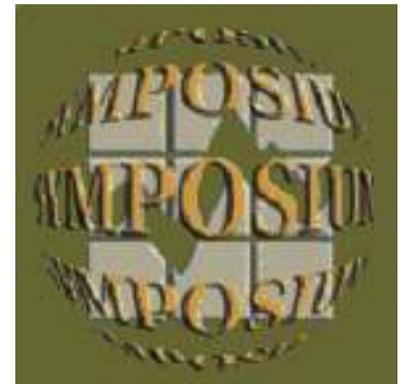


Catalogue no. 11-522-XIE

**Statistics Canada International
Symposium Series - Proceedings**

**Symposium 2006 :
Methodological Issues in
Measuring Population Health**



2006



**Statistics
Canada**

**Statistique
Canada**

Canada

Measuring Health in Population Surveys

Graham Kalton¹

Abstract

Many countries conduct surveys that focus specifically on their population's health. Because health plays a key role in most aspects of life, health data are also often collected in population surveys on other topics. The subject matter of population health surveys broadly encompasses physical and mental health, dental health, disabilities, substance abuse, health risk factors, nutrition, health promotion, health care utilization and quality, health coverage, and costs. Some surveys focus on specific health conditions, whereas others aim to obtain an overall health assessment. Health is often an important component in longitudinal studies, particularly in birth and aging cohorts. Information about health can be collected by respondents' reports (for themselves and sometimes for others), by medical examinations, and by collecting biological measures. There is a serious concern about the accuracy of health information collected by respondents' reports. Logistical issues, cost considerations, and respondent cooperation feature prominently when the information is collected by medical examinations. Ethical and privacy issues are often important, particularly when DNA and biomarkers are involved. International comparability of health measures is of growing importance. This paper reviews the methodology for a range of health surveys and will discuss the challenges in obtaining accurate data in this field.

KEY WORDS: Health measurement scales; Biomarkers; Longitudinal surveys; Medical examinations; Disability; Mental health.

1. Introduction

It is not surprising that health, which is such a major feature of a person's well-being, has been an important topic for survey research from the earliest days of the development of the discipline. As Suchman (1967), Cartwright (1983), and Aday (1996) have noted, there are many different topics for health surveys, such as the health status and health behaviours of the population; characteristics of the health care system; utilization of, and satisfaction with, the health care services; and costs of health care. Survey methods are also used with population-based case-control studies (Kalton and Piesse, 2007), but such studies are not reviewed here; Scott discusses the analysis of population-based case-control studies elsewhere in these proceedings (see also Scott, 2006). This paper focuses only on surveys relating to the health status and health behaviours of the general population. It excludes the many surveys of health care providers and their patients, such as the National Hospital Discharge Survey, the National Ambulatory Medical Care Survey, and the National Nursing Home Survey conducted by the U.S. National Center for Health Statistics (2007a). It also largely excludes population surveys of experiences with the health care system, such as the Medical Expenditure Panel Survey (MEPS) conducted by the U.S. Agency for Healthcare Research and Quality (2006).

Even after narrowing the paper's focus to population-based surveys of health status, health behaviours, and risk factors, there remains a broad range of subject matter. Some population health surveys assess general health status and behaviours based on respondents' reports; some conduct medical examinations; and some study specific health conditions and behaviours. Furthermore, in recent years health has attracted increased attention in surveys dealing with the social and economic conditions of the population. The range of topics covered by such surveys includes physical health, mental health, disabilities, dental health, immunizations, substance abuse, nutrition, and health behaviours (such as smoking, drinking, and exercise). Many health surveys are designed to measure the prevalence and distribution of specified health conditions in the population. Some are carried out to evaluate the effects of an intervention, such as an intervention that encourages teenagers to exercise or one that encourages them to avoid taking drugs (Kalton and Piesse, 2007). Collecting survey data on the population's health has its challenges, and there is a substantial literature on various aspects of the methodology of health surveys. The proceedings of the nine Conferences on Health Survey Research Methods convened by U.S. Federal agencies involved with health surveys

¹Graham Kalton, Westat, 1650 Research Blvd., Rockville, Maryland 20850, USA (grahamkalton@westat.com).

indicate the range of topics that has been researched (see U.S. National Center for Health Statistics, 2001 and 2004, for the proceedings of the seventh and eighth conferences). The series of reports on Data Evaluation and Methods Research published by the U.S. National Center for Health Statistics (2007b) is another valuable source.

A common concern with health surveys is that the conditions under study are often rare and they may relate only to a small proportion of the overall population. In addition, they may be sensitive conditions that the respondent is reluctant to report. For example, disabilities and severe pain are rare and are mainly concentrated in the older population. Child and elder abuse, HIV/AIDS, and sexual dysfunction are all sensitive subjects. Cognitive impairment is difficult to measure because, among other considerations, severely cognitively impaired persons are not competent to give informed consent for survey data collection.

Another concern in some areas of study is that, because most population health surveys are conducted with the household population, they may fail to cover sizable proportions of persons with certain conditions who are in institutions or are homeless. Thus, for example, to address this concern, the Washington D.C. Metropolitan Area Drug Study (DC*MADS) included samples of persons in institutions and of the homeless (Bray, 1998). As another example, the 1996 Medical Care Expenditure Panel Survey included a Nursing Home Component that surveyed a sample of nursing homes and their residents in order to collect data on the high expenditures associated with nursing home care (U.S. Agency for Healthcare Research and Quality, 2006).

The remainder of the paper is organized as follows. Section 2 briefly reviews some general issues concerning modes for collecting health data—and also some design considerations—in general population household surveys. Section 3 contains some concluding remarks.

2. Modes of Data Collection in Health Surveys

2.1 General Health Interview Surveys

The approach of asking national samples of persons to report their general health status and conditions has a long history. In a review of the early history of such surveys, Logan and Brooke (1957) note that the Tenth Census in the United States in 1880 included a question about sickness or disability that made the person unable to pursue his or her ordinary occupation. They also note that a number of local health surveys were conducted in the United States between 1915 and 1930. In the United Kingdom, the Survey of Sickness was introduced in 1943 and continued, with monthly samples, until 1952 (Logan and Brooke, 1957). Subsequently, self-reports on health have been collected in the U.K. General Household Survey and in the Health Survey for England (HSE), with the HSE also including a visit from a nurse to take measurements and collect specimens (Sproston and Mindell, 2006). The U.S. National Health Interview Survey (NHIS) is celebrating its 50th year in operation in 2007 (U.S. National Center for Health Statistics, 2007c); the California Health Interview Survey (CHIS), a telephone survey started in 2003, covers many similar topics (UCLA Center for Health Policy Research, 2005). The first Canadian nationwide health survey was a Sickness Survey conducted in 1950. Canada now conducts the National Population Health Survey (NPHS), which is a longitudinal survey, and the Canadian Community Health Survey (CCHS) (Statistics Canada, 2005). See Kendall, Lipskie, and MacEachern (1997) for a history of Canadian health surveys.

In line with a recent development in other areas of survey research, there are now several health interview surveys that are international in scope. The World Health Organization's World Health Survey on general health has been conducted in 70 countries (see the paper by Chatterji in these proceedings). The Demographic and Health Surveys supported primarily by USAID (MEASURE DHS, 2006) and UNICEF's Multiple Indicator Cluster Surveys (UNICEF, 2006) focus on maternal and child health. The Health and Retirement Survey in the U.S. (Institute for Social Research, University of Michigan, 2007a), the English Longitudinal Study of Ageing (Institute for Fiscal Studies, 2007), the Study on Health and Retirement in Europe (SHARE, 2007), and the WHO's Study on Global Ageing and Health (SAGE) (World Health Organization, 2006) are linked longitudinal surveys of the health and life experiences of older people. Recently Statistics Canada and the National Center for Health Statistics collaborated in conducting the Joint Canada/United States Survey of Health, using telephone data collection, to provide comparable data on the health of adults in the two countries (U.S. National Center for Health Statistics, 2007d).

Another recent development in survey research that also applies to health surveys is the demand for estimates for small areas. As a case in point, the CCHS is designed to produce estimates for 136 health regions based on a sample of around 160,000 respondents over 2 years, with data collected by a combination of face-to-face and telephone interviews. In the United States, state health departments manage the data collection for the Behavioral Risk Factor Surveillance System (BRFSS), a survey system that collects data on preventive health practice and risk behaviours mainly by telephone interviewing (U.S. National Center for Chronic Disease Prevention and Health Promotion, 2006). Estimates are produced for states, counties, and metropolitan and micropolitan statistical areas. The lower costs associated with telephone surveys make this mode of data collection attractive for large-scale health surveys that aim to produce design-based small area estimates.

The early Survey of Sickness in England and Wales took as its definition of illness that “a person is ill if he feels ill” with a reference period of the past 2 or 3 calendar months. Proxy interviews were allowed if the respondent was not contacted in the first three calls. Issues of reliance on respondents’ reports and recall errors were well recognized, but it was felt that some information was better than none (Logan and Brooke, 1957). Although many methodological advances have occurred in health surveys since the 1950s, the quality of respondents’ reports on their health and the health of others remains a key concern.

An important issue in interpreting respondents’ reports of health conditions is one of severity. Seeking medical attention for a condition provides one indicator of severity as well as potentially producing a medical diagnosis. Reports of doctors’ diagnoses play an important role in health interview surveys. The following questions taken from the HSE illustrate a common approach:

Have you ever had angina? (Yes/No)

You said you had angina. Were you told by a doctor that you had angina? (Yes/No)

Approximately how old were you when you were first told by a doctor that you had angina? (Age in years)

Have you had angina during the past 12 months? (Yes/No)

A number of conditions need to be satisfied if the answers to such questions are to yield an accurate estimate of the prevalence of angina in the population: a person with angina needs to consult a doctor about his or her condition; the doctor has to diagnose the condition; the doctor has to inform the person that he or she has angina; the person has to understand the doctor; the person has to recall the condition at the time of interview; the person has to accurately determine whether he or she had angina in the 12-month reference period; and the person has to be willing to report the condition to the interviewer. There are a number of reasons why one or more of these conditions may not be met for some health conditions (Kalton, 1972). For example, people differ in their reactions to their illnesses: some routinely seek medical attention whereas others are reluctant to do so. These differences are associated with the availability and costs of health care. As a result, analyses based only on medically treated conditions can be misleading in some cases (see, for example, Waters, 1971, on the association between migraine and social class). Some conditions often go undiagnosed (e.g., diabetes). Patients may not understand the doctor’s description of the diagnosis of some conditions. The problems of recall error and telescoping effects are well-known and some people may not be willing to report sensitive or embarrassing conditions.

In the early days of the NHIS, information was collected for every member of a sampled household, using an adult proxy informant if a person was absent when the interviewer called. This scheme was cost-efficient, but a number of studies demonstrated that proxy informants report less illness than persons report for themselves. In 1997 the NHIS changed to sampling one adult and one child (if the household has at least one child) in a sampled household. Other national health interview surveys have also mostly adopted this kind of practice. Data collection from proxy informants may still sometimes be allowed when a sampled person cannot be contacted—and also for young children—but self-reports are sought whenever possible.

To supplement respondents’ reports on health status, additional measurements are now often being included in surveys collecting data on health. The HSE data collection includes a visit by a nurse to take height, weight, and collect blood pressure measurements and to collect blood and saliva samples. For further discussion, see Section 2.4.

2.2 Health Examination Surveys

The reliance on respondents' potentially inaccurate reports of their health conditions can be avoided by including clinical examinations as part of a health survey's data collection process. Examples include the longstanding U.S. National Health and Nutrition Examination Survey (NHANES), the recently introduced Canadian Health Measures Survey (CHMS), and Health 2000 in Finland, all of which are described elsewhere in these proceedings. See Aromaa et al. (2003) for health examination surveys, of varying levels of detail, conducted in other European countries.

The NHANES and CHMS include comprehensive assessments of the health of sampled persons. Both surveys collect some data in household interviews, which are then followed up by medical examinations carried out in mobile medical examination centers (MECs) that travel from one sampled primary sampling unit (PSU) to the next. For details, see the papers by Johnson and Tremblay in this volume. The largest deterrent to conducting such surveys is their high cost, not only for data collection but also for laboratory processing of the specimens collected. These surveys impose a heavy burden on respondents: it takes a good deal of time for them to travel to and from the MEC and to go through the medical examination. Some compensation for their efforts is appropriate.

The conduct of the medical examinations in MECs exerts a strong influence on the sample design. First, compact clustering is needed so that all the sampled members in a sampled cluster can readily travel to the MEC. Second, the logistics dictate that the mobile MECs should stay in each sampled PSU for an extended period. This restriction leads to a requirement of a large number of sampled persons in each PSU. In comparison with other surveys, such a design may appear inefficient, but the operational issues dominate. Also, the analyses of health examination data are typically conducted by demographic subdomains, with much smaller subgroup sample sizes per PSU. See the papers by Giroux and by Mohadjer and Curtin in these proceedings for further details of the CHMS and NHANES sample designs.

A final point to be noted about health examination surveys is that the physical measurements taken should not be uncritically treated as "true values" in contrast to the potentially inaccurate respondents' reports. As Johnson notes in his paper on NHANES, as with interview data, much care is needed to ensure that a standardized approach is taken to both collecting and analyzing physical data.

2.3 Health Measurement Scales

A considerable amount of research has been conducted to develop measurement scales for various dimensions of health, many of which can be applied—in full or abbreviated form—in a survey setting. Thus, for example, McDowell and Newell (1996) review many scales along the dimensions of physical disability and handicap, social health, psychological well-being, depression, mental health status, pain measurement, and general health status and quality of life. Focused on clinical trial applications, the volume edited by Spilker (1995) reviews measures for assessing quality of life. Research is also currently underway to develop a toolbox comprising a large number of brief measures for assessing neurological and behavioural functioning.

A number of specific illnesses are defined by the presence of certain symptoms that are reported by the patient, which makes them well suited to measurement in surveys. For example, scales have been developed to measure such illnesses as childhood asthma, migraine, chronic bronchitis, angina, and arthritis.

Mental health measurement by means of survey questionnaires is often a major component of health surveys. Mental health and well-being were, for example, the focus of the CCMS in 2002 (Statistics Canada, 2005). The U.S. National Comorbidity Survey employed a structured research interview instrument to assess mental and substance abuse disorders (Harvard School of Medicine, 2005a). That instrument is also the basis of the instrument used for the WHO's World Mental Health Survey Initiative with surveys conducted in 26 countries (Harvard School of Medicine, 2005b).

Disability is another major component of many health surveys. However, disability is hard to measure because it is multidimensional, its duration and its periodicity need to be established, it sometimes involves mental illness and cognitive impairment, and there are special difficulties in the case of children (Adler and Hendershot, 2000).

Commonly used instruments for physical disability are the Activities of Daily Living (ADLs), such as bathing, dressing, eating, and toileting, and the Instrumental Activities of Daily Living (IADLs), such as shopping, preparing meals, and using the phone. There are, however, serious concerns about the extent of measurement error in the responses obtained (e.g., proxy informants reporting more difficulties with ADLs than self-respondents). For a discussion of the conceptual and methodological issues involved in determining work disability for the U.S. Social Security Administration, see Wunderlich, Rice, and Amado (2002). See also the paper in these proceedings by McMenamin on designing disability questions for inclusion in labour force surveys.

2.4 Biomarkers

In the past few years, there has been a marked increase in interest in the collection of biomarker information in health surveys and also in other social surveys in which health is an important component. The collection of biomarker data in interview surveys makes data collection much more complex. Nurses may be needed to administer some collections, and incentives may be required to gain cooperation. Special consent forms are needed, with provisions to provide feedback when a serious health issue is identified. Also, the consent forms should indicate the tests for which specimens will be used and not used (e.g., not for the HIV virus). The book edited by Finch, Vaupel, and Kinsella (2001) provides a thorough discussion of issues involved in collecting biological measures in survey research.

The variety of biomarkers being considered for surveys is expanding. Physical measures such as height, weight, waist or hip size, and demispan for older people are often used, and improved measures may be developed for assessing obesity in an in-home setting. Blood pressures and pulse assessment are also often collected. Performance measures, such as grip strength measured with a hand dynamometer, ability to get up from a standard chair, and walking speed, can also be useful indicators for older persons. Lung function is measured in the HSE and some other studies.

Blood is frequently collected in such studies, either in the form of a simple blood spot from a finger stick or by phlebotomy. It can be tested for a wide range of analytes. While a blood spot is sufficient for some tests (glucose, haemoglobin), the collection of three or four tubes of blood permits many more tests to be carried out. Blood can also be stored for future use, but there are significant issues of informed consent that need to be addressed. A critical issue is the public acceptability of the use of blood samples, saliva samples, or cheek swabs for DNA analysis. Other specimens that are sometimes collected include hair, urine, and nail clippings. Specimens that are easily collected have a particular attraction, and some may even be collected without the need for the presence of a fieldworker. The U.S. Agricultural Health Study (2007), for example, has collected buccal cells using a mouthwash procedure by mail.

The collection of high quality biomarker data requires careful training of the fieldworkers. It may require special equipment that is difficult to transport to respondents' homes, and also complex storage and shipment procedures. Furthermore, careful quality control is needed for the laboratories analyzing the specimens. Smith, Jaszczak, and Lundeen (2007) and Sproston and Mindell (2006) describe the collection and quality control procedures used in the U.S. National Social Life, Health, and Aging Project (NSHAP) and the HSE, respectively.

2.2 Longitudinal Surveys

The value of longitudinal data on the health of individuals and factors associated with their health has been long recognized, and there have been a sizeable number of longitudinal health surveys. An early example is the National Survey of Health and Development (NSHD) that started with a birth cohort in Great Britain in 1946. Since its inception, the NSHD has collected data on many occasions about the cohort members, including a source of DNA data when they were age 53 (Wadsworth, 2004). It has also collected some data for the first born offspring of cohort members. The NSHD was followed by similar birth cohort studies in Britain in 1958 (the National Child Development Study), in 1970 (the 1970 British Cohort Study), and in 2001-03 the Millennium Cohort Study (Centre for Longitudinal Studies, University of London, 2006). These studies provide a valuable life course perspective on health and its antecedents, and comparisons between the cohorts sheds light on the effects of changing societal factors on health outcomes. In the United States, the National Children's Study (NCS), a new birth cohort study of

about 100,000 births, is under development. The NCS is a longitudinal study that starts with pregnant women early in their pregnancies, follows them through birth, and then follows their children for 21 years, with the aim of examining the effects of physical and social environmental exposures on children's health and development (NCS, 2006).

At the other end of the life course are a number of longitudinal studies that examine aspects of health and retirement for older populations, as mentioned earlier: the U.S. Health and Retirement Study (Institute for Social Research, University of Michigan, 2007a), the English Longitudinal Study of Ageing (Institute of Fiscal Studies, 2006), SHARE (2007) in Europe, and SAGE (World Health Organization, 2006). The Canadian National Population Health Survey's longitudinal component consists of a national sample of persons of all ages from 1994/1995, who are being interviewed every 2 years over 10 waves of data collection (Statistics Canada, 2005). The U.S. National Longitudinal Study of Adolescent Health (Add Health) is a school-based study that follows young people from adolescence into early adulthood (Carolina Population Center, University of North Carolina, 2004).

In addition to longitudinal surveys that have a major focus on health, health has become an increasingly important component of other longitudinal social surveys, such as the U.S. Panel Study of Income Dynamics (Institute for Social Research, University of Michigan, 2007b). Biomarker data are now being collected, or are being considered for collection, in a number of these surveys. Thus, for instance, Kumari et al. (2006) describe a set of biomarkers that they propose for collection in the planned new large-scale U.K. Longitudinal Household Study.

3. Concluding Remarks

The aim of this paper has been to give a broad overview of the current range of population health surveys and of some of the issues involved in conducting them. In view of the wide variety of such surveys, the treatment has necessarily been cursory and selective, but the references can provide sources for more detailed study.

Although the paper has tried to represent a range of different approaches, it needs to be recognized that surveys for specific health topics require their own individual methodologies. For instance, some health interview surveys require follow-back enquiries to health care providers to collect data that respondents cannot provide or cannot provide with sufficient accuracy. For example, the U.S. National Immunization Survey contacts immunization providers to check on the vaccination coverage that household respondents report for their children (U.S. National Center for Health Statistics, 2007e) and the U.S. Medical Expenditure Panel Survey contacts health care providers to ascertain the costs of the treatments that household respondents report (U.S. Agency for Healthcare Research and Quality, 2006). A number of health surveys collect information on highly sensitive topics for which special techniques are required in order to obtain accurate responses. An example is the National Survey of Drug Use and Health conducted by the U.S. Substance Abuse and Mental Health Services Administration (Research Triangle Institute, 2007). In that survey, data about illicit drug use and other sensitive topics are collected using audio computer-assisted self-interviewing (ACASI) methods, following a study that showed a tendency for ACASI to produce higher estimates of drug use, especially among 12- to 17-year-olds (U.S. Substance Abuse and Mental Health Services Administration, 2001).

Many health surveys—both interview and examination surveys—collect data on nutrition. There are also many surveys that focus primarily on nutrition. The collection of accurate and detailed nutrition data is highly complex. Often detailed data on all food and drink consumed are collected for one or two 24-hour periods. When this collection is based on respondent recall, underreporting is likely unless repeated probes are used. Respondents need to be provided with measuring guides in order to gauge the quantities of different types of food and drink they have consumed. The data collection needs to take into account that food consumption patterns vary by day of the week, and also possibly by season of the year. Organizing the data collection to get an approximately equal number of interviews across days (or certain combinations of days) adds significant complexity. Coding the nutrient information for the foods and drink consumed is a major task that requires careful quality control. See U.S. National Center for Health Statistics (2006) for the procedures used in NHANES and for further references.

In common with surveys in other areas, there is likely to be growth in health surveys of the following types: cross-national and international surveys; surveys designed to produce small area statistics that inform local policymakers;

mixed mode surveys that combine different modes of data collection to capitalize on the advantages of the various modes and to collect the survey data as economically as possible; and longitudinal health surveys. In addition there is likely to be expansion in the collection of health-related measures in other social surveys, in the collection of biomeasures and environmental exposures, and in surveys of the health and living conditions of the elderly. Since health data are widely viewed as highly sensitive, there is also likely to be a continued growth in concern about informed consent and confidentiality issues. The projected future expansion in health measurement in population surveys will be accompanied by the need for more research to address the many new methodological issues that will undoubtedly arise.

References

- Aday, L. A. (1996), *Designing and Conducting Health Surveys*, 2nd ed., San Francisco: Jossey-Bass.
- Adler, M. C., and Hendershot, G. E. (2000), "Federal Disability Surveys in the United States: Lessons and Challenges", *Proceeding of the Survey Research Methods Section, American Statistical Association*, <http://www.amstat.org/sections/srms/Proceedings/>.
- Aromaa, A., Koponen, P., Tafforeau, J., Vermeire, C., and the HIS/HES Core Group (2003), "Evaluation of Health Interview Surveys and Health Examination Surveys in the European Union", *European Journal of Public Health*, 13, pp. 67-72.
- Bray, R. M. ed. (1998), *Drug Use in Metropolitan America*, Thousand Oaks, CA: Sage Publications.
- Carolina Population Center, University of North Carolina (2004), "The National Longitudinal Study of Adolescent Health", <http://www.cpc.unc.edu/projects/addhealth/>.
- Cartwright, A. (1983), *Health Surveys in Practice and Potential: A Critical Review of Their Scope and Methods*, London: King Edward's Hospital Fund for London.
- Centre for Longitudinal Studies, University of London (2006), "Cohort Studies", <http://www.nshd.mrc.ac.uk/>.
- Finch, C. E., Vaupel, J. W., and Kinsella, K. (2001), *Cells and Surveys: Should Biological Measures be Included in Social Science Research?*, Washington, D.C.: The National Academies Press. http://books.nap.edu/openbook.php?record_id=9995.
- Harvard School of Medicine (2005a), "National Comorbidity Survey (NCS) and National Comorbidity Survey Replication (N-NCS)", <http://www.hcp.med.harvard.edu/ncs/>.
- Harvard School of Medicine (2005b), "The World Health Organization (WHO) World Mental Health Initiative Version of the Composite International Diagnostic Interview (CIDI)", <http://www.hcp.med.harvard.edu/wmhcdi/>.
- Institute for Fiscal Studies (2007), "English Longitudinal Study of Ageing", <http://www.ifs.org.uk/elsa/>.
- Institute for Social Research, University of Michigan (2007a), "The Health and Retirement Study", <http://hrsonline.isr.umich.edu/>.
- Institute for Social Research, University of Michigan (2007b), "Panel Study of Income Dynamics", <http://psidonline.isr.umich.edu/>.
- Kalton, G. (1972), "The Role of Population Surveys as a Source of Morbidity and Other Health Data", *The Statistician*, 21, pp. 301-324.

- Kalton, G., and Piesse, A. (2007), "Survey Research Methods in Evaluation and Case-Control Studies", *Statistics in Medicine*, 26, pp. 1675-1687.
- Kendall, O., Lipskie, T., and MacEachern, S. (1997), "Canadian Health Surveys, 1950-1997", *Chronic Diseases in Canada*, 18, No. 2, http://www.phac-aspc.gc.ca/publicat/cdic-mcc/18-2/b_e.html.
- Kumari, M., Wadsworth, M., Blake, M., Bynner, J., and Wagner, G.G. (2006), "Biomarkers in the Proposed U.K. Longitudinal Household Study", <http://www.longviewuk.com/pages/publications.shtml>.
- Logan, W. P. D., and Brooke, E. M. (1957), *The Survey of Sickness 1943 to 1952*, London: Her Majesty's Stationery Office.
- McDowell, I., and Newell, C. (1996), *Measuring Health: A Guide to Rating Scales and Questionnaires*, New York: Oxford University Press.
- MEASURE DHS (2006), "Demographic and Health Surveys", <http://www.measuredhs.com/aboutsurveys/dhs/>.
- NCS (2006), "The National Children's Study", <http://www.nationalchildrensstudy.gov/>.
- Research Triangle Institute (2007), "National Survey on Drug Use and Health", <https://nsduhweb.rti.org/>.
- Scott, A. (2006), "Population-Based Case Control Studies", *Survey Methodology*, 32, pp. 123-132.
- SHARE (2007), "Survey of Health, Ageing and Retirement in Europe", <http://www.share-project.org/>.
- Smith, S., Jaszczak A., and Lundeen K. (2007), "Operational Issues of Collecting Biomeasures in the Survey Context", *Proceedings of the Ninth Conference on Health Survey Research Methods*, forthcoming.
- Spilker, B. ed. (1995), *Quality of Life and Pharmacoeconomics in Clinical Trials*, 2nd ed., Philadelphia, PA: Lippincott-Raven Publishers.
- Sproston, K. and Mindell, J. eds. (2006), *Health Survey for England 2004. Volume 2 Methodology and Documentation*, Leeds: The Information Centre. <http://www.esds.ac.uk/government/hse/>.
- Statistics Canada (2005), "Population Health Surveys", <http://www.statcan.ca/english/concepts/hs/>.
- Suchman, E. A. (1967), "The Survey Method Applied to Public Health and Medicine", in C.Y. Glock (ed.) *Survey Research in the Social Sciences*, New York: Russell Sage Foundation, pp. 423-519.
- U.K. Medical Research Council (2006), "The MRC National Survey of Health and Development", <http://www.nshd.mrc.ac.uk/>.
- UCLA Center for Health Policy Research (2005), "California Health Interview Survey", <http://www.chis.ucla.edu/>.
- UNICEF (2006), "Monitoring the Situation of Children and Women", <http://www.childinfo.org/>.
- U.S. Agency for Healthcare Research and Quality (2006), "Medical Expenditure Panel Survey (MEPS)", <http://www.meps.ahrq.gov/mepsweb/>.
- U.S. Agricultural Health Study (2007), "Agricultural Health Study", <http://www.aghealth.org/>.
- U.S. National Center for Chronic Disease Prevention and Health Promotion (2006), "Behavioral Risk Factor Surveillance System: Turning Information into Health", <http://www.cdc.gov/brfss/>.

- U.S. National Center for Health Statistics (2001). *Seventh Conference on Health Survey Research Methods*, M. L. Cynamon and R. A. Kulka (eds.), Hyattsville, MD.: U.S. National Center for Health Statistics, <http://www.cdc.gov/nchs/data/conf/conf07.pdf>.
- U.S. National Center for Health Statistics. (2004). *Eighth Conference on Health Survey Research Methods*, S. B. Cohen and J. M. Lepkowski (eds.), Hyattsville, MD: U.S. National Center for Health Statistics, http://www.cdc.gov/nchs/data/misc/proceedings_hsr2004.pdf.
- U.S. National Center for Health Statistics (2006), “NHANES 2001-2002 Data Release: Dietary Interview – Individual Foods File (DRXIFF_B)”, <http://www.cdc.gov/nchs/nhanes.htm>.
- U.S. National Center for Health Statistics (2007a), “National Health Care Surveys”, <http://www.cdc.gov/nchs/nhcs.htm>.
- U.S. National Center for Health Statistics (2007b), “Series 2. Data Evaluation and Methods Research”, <http://www.cdc.gov/nchs/products/pubs/pubd/series/sr02/ser2.htm>.
- U.S. National Center for Health Statistics (2007c), “National Health Interview Survey (NHIS)”, <http://www.cdc.gov/nchs/nhis.htm>.
- U.S. National Center for Health Statistics (2007d), “The Joint Canada/United States Survey of Health (JCUSH)”, http://www.cdc.gov/nchs/about/major/nhis/jcush_mainpage.htm.
- U.S. National Center for Health Statistics (2007e), “The National Immunization Survey”, <http://www.cdc.gov/nis/>.
- U.S. Substance Abuse and Mental Health Administration (2001), “*Development of Computer-Assisted Interviewing Procedures for the National Household Survey on Drug Abuse*”, Methodological Series M-4, Rockville MD: Office of Applied Studies, SAMHSA. <http://www.oas.samhsa.gov/methods.htm>.
- Wadsworth, M. (2004), “Life Course Health Research”, in S. B. Cohen and J. M. Lepkowski (eds.), *Eighth Conference on Health Survey Research Methods*, Hyattsville, MD: U.S. National Center for Health Statistics, pp. 3-8, http://www.cdc.gov/nchs/data/misc/proceedings_hsr2004.pdf.
- Waters, W. E. (1971), “Migraine: Intelligence, Social Class and Familial Prevalence”, *British Medical Journal*, 2, pp. 77-81.
- World Health Organization (2006), “WHO Study on Global Ageing and Adult Health”, <http://www.who.int/healthinfo/systems/sage/en/>.
- Wunderlich, G., Rice, D. P., and Amado, N. L. eds. (2002), *The Dynamics of Disability: Measuring and Monitoring Disability for Social Security Programs*, Washington: National Academy of Sciences.