy and Confidentiality as Factors in Survey Response - EDWIN D. GOLDFIELD, Nat. Academy of Sciences; ANTHONY G. TURNER and CHARLES D. COWAN, U.S. Bureau of the Census; JOHN C. SCOTT, University of Michigan.....	219
Discussion - TORE DALENIUS, University of Stockholm.....	230

## XIII

### EVALUATING TELEPHONE SURVEY METHODOLOGY

Chairman: EDWARD A. SCHILLMOELLER, A. C. Nielsen Co.

An Experimental Comparison of National Telephone and Personal Interview Surveys - ROBERT M. GROVES, University of Michigan.....	232
Discussion - HAROLD NISSELSO, U.S. Bureau of the Census.....	242
Discussion - CHARLES D. PALIT, University of Wisconsin.....	243

## CONTRIBUTED PAPERS BY TOPIC

### I: SERVICE STATISTICS FOR ANALYSIS OF SOCIAL PROBLEMS

Predicting the Change in the Number of Persons in Poverty by a Regression Model - BRUCE W. KLEIN, U.S. Dept. of HEW.....	245
Measuring the Socioeconomic Status of Occupations - ALICE HENRY, Cornell University and NEIL W. HENRY, Virginia Commonwealth University.....	249
Estimation of Summary Measures of Income Size Distribution from Grouped Data - EMMETT SPIERS, U.S. Bureau of the Census.....	252
A Simplified Urban Housing Inventory Model - with Practical Applications - KO CHING SHIH, U.S. Dept. of HUD.....	258
Selected Characteristics of Persons who Reported a Work Disability in the 1970 Census - JOHN M. McNEIL and DOUGLAS K. SATER, U.S. Bureau of the Census.....	264

### II: RESPONSE PROBLEMS IN SURVEYS

The Comprehension Factor in Randomized Response - DENNIS M. O'BRIEN, University of Wisconsin and ROBERT S. COCHRAN, University of Wyoming.....	270
A Randomized Response Technique for Investigating Several Sensitive Attributes - AJIT C. TAMHANE, Northwestern University.....	273
Assessing the Effects of Missing Data - JOHN D. HUTCHESON, Jr. and JAMES E. PRÄTHER, Georgia State University.....	279
Two Direct Approaches to Survey Nonresponse: Estimating a Proportion with Callbacks and Allocating Effort to Raise Response Rate - CHARLES H. PROCTOR, North Carolina State University.....	284
An Indication of the Effect of Noninterview Adjustment and Post-Stratification on Estimates from a Sample Survey - MARTHA J. BANKS, University of Chicago.....	291
On the Reduction of Response Bias in Sample Surveys Using Auxiliary Information - K. P. CHAKRABARTY, Jackson State University.....	296

### III: VARIANCE ESTIMATION IN SAMPLE SURVEYS

Some Interesting Results in Unequal Probability Sampling from a Finite Population - GRANT CAPPS, U.S. Bureau of the Census.....	301
Numerical Comparison of Some Estimators of Variance Under PPS Systematic Sampling - CARY T. ISAKI and SUSAN J. PINCIARO, U.S. Bureau of the Census.....	308
Variance Estimation for State Estimates from the Expanded Current Population Survey - LAWRENCE CAHOON, U.S. Bureau of the Census.....	314
The Analysis of Sampling Errors - K. P. KROTKI, Statistics Canada; L. KISH and R. M. GROVES, University of Michigan.....	321
More Dallying with CPS Design Effects - THOMAS N. HERZOG, Social Security Admin. ....	326
Discussion - B. V. SUKHATME, Iowa State University.....	333
Discussion - J. N. K. RAO, Carleton University.....	335

### IV: PROBLEMS OF DATA COLLECTION IN SURVEYS

Surveys: A Practical Approach - NICHOLAS J. CIANCIO and JOHN L. STOVER, U.S. Dept. of Agric. .	337
Measuring Interviewer Performance in Mock Interviews - ANITRA RUSTEMEYER, U.S. Bureau of the Census.....	341
Counting Rule Bias in Household Surveys of Deaths - MONROE G. SIRKEN and PATRICIA N. ROYSTON, NCHS and M. P. BRIDGES, Research Triangle Institute.....	347

Effect of Ethnicity of Signature in Mail Surveys - HERSHEY H. FRIEDMAN, Montclair State College and ROBERT B. FIREWORKER, St. John's University.....	352
Coding of Verbal Information - LARS LYBERG, Nat. Central Bur. of Statistics, Sweden.....	354
Factors Affecting the Validity of Self-Reports of Drug Use: An Overview - ROBERT L. HUBBARD, WILLIAM C. ECKERMAN, J. VALLEY RACHAL and JAY R. WILLIAMS, Research Triangle Institute.....	360

#### V: VITAL RATES IN DEVELOPING COUNTRIES

The Random Variation in Rates Based on Total Enumeration of Events - J. RICHARD UDRY, CHARLES TEDDLIE and C. M. SUCHINDRAN, University of North Carolina.....	366
Log-Linear Analysis of Fertility Using Census and Survey Data with an Example - I. ELAINE ALLEN and ROGER C. AVERY, Cornell University.....	372
A Comparison of Male Occupation Specific Labor Force Separations Obtained Through a Longitudinal Study and those Obtained Through Standard Working Life Tables - ALI RASHID, Central Dept. of Statistics, Saudi Arabia, and MICHAEL P. McELROY, U.S. Bureau of the Census.....	378
A Model of Population Growth Involving Mortality Fertility Interactions: Projections for India- G. K. KRIPALANI and RODNEY SMITH, Western Michigan University.....	382
A Simulation Analysis of Lagged Fertility Adjustments in Developing Countries to Exogenous Mortality Disturbances - G. S. TOLLEY, University of Chicago and G. K. KRIPALANI, Western Michigan University.....	388
Discussion - CHE-FU LEE, Catholic University of America.....	393

#### VI: THE SURVEY OF INCOME AND EDUCATION

Description of the Survey of Income and Education (SIE) Operations - GEORGE H. GRAY and MARVIN M. THOMPSON, U.S. Bureau of the Census.....	396
Evaluation of Income Reporting on the Survey of Income and Education - JOHN CODER, U.S. Bureau of the Census.....	402
Uses of Data from the Survey of Income and Education for Policy Analysis - ALAN GINSBURG and GEORGE GROB, U.S. Dept. of HEW.....	409
Problems of Nonsampling Error in the Survey of Income and Education: Coverage Evaluation - ELI S. MARKS and HAROLD NISSELSON, U.S. Bureau of the Census.....	414
Problems of Nonsampling Error in the Survey of Income and Education: Content Analysis - ROBERT E. FAY III, U.S. Bureau of the Census.....	418
Discussion - SYLVESTER J. SCHIEBER, Social Security Admin. ....	422

#### VII: APPLICATIONS OF LIFE TABLE TECHNIQUES

A Precise Life Table Method - JOHN J. HSIEH, University of Toronto.....	425
Analysis of Fertility by Increment-Decrement Life Tables - C. M. SUCHINDRAN, N. K. NAMBOODIRI and K. K. WEST, University of North Carolina.....	431
A Stochastic Process Model of Work Force History - P. KRISHNAN, University of Alberta.....	437
A Modified Census Survival Ratio Method for the Estimation of Intercensal Net Internal Migration - ALEXANDER MAZURKEWYCZ, Brandon University.....	441
Projection of Direct Farm Laborer Displacement from Geothermal Development, Imperial County, California - JAMES B. PICK, TAE HWAN JUNG and EDGAR W. BUTLER, University of California.....	443

#### VIII: STATISTICS AND MODELING IN URBAN SOCIAL PROBLEMS

Demographic Correlates of Attitudes Towards Busing and School Integration: Detroit, 1976 - JOHN B. CASTERLINE, University of Michigan.....	448
White Flight and Central City Loss: Application of an Analytic Migration Framework - WILLIAM H. FREY, University of Wisconsin.....	454



Black-White Housing Quality Differentials in the United States, 1970 - M. E. EL ATTAR, S. EL ATTAR, W. FRESE and M. S. AL-MARAYATI, Mississippi State University.....	460
Statistical Modeling to Support a Claim of Intentional Discrimination - JAMES W. L. COLE, Pittsburgh, Pa., and DAVID C. BALDUS, University of Iowa.....	465
Dynamic Modeling of Neighborhood Transition - L. SANATHANAN, W. O'NEILL and J. McDONALD, University of Illinois.....	471
Impact Models of Highway Construction on Urban Neighborhoods: Some Empirical Results - BEN-CHIEH LIU, Midwest Research Institute.....	476
Discussion - FRANCES M. LERNER, University of Baltimore.....	482

#### IX: IMPLICATIONS OF THE 1972-73 NATIONAL SURVEY OF CONSUMER INCOME AND EXPENDITURES

Evaluation of the 1972-73 Consumer Expenditure Survey - CATHRYN DIPPO, JOHN COLEMAN and CURTIS JACOBS, U.S. Bureau of Labor Statistics.....	486
The 1972-73 U.S. Consumer Expenditure Survey: A Preliminary Evaluation - ROBERT B. PEARL, University of Illinois.....	492
Incentive Effects on Amounts Reported in an Expenditure Diary Survey - CHARLES D. COWAN, U.S. Bureau of the Census.....	498
An Experiment in Data Collection: Use of Financial Records - F. THOMAS JUSTER, University of Michigan.....	504
A Comparison of Alternative Panel Procedures for Obtaining Health Data - SEYMOUR SUDMAN and LINDA BEAN LANNOM, University of Illinois.....	511
Discussion - MARTIN DAVID, University of Wisconsin.....	517

#### X: STATISTICS AND LAW

Measuring Crime by Mail Surveys: The Texas Crime Trend Survey - ALFRED ST. LOUIS, Texas Dept. of Public Safety.....	520
Sample Selection Procedures for the IACP Uniform Crime Report Audit - DAVID W. CHAPMAN, Westat	526
Counting the Uncountable Illegals: Some Initial Statistical Speculations Employing Capture-Recapture Techniques - CLARISE LANCASTER, Dept. of HEW and FREDERICK J. SCHEUREN, Social Security Admin. ....	530
Queening in Master Chess Tournaments: 1867-1970 - ERNEST RUBIN, American University and University of the District of Columbia.....	536
Fourier Analysis of the Number of Public Laws 1789 - 1976 - DAVID L. FARNSWORTH, Eisenhower College and MICHAEL G. STRATTON, GTE Sylvania.....	543

(Continued in Part II)

# CONSIDERATIONS IN USING INDIVIDUAL SOCIOECONOMIC CHARACTERISTICS IN THE ANALYSIS OF MORTALITY

Mary Grace Kovar and James A. Weed  
National Center for Health Statistics

In the last paragraph of their APHA monograph Differential Mortality in the United States, Kitagawa and Hauser (1973) gave strong support to the view that the improvement of social-economic conditions would be the most promising route to take in achieving further mortality reduction:

Perhaps the most important next gain in mortality reduction is to be achieved through improved social-economic conditions rather than through increments to and application of biomedical knowledge. Certainly the biomedical know-how now available is either not available to the lower socioeconomic classes in the United States, or its impact, at this stage in the reduction of mortality, is relatively small compared to what could be achieved through reduction of the gap in levels of living and life styles associated with education, income, occupation, and geographic locale. If the United States is to demonstrate that she is indeed a land of equal opportunity, she must do considerably more to increase equality of opportunity on all fronts which affect the most significant index of effective equalitarianism--the ability to survive--duration of life itself.

These words were written in 1972 and referred to the authors' analyses of the cross-sectional 1960 Matched Records Study and of longitudinal census tract data for the city of Chicago. Socioeconomic differences in mortality were evident at both the individual and aggregate levels of analysis, no matter which indexes of socioeconomic level were employed. However, the longitudinal analysis of aggregated data for Chicago census tracts provided a finding which had special significance for the authors' conclusion regarding the improvement of social-economic conditions. They observed that between 1930 and 1940 there was a general convergence of socioeconomic differentials in the Chicago area, followed by a widening of these differentials between 1940 and 1960. As Kitagawa has more recently noted (1977), other research has also indicated a reversal of the older trend, i.e., now toward increasing socioeconomic differentials in mortality. For example, Lerner and Stutz (1976, 1977) have found widening differentials between 1960 and 1970 for Maryland and for the United States as a whole.

All of the studies which show a recent widening of socioeconomic differentials in the United States have been based solely on aggregate (or areal) data, employing "ecological" methods of analysis. Indeed, the largest part of research

on mortality differentials has been based on aggregate data. Hannan and Burstein (1974) have noted that there generally will be a loss of efficiency for estimates from grouped observations. Moreover, using a structural equations perspective, they have shown that grouping of observations may result in biased estimates, depending on the nature of the causal relationships between the grouping criterion and the variables--both dependent and independent--in the model. Their analysis also emphasizes the possibility that grouping may have the effect of magnifying specification error in the micro-model of interest.

In view of these analytical considerations, we suggest that more attention should be given to the development of data systems which can provide individual socioeconomic characteristics in the analysis of trends in mortality. Accordingly, the purpose of this paper is to discuss important issues relating to the design of individual-level data systems with this goal.

## Conceptualizing the variables.

One of the first concerns to be dealt with by anyone proposing an individual-level study of socioeconomic differentials in mortality is the problem of how to conceptualize the variables of interest. Generally, the resolution of this problem requires that we keep in mind how the parameter of common interest is calculated. We will usually want to obtain a rate for each socioeconomic group such that the weighted rates sum to the rate for the total population:

$$r_i = \left( \frac{\text{Deaths in class } i \text{ during time period}}{\text{Population in class } i \text{ during time period}} \right) \times c$$

for each of K classes where each class is defined as a mutually exclusive subgroup of the total population such that

$$R = \text{rate for the total population} = \sum_{i=1}^K r_i p_i \text{ where}$$

$p_i$  = proportion ith class is of the total population:

$$\sum_{i=1}^K p_i = 1.$$

The problem which is immediately apparent even though the implications are not always realized is that a rate consists of a numerator and a denominator and that the classifications in the numerator and denominator should be identical. In forming an appropriate classification, the system must form classes which

- 1) are mutually exclusive and exhaustive of the population;
- 2) answer the question being asked;
- 3) make it possible to collect the data.

Creating mutually exclusive and exhaustive categories is a problem we always have to confront. The second and third considerations must always be faced as well, but because we are concerned here with mortality there are some extra problems which emerge. Among the socioeconomic characteristics of potential interest, some are fixed regardless of stage in the life cycle, some are stable (or at least relatively so) during adulthood, and some are subject to change over the entire life cycle. Examples of unchanging characteristics are sex, race, and ethnic group. Education and religion are characteristics that are relatively unlikely to change during adulthood, at least after age 25. Those characteristics changing throughout life clearly form the largest group, including age, marital status, size of family, living arrangements, quality of housing, employment status, labor force participation, occupation, income, assets, and residence.

From their analyses, Kitagawa and Hauser (1973) drew the conclusion that "education is probably the single most important indicator of socioeconomic status for mortality analysis." (p.179) Education was the measure they used to calculate excess deaths--the deaths which would not have occurred if the estimated age-specific death rates of white men (or women) who had completed at least one year of college had prevailed in each color-education subgroup of men (or women). It seems reasonable to infer that the usefulness of education as an indicator of socioeconomic status derives considerably from the stability of a person's educational level over adulthood.

If the characteristic of interest is one which changes over the life cycle, then the time reference is critical. For example, the question "Do mortality rates differ by income?" is deceptively simple and laden with traps for the unwary. The question must be clarified by stipulating a time frame. Specifically, we might refer to income at the time of death, but if we do so, we must be aware of the fact that two-thirds of the deaths in the United States are deaths after the 65th birthday when the majority of people are retired and probably have reduced incomes. For persons who die younger, it is possible that many such persons had to quit working because of the disability which led to death and consequently had unusually low incomes during the last year of life. Alternatively, we could be interested in maximum income earned during adulthood, or average annual income throughout adulthood. In the latter instances, it would be difficult to avoid expressing income in constant dollars. To study stress due to reduced income, the magnitude of the income reduction and the interval since it occurred would both be needed. To answer other types of questions, it might be necessary to obtain income of family during childhood, to supplement

information on family background. In addition, it may be essential to distinguish between family income and individual income, because family size and relationships also change over time, and some people never do have any individual income. The answers to such questions will dictate the kinds of data one attempts to collect, and in turn the method of data collection. Viewed from the opposite direction, the limitations of the data collection system will modify the amount and type of data which can be collected, and the analytical design as well.

#### Data Collection Systems: A Typology.

It is useful to organize our discussion of issues related to the study of socioeconomic differentials in mortality by setting up a typology of possible mechanisms for collecting data on individual socioeconomic characteristics, as follows:

Single systems: Numerator and denominator from the same source

Longitudinal

Population Registers

Prospective Studies designed for special purposes

Cross-sectional

Census of population

Interview surveys

Regular interview survey

Multiplicity survey

Dual systems: Numerator and denominator from independent sources

Longitudinal

Cross-sectional

Record Matching

Follow-back surveys

Denominator from existing system

Denominator from special questions or systems

#### Single system longitudinal.

Longitudinal systems are those in which a cohort is defined by a characteristic or characteristics common to the group (born in a certain year, living in a specified area, members of a union) and the study group so defined is observed until the event of interest, in this case death, occurs. In a cohort study some of the relevant events may or may not have occurred at the time the cohort is defined but

death will not have occurred and the investigator must wait.

In theory, longitudinal systems are by far the best means of collecting data for differential mortality analysis. Data can be recorded on a continuing basis as people age so that there are no recall problems due to forgetfulness or bias because of later events.

The major disadvantages are due to the length of time involved. If data are needed to answer a current question, setting up a longitudinal data system now will not be useful. The cost of a longitudinal system is large as a staff has to be maintained over many years and the staff will change over the years as people involved in the original plan move on. Members of the cohort may be lost to observation unless very carefully followed and, if lost, must be traced to reduce bias.

Many of these disadvantages may be overcome if it is possible to tap into an existing system and utilize the data already collected.

In some countries there is a population register for the entire population which has to be updated each time an individual moves, changes jobs, or when other specified events occur.

The United States does not maintain a comprehensive population register. There are, however, a number of special registers which people stay on continuously. The Medical Follow-up Agency makes the medical experience of the general military-veteran population available and maintains a registry of 16,000 pairs of veteran twins as a subsidiary resource. There are disease registers, of which the cancer registers are probably best known. There are categorical program registers such as the Medicare recipients. There are registers maintained by some unions and professional organizations. For the most part these have not been utilized to study socioeconomic differentials in mortality and many of them in their present form cannot be used because the socioeconomic data are not recorded. It should be possible to add at least education to the data collected and thus increase their usefulness.

Prospective studies are designed for the specific purpose of following a cohort and recording observations about its members over a long period of time. They could be extremely useful for analysis of socioeconomic differentials if they were designed for that purpose, as the data are usually very carefully collected and recorded for the study participants.

There are two methodological problems with many of the prospective surveys now underway which make it impossible to draw inferences about socioeconomic differentials for the total population at risk. The first is that they are not probability samples. Many consist solely of white males who volunteer for the study and then remain participants on a voluntary basis.

Some are restricted by the condition that the participants be healthy when the study began. The second problem is the well-known Hawthorne effect--the act of observing may change the characteristic being observed. The participants in a study usually receive some benefit from participation and the benefit is often early diagnosis or receipt of services which may affect the risk of death.

This is not to say that the prospective studies now underway are not useful or that a prospective study could not be designed to analyze socioeconomic differentials. The present studies are extremely useful for many purposes such as the study of physiological change. A study designed for socioeconomic analysis should be a probability sample of a defined population, must take into account the possible effects of observation on the participants, must have careful follow-up procedures for dropouts and analytical procedures for allowing for the dropouts, must be large enough to detect differences among the socioeconomic classes of interest, and must be well-funded over a period long enough for data collection and analysis.

#### Single system cross-sectional.

Cross-sectional studies are those in which data on the event of interest and the relevant variables all relate to the same point in time although the time reference may be extended through recall. When a single source is used to collect numerator and denominator data, the number of people who died and their characteristics must be obtained at the same time data on the population at risk is obtained. Collecting data on decedents in this fashion presents a number of methodological difficulties.

Any demographer knows that we have far better definitions of socioeconomic variables and far better data available for fertility than we do for mortality. One reason is the reality of funding; there has been far more funding for fertility research than for mortality research. A second, and more subtle reason, is that, given the paucity of information on either birth or death certificates, it is far easier to collect additional data on births than on deaths.

The usual method of collecting socioeconomic data is through a household interview census or survey. Such a survey works well for births, which are associated with family dissolution. It is possible through interviewing people in households to identify children by date of birth and collect the data of interest. In almost all cases the mother is living; in most cases the child is also. Contrast that with conducting household interviews to collect data on persons who died, say, within the year.

Two-thirds of the decedents in the United States are age 65 and over. In 1960, 4 percent of the population age 65 and over were residents of institutions, and 22 percent lived either



alone or with non-relatives. If there were no differential in death rates by living arrangements, that is, if death rates for people not living in families were the same as rates for people living in families, 22 percent of the elderly decedents would be missed on a census because there would be no surviving family member in the household to report for them and an additional 4 percent would be missed on an interview survey which did not cover residents of institutions.

However, death rates are not the same for elderly people in each type of living arrangement. In 1962-3, 23 percent of the elderly decedents were residents of institutions. Thirteen percent lived alone, and 4 percent lived with non-relatives. A question on the census would have missed 13-17 percent of the elderly decedents and a household survey would have missed 41 percent. Any analysis of death rates by socioeconomic status would be biased to the extent that socioeconomic status was associated with living arrangements. And that association does exist; people living alone or with non-relatives are poorer and less educated than those in families.

Among younger adults, the proportions living alone or in institutions are much lower but the differential death rates by living arrangement still exist. An additional problem is that when death occurs a household sometimes breaks up and reforms. The surviving member(s) move(s) in with someone else. There is no one in the original household left to interview. We do not have data on the extent of household reformation.

If a child dies, the household usually remains and data could be collected. Since deaths of children are rare events, the number of interviews required to yield a sufficient number of deaths for reliable estimates would be very large with consequent high cost.

One point that has been touched on needs to be stated explicitly. Age is important when considering the data needed and the best method of collecting it. Children are almost always living in families and their socioeconomic characteristics are those of the family. Adults under age 65 are usually living in families and the socioeconomic data of interest may be individual or family characteristics. Adults age 65 and over frequently are not living in families, the socioeconomic data of interest may be individual or family and may be current or from some time when they were eligible for employment, and household surveys do not include residents of institutions.

It is a shame that the household interview survey is not useful, as response rates for the continuing national surveys remain at approximately 95 percent. The effective ongoing data collection systems exist, but the disintegration of household of decedents and the fact that death is a rare event--on a population basis--preclude using this mechanism to collect data

for the analysis of socioeconomic differentials in mortality.

A relatively new development in interview surveys is the multiplicity survey in which household respondents are asked to report not only for their own household members but also for a specified set of relatives (Sirken and Royston, 1970, 1973).

The advantages of a multiplicity survey are:

- A. Smaller sampling errors than conventional survey;
- B. Reduced response bias for decedents who lived alone at time of death, as a surviving relative in another household can report for them;
- C. Can include institutional decedents.

The disadvantages of a multiplicity survey are:

- A. Interviewer must collect the additional items;
- B. Estimation and weighting procedures require carefully defined information;
  1. Household weight requires knowledge of the number of households containing persons eligible to report the death.
  2. Person weight requires knowledge of (a) the total number of persons eligible to report the death, and (b) the number of eligible persons living with the respondent. This is easier to collect because no knowledge is required of the location of other eligible persons.

No research has been done yet on whether the multiplicity approach will be useful for collecting socioeconomic data. Research to date has focused on how well the death itself has been reported and the basic demographic data.

#### Dual system longitudinal

It is possible to ascertain the fact of death from an independent source, usually the death certificate, and match that record with the records from a longitudinal data system or with record collected at some time in the past. This has in fact been done in epidemiological studies and has been especially useful in determining whether exposure to environmental conditions results in increased death risks.

Determining whether death has occurred and, if so, where (so that the death certificate can be located) is difficult and tedious. This has led to proposals for a National Death Index--a computerized register of all deaths occurring each year in the United States which could be used to ascertain whether an individual has died and in what State. Such a system would have all the problems inherent in any matching study but could greatly expand the potential