Canadian Health Measures Survey

Brief Overview

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ABSTRACT

The Canadian Health Measures Survey (CHMS) was developed to address important data gaps and limitations in existing health information by collecting directly measured indicators of health and wellness on a representative sample of approximately 5,000 Canadians aged 6-79 years. The CHMS includes an in-home general health interview and a subsequent clinic visit where direct physical measures of health are taken (anthropometry, spirometry, blood pressure, fitness, physical activity, oral health examination, blood and urine specimens) in mobile clinics. Reference laboratories are used to analyze biological specimens for indicators of general health, chronic disease, infectious disease and environmental biomarkers and to store biospecimens for future research. This paper provides a brief overview of the survey sampling, methodological, operational, logistical, ethical, legal and social issues and procedures related to the CHMS.

MeSH terms: Research design; population; measurements; physical fitness; health promotion; oral health

RÉSUMÉ

L'Enquête canadienne sur les mesures de la santé (ECMS) vise à éliminer d'importantes contraintes et lacunes statistiques dans l'information sanitaire actuelle en obtenant des indicateurs de la santé et du bien-être à partir de mesures concrètes auprès d'un échantillon représentatif d'environ 5 000 Canadiens âgés de 6 à 79 ans. L'ECMS comporte un entretien général sur la santé mené à domicile, suivi d'une visite dans une unité sanitaire mobile où l'on prend les mesures physiques du répondant (anthropométrie, spirométrie, pression artérielle, forme physique, activité physique, examen bucco-dentaire, prélèvements de sang et d'urine). Des laboratoires de référence déterminent ensuite, à partir des prélèvements biologiques, les indicateurs de la santé générale, des maladies chroniques, des maladies infectieuses et des biomarqueurs environnementaux et stockent les spécimens biologiques pour les besoins de la recherche future. Dans cet article, nous donnons un bref aperçu de l'échantillonnage de l'enquête et des enjeux et procédures méthodologiques, opérationnels, logistiques, éthiques, juridiques et sociaux qui s'y rapportent.

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Disclaimer: This paper represents a brief summary of five detailed background papers written on the Canadian Health Measures Survey and published in a supplemental issue of Statistics Canada's journal *Health Reports* (Statistics Canada, Catalogue 82-003) (available at www.statcan.ca/cgi-bin/downpub/freepub.cgi).

There is evidence of the need for directly measured health data as an integral part of a national health surveillance system.¹ Direct measures are the only way to gather information on many important and emerging health variables (e.g., chronic disease, environmental biomarkers, genotype). Furthermore, recent papers demonstrate systematic bias between self-report and direct measures for height, weight, and body mass index,² while the discordance between food frequency, 24-hour dietary recall and objective biomarkers of energy intake show significant variations in reporting error by sex and obesity status.³ The Canadian Health Measures Survey (CHMS) was developed by Statistics Canada in partnership with Health Canada and the Public Health Agency of Canada to address these important data gaps and limitations in existing health information by collecting directly measured indicators of health and wellness on a representative sample of Canadians. Five background papers were recently published in a supplemental issue of the Statistics Canada journal *Health Reports*, and provide detailed information on the 1) background, rationale and overview of methods,⁴ 2) survey sampling strategy,⁵ 3) operations and logistics of survey collection,⁶ 4) ethical, legal and social issues,⁷ 5) CHMS Pre-test.⁸ This brief review provides a concise synthesis of these five papers and serves as a follow-up to the earlier editorial by Tremblay.¹ The CHMS has received approval from the Health Canada Research Ethics Board.

Background paper

Data collection for the CHMS is taking place over a 24-month period (2007-2009) and is done in two steps. First, an interviewer visits the respondent's home to administer the household questionnaire. Second, respondents are asked to attend an appointment at a nearby CHMS mobile clinic where trained health professionals take physical health measurements (Table 1). Respondents are also asked to wear a physical activity monitor (accelerometer) for a week to measure their activity levels. The CHMS mobile clinic is stationed at each site for six weeks.

The information collected in the CHMS will be used to establish national baseline data for a variety of important health indicators of obesity, hypertension, cardiovas-

cular disease, nutrition, exposure to infectious diseases, and exposure to environmental contaminants. In addition, the survey will provide insight into the fitness of the nation and the extent of undiagnosed disease among Canadians.

The CHMS employed a conceptual framework (Figure 1) to assist in ensuring that a battery of measures were included that would allow for a comprehensive assessment of individual and population health. The concentric circles in Figure 1 illustrate the importance of measuring non-individual-level variables that may serve as important mediators or moderators of individual health indicators (e.g., geography, culture, climate, social inequality, workplace or school health policies, air quality, water quality, food access, local land use, green space availability, public safety (crime), traffic patterns, health care availability, population density). Although many of these variables are not being collected in the CHMS at this time, the survey was designed to accommodate both individual and non-individual-level measures of health (whether through direct measure or linkage to other data sources).

The CHMS has a detailed analytical plan that describes and organizes key analytical activities. The plan was developed to ensure that priority health information needs that led to the funding of the CHMS are met and that sufficient advance planning is done to ensure extensive utilization of CHMS data for scientific publications, research training, policy development and knowledge creation in a timely fashion.

Pre-test and dress rehearsal

A pre-test of the CHMS took place from October through December 2004 in Calgary, Alberta. The pre-test replicated the planned design for the full CHMS as closely as possible. The objectives of the pre-test were to: determine Canadians' willingness to participate in a direct health measures survey; assess the human resource and financial costs; examine response rates, processes and materials; and test planning assumptions. The pre-test consisted of a home interview followed by a series of direct physical and laboratory measures conducted in a clinic in the South Calgary Health Centre. The clinic setting was a new venue for a Statistics Canada survey and the pre-test provided valuable insight

TABLE I

List of Direct Health Measures in the CHMS*

Measure	Age Group	Sample Size
Anthropometry	All ages	5000
Standing height		
Sitting height		
Weight		
Waist circumference		
Hip circumference		
Skinfolds		
Blood pressure	All ages	5000
Resting heart rate	All ages	5000
Accelerometry (physical activity monitoring)	All ages	5000
Spirometry (lung functioning)	All ages	5000
Cardiovascular fitness (mCAFT step test)	Ages 6 to 69 years	4525
Muscular strength, endurance and flexibility		
Hand grip strength	All ages	5000
Partial curl-ups	Ages 6 to 69 years	4525
Sit and reach	Ages 6 to 69 years	4525
Oral health exam	All ages	5000
Blood sample	All ages	5000
Urine sample	All ages	5000
Storage of blood and urine	All ages	5000
Storage of DNA	Ages 20 years and older	3000

* More detailed list provided elsewhere⁴

TABLE II

CHMS Collection Sites

Region	Location
Atlantic	Moncton area, New Brunswick
Quebec	Québec City area
	Montreal area (2 sites)
	South of Mauricie area
Ontario	Oshawa area
	Toronto area (2 sites)
	St. Catherine's – Niagara area
	Kitchener-Waterloo area
	Northumberland County area
Prairies	Edmonton area, Alberta
	Red Deer area, Alberta
British Columbia	Vancouver area
	Williams Lake and Quesnel area

about its advantages and disadvantages. Based on the results of the pre-test, a mobile clinic was selected as the preferred clinic format because of the flexibility that it affords for selecting locations and enhancing accessibility, both of which can influence response rates. This is consistent with international surveys which have successfully used the mobile clinic model for their physical measures surveys.⁹

Two months before the start of the CHMS, a dress rehearsal of the survey was performed on a convenience sample of volunteers. Approximately 120 volunteers from selected age groups were tested using the full survey collection procedures and laboratory measures. The dress rehearsal provided opportunity for further staff training, simulating emergency situations and interruption procedures and making adjustments to procedures.

Sampling methodology

The CHMS targets individuals aged 6 to 79 years who live in private households.

To meet the objective of providing national baseline estimates on a variety of health indicators, the CHMS requires 5,000 respondents equally distributed by age group (6 to 11, 12 to 19, 20 to 39, 40 to 59, and 60 to 79 years) and sex.

Statistics Canada's Labour Force Survey area frame was used to select a set of collection sites in order to accommodate a reasonable travel distance for CHMS respondents to report to a centrally located clinic. A collection site is a geographic area with a population of at least 10,000 and a maximum respondent travel distance of 100 kilometres. The sites cover 96.3% of the Canadian population.⁵

Collection sites were stratified in five regions to ensure all regions in Canada were included (British Columbia (including Whitehorse, YK); Prairies (including Yellowknife, NWT); Ontario; Quebec; Atlantic provinces). A balance between logistical and cost considerations and national coverage resulted in 15 collection sites being selected.⁵ Each site collects data

Figure 1. Conceptual framework for the CHMS

Shaded circles indicate interactions among the arrows.

Examples of non-modifiable population health determinants include: age, sex, ethnicity, genotype; examples of modifiable population health determinants include: income, education, social environment, physical environment, health care system; examples of health behaviours include: physical activity, nutrition, alcohol and substance abuse, smoking status, medication use, sex behaviours, stress exposures; examples of health characteristics include functional status, immunization status, stress reactivity, body weight, cardiovascular fitness, musculoskeletal fitness, metabolic fitness; examples of health outcomes include detectable disease, health care system contact, disability.

from approximately 333 individuals for a total of 5,000 respondents (Table II lists the CHMS sites).

For each site, dwellings with known household composition based on newly collected data from the 2006 Census were stratified by age and a random sample of dwellings was selected in each stratum. Each selected dwelling is then contacted and asked to provide a list of current household members, which is used to select survey participants. Subsamples of the survey's respondents are also selected for laboratory analyses of specific environmental chemicals.

Survey operations and logistics

The logistical and operational requirements and procedures employed to collect the physical measures and biological specimens in the clinic component of the survey are complex.⁶ Mobile clinics are comprised of two 53-foot-long trailers (administrative trailer and clinic trailer) which are connected by an enclosed pedestrian walkway. The clinic team consists of a manager, health measures specialists who administer most physical measures tests (blood pressure, anthropometry, fitness testing, spirometry), laboratory technicians or technologists who perform the phlebotomy and process the biospecimens for storage and shipment to the reference laboratories, clinic

coordinators, and dentists and dental recorders. The staff travel from site to site staying in apartment-style accommodations at each location for approximately 6 weeks before relocating to the next site. Staff at Statistics Canada's headquarters in Ottawa provide logistical, operational, administrative, advisory, communications and technical support to the field staff.

Developing the laboratory component of the CHMS involved preparing procedures for collecting, processing, analyzing, storing and shipping blood and urine specimens and setting up a mobile laboratory. Except for the DNA samples, all biological samples collected in the clinic are processed (e.g., centrifuged, aliquoted) before they are shipped to the reference laboratories. The only biospecimen test conducted in the mobile clinic is the complete blood count. To detect chronic disease, infectious disease and environmental chemical exposure, the blood and urine samples are sent to three reference laboratories for analysis:

- Health Canada Laboratory, Bureau of Nutritional Sciences, Nutrition Research Division (nutrition and chronic disease markers)
- National Microbiology Laboratory (infectious disease, biorepository and DNA preparation)

- L'Institut national de santé publique du Québec (environmental biomarkers).

Ethical, legal and social issues

The ethical, legal and social issues surrounding the CHMS are arguably the most delicate and intricate elements of the survey. The CHMS is the first survey for which Statistics Canada has sought the expertise of a Research Ethics Board with informed consent being its key focus. Participation is voluntary and participants can decline to answer any specific questions or participate in any specific measure. Specific written consent is obtained for participation in the physical measures (including biospecimen collection); receiving lab results; measurement and reporting of reportable diseases; storage of biospecimens (except DNA); and storage of DNA. Assent is obtained from children in addition to consent from their parent or guardian. A detailed privacy impact assessment was completed and submitted to the Office of the Privacy Commissioner of Canada and provincial counterparts.

A biorepository oversight committee is being established to address issues related to storage and access to samples and to ensure the confidentiality and privacy of the information obtained from the biospecimens. This committee will provide

oversight, advice and direction to Statistics Canada on established protocols for accessing the biospecimens and conducting research with them, and will make recommendations for changes to the protocols. A detailed network of expert advisory committees also assists in directing the CHMS.⁷

CONCLUSION

In March 2007, Statistics Canada launched the CHMS, the most comprehensive, national direct health measures survey ever conducted in Canada.⁴ The survey will provide robust, population-representative data on many important public health indicators. These data should be available in early 2010 and will be integral for informing future public health pol-

icy in Canada. These data are limited to providing national estimates for those variables that are sufficiently common that the sample size can produce reliable estimates; however, efforts are underway to try and continue the survey, allowing an increased sample size to be accumulated.

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