

2006 Ontario Survey on the Prevalence and Control of Hypertension (ON-BP): Rationale and design of a community-based cross-sectional survey

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BACKGROUND: The presently available Canadian data, based on direct measurements of blood pressure (BP) from the Canadian Heart Health Surveys, are more than 15 years old. In view of major changes in the demographics and health status of the Ontario population, there is an urgent need to update this information. On the initiative of the Heart and Stroke Foundation of Ontario, the University of Ottawa Heart Institute, jointly with Statistics Canada, designed and implemented a population-based cross-sectional survey of hypertension in the Province of Ontario: the 2006 Ontario Survey on the Prevalence and Control of Hypertension (ON-BP). **OBJECTIVES:** To establish the prevalence of hypertension in the Ontario adult population between the ages of 20 and 79 years; to assess the awareness, current status and management of hypertension; and to gather respondent information about sex, age, physical measurements, personal health practices, socioeconomic measures, ethnicity and comorbidities. **METHODS:** The present paper describes the background history and the successive steps undertaken during the implementation of this project. **CONCLUSIONS:** The authors' experiences from the ON-BP indicate that close co-operation between research scientists, statisticians, governmental and nongovernmental organizations – in the present case, the Heart and Stroke Foundation of Ontario – is essential to conduct a successful, large-scale survey of BP distribution.

Key Words: *Epidemiology; Hypertension*

Hypertension is an important cardiovascular risk factor and a major cause of disability and death. It is also a very prevalent condition, and in North America, hypertension develops in approximately one-half of individuals older than 50 years of age (1,2). Due to its massive occurrence, hypertension is not only a clinical but also a major public health problem.

In the United States, the prevalence of hypertension declined between 1960 and 1991 (3), but the most recent United States National Health and Nutrition Examination Surveys (US NHANES) (4) reported an increase in the prevalence of hypertension. In Europe, a carefully conducted study in the Czech Republic (5) ascertained a decline in the population level of systolic and diastolic blood pressure (BP) during a 15-year period, between 1985 and 2000. In this study, a significant decline in the prevalence of hypertension from 47% to 39% was reported, as well as significant increases in the awareness of hypertension and in the number of individuals taking antihypertensive medications (5).

In Canada, similar and recent data concerning the long-term trends of population BP levels are not available. During the 1990s, Canada, and particularly Ontario, underwent a significant transformation, such as the rapid increase in the prevalence of obesity (6) and diabetes (7), as well as a change in the ethnic composition of the

L'enquête ontarienne de 2006 sur la prévalence et la maîtrise de l'hypertension (ON-BP) : La raison d'être et la conception d'une étude communautaire transversale

HISTORIQUE : Les données canadiennes disponibles, d'après des mesures directes de la tension artérielle tirées des enquêtes canadiennes sur la santé cardiovasculaire, ont plus de 15 ans. Étant donné les importants changements démographiques et relatifs à la santé de la population ontarienne, il est urgent de mettre cette information à jour. À l'instigation de la Fondation des maladies du cœur de l'Ontario, l'Institut de cardiologie de l'Université d'Ottawa, conjointement avec Statistique Canada, a conçu et implanté une enquête démographique transversale de l'hypertension dans la province de l'Ontario : l'enquête ontarienne de 2006 sur la prévalence et la maîtrise de l'hypertension (ON-BP).

OBJECTIFS : Établir la prévalence de l'hypertension au sein de la population adulte de l'Ontario de 20 à 79 ans, évaluer la sensibilisation, le statut et la prise en charge de l'hypertension et colliger de l'information au sujet du sexe, de l'âge, des mesures physiques, des pratiques de santé personnelles, des mesures socio-économiques, de l'ethnie et des comorbidités des répondants.

MÉTHODOLOGIE : Le présent article décrit l'historique et les étapes successives entreprises pendant l'implantation de ce projet.

CONCLUSIONS : L'expérience des auteurs acquise dans le cadre de l'ON-BP démontre qu'il est essentiel de compter sur une étroite collaboration entre les chercheurs, les statisticiens et les organismes gouvernementaux et non gouvernementaux, dans ce cas la Fondation des maladies du cœur de l'Ontario, pour réussir une étude à grande échelle sur la répartition de la tension artérielle.

society (8). Due to a strong correlation of obesity with elevated BP, we assume that this change would result in higher prevalence of hypertension. Another important aspect calling for more data is the proportion of diabetics with hypertension who constitute a group with particularly high risk of cardiovascular disease. A further issue requiring assessment is whether certain ethnic groups in Canada, such as Canadians with African roots, have a similarly high prevalence of hypertension to that of African-Americans in the United States. This type of information is essential to determine whether some population groups require increased attention from diagnostic and therapeutic points of view.

Detection and management of hypertension are feasible, efficacious and cost-effective interventions (9-11) that reduce the incidence of cardiovascular and cerebrovascular events (12). Meta-analyses of randomized controlled trials have shown that decreasing diastolic BP by 5 mmHg can reduce the incidence of cerebrovascular strokes by 34%, and decreasing systolic BP by 10 mmHg may prevent cerebrovascular strokes by 28% (12). The incidence of heart failure can also be reduced by approximately 50% with successful BP control.

Despite the significant benefits of treating hypertension, the level of successful control in Canada, as ascertained by surveys performed in

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the early 1990s, was very low (13,14). However, these data for Canada, based on direct observation (ie, actual measurements of BP), are more than 20 years old (13). The Canadian Heart Health Surveys (CHHS) (1986 to 1992) reported that, at that time, hypertension was present in 22% of participants (26% of men and 18% of women). In that sample, only a small percentage (16%) were treated and had their BP under satisfactory control. The majority of hypertensive individuals were either unaware of their condition or were not treated (14).

Reflecting on these findings, intensive professional and public educational campaigns were launched by the Heart and Stroke Foundations, the Canadian Hypertension Education Program, Blood Pressure Canada, and other governmental and nongovernmental organizations. Furthermore, since the 1990s, major progress in the pharmacotherapy of hypertension has taken place worldwide and in Canada (15). A substantial body of randomized controlled trial evidence accumulated on the benefits of angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers and calcium channel blockers, has significantly improved the possibilities for the clinical management of hypertensive patients (15). The new antihypertensive medications have been aggressively promoted by the industry, leading to a rapid increase in the number of prescriptions (16) and probably better BP control.

These multifaceted changes occurring during the past two decades called for an update and expansion of the 1992 CHHS. One of the most important questions that needed to be answered is how much the present levels of hypertension awareness and control in Canada have improved as a result of the above listed interventions compared with the situation in the early 1990s.

In November 2004, the Heart and Stroke Foundation of Ontario (HSFO) launched a request for proposal for the Ontario Survey on the Prevalence of High Blood Pressure and Control of Hypertension (ON-BP) in the population of Ontario. The HSFO request for proposal outlined that it was "seeking a supplier to design, run and analyze a hypertension physical measurements survey among Ontario adults". The proposed objectives of the survey were to:

- obtain accurate BP measurements among a random and representative sample of Ontario adults 20 years or older, with appropriate ethnic representation;
- use validated measurements and methodology to allow comparison with other surveys;
- capture respondent information on sex, age, physical measurements, personal health practices, socioeconomic measures, ethnicity, diagnosis and management of hypertension, and comorbidities; and
- determine the prevalence and control of hypertension in the Ontario population.

The researchers at the University of Ottawa Heart Institute (Drs Leenen and Fodor) in Ottawa, Ontario, established a partnership with the Consulting Services in Statistical and Survey Methods group at Statistics Canada. This partnership was considered to be essential to conduct a successful and reliable community-based, population-wide and cross-sectional survey in Ontario.

The finalized proposal was submitted to the HSFO in January 2005 and in March 2005, HSFO awarded funding to implement the 2006 ON-BP. From April to August 2005, a project management team was established, the survey protocol was developed in greater detail, the survey communities were identified, a listing of dwellings was completed and the sample was selected. Pilot survey sites ran from September to December 2005, and the full survey was conducted from March to October 2006.

METHODS

Survey sample and listing procedures

The Consulting Services group from Statistics Canada developed the sampling frame and listing procedures for the survey. The sampling frame was based on municipalities and dissemination areas of the 2001

census, which contained five of Ontario's seven health regions. Certain municipalities of interest, as well as dissemination areas with higher proportions of specific ethnic groups for which quality information on hypertension was dated or nonexistent, were targeted for the sampling. As a result, three minority ethnic groups, namely, black, south Asian and east Asian, were over-represented in the survey. Specifically, black individuals represented 9% of respondents versus 3% of the population, south Asian individuals represented 15% versus 5% and east Asian individuals represented 10% versus 3%. Sixteen municipalities in total were selected: Barrie, Brampton, East York, Etobicoke, Guelph, Lakeshore, Markham, Mississauga, Niagara-on-the-Lake, North York, Oshawa, Ottawa, Scarborough, Stratford, South Stormont and Sudbury. Enumerators with Statistics Canada survey experience carried out the listing of street addresses found in the selected dissemination areas of the survey communities. Once all the addresses in the dissemination areas were listed, households were randomly chosen to be included in the survey. Only one person between the ages of 20 and 79 years was chosen (most recent date of birth) per household to minimize hereditary and environmental variables as confounders.

Pilot phase and advisory group

Four municipalities served as pilot sites to test the original survey protocol, which consisted of:

- mailing out a letter of information to selected households before the telephone contact or home visit;
- using nursing nursing agency interviewers to recruit respondents;
- conducting survey clinics during the day on weekdays; and
- administering the survey questionnaire during the clinic visit.

The response rates in the pilot sites were very low, ranging from 5% to 30%. At the conclusion of the pilot phase, the protocol was modified as outlined below.

An advisory group made up of nationally recognized experts in clinical and epidemiological aspects of hypertension was also established and consulted as the pilot sites and survey progressed.

Survey protocol

From the pilot phase, it became obvious that a number of areas in the survey protocol had to be modified to optimize the response rate.

First, to convince the selected respondents to agree to participate in the study, not only an individual approach but also a community-based promotion was required. Thus, before visiting each municipality, information regarding the survey was advertised in the local media to generate awareness. Interviewers from a nursing agency (pilot phase) were replaced with Statistics Canada interviewers, given their extensive applied knowledge in interviewing techniques. Interviewers were also given an additional incentive, on top of their regular earnings, for every participant who attended the clinic. The professionally trained Statistics Canada interviewers visited the randomly selected dwellings during the day, early evening and on weekends. Potential respondents were invited to participate in the survey with a letter of information presented to them in person. Mail and phone calls were omitted. Individuals who agreed to take part completed a standardized questionnaire with the interviewer in the home. Questionnaires were administered in the home rather than at the clinic (as during the pilot phase) to make clinic visits shorter, hopefully improving attendance rate. The questionnaire captured information in relation to demographics, ethnic origin, socioeconomic factors, BP history, hypertension treatment and medication compliance, cholesterol, diabetes, smoking history, alcohol consumption, physical activity, nutrition, stress, sleep and medical history. Participants were then booked to attend a clinic visit, where a trained nurse took their BP and other physical measurements, including height, weight, and waist and hip circumferences. Clinic visits were conducted at 'ad hoc' clinics

established in conveniently accessible areas within the community. To address the low clinic attendance rate that was experienced during the pilot phase (clinics only during the day), clinic hours were extended to include evenings and weekends. Participants were compensated for their travel and/or parking expenses.

In the ON-BP survey, unlike the NHANES and CHHS, BP was measured using the fully automated BpTRU device (BpTRU Medical Devices, Canada). After a 5 min resting period, six BP readings were taken at 1 min intervals, whereby the first reading was discarded and the remaining five were averaged. The average reading was recorded as the individual's BP measurement.

By using a fully automated BP measuring instrument, a number of biases and confounders were eliminated. The 'white coat' effect was removed because BP was measured without the presence of an observer, and inter- and intraobserver error, digital preference and physician impact on BP levels were also eliminated. These pitfalls in BP measurement are well-documented (17,18). Thus, the ON-BP survey achieved a high level of accuracy in BP assessment.

In addition, in 10% of the sample, participant BP was measured using both the BpTRU device and a mercury sphygmomanometer, alternating the instrument used first. The BpTRU measurements were adjusted using a linear regression equation derived from this subsample of participants to permit comparability with other surveys' BP measurement techniques (eg, CHHS used mercury manometers) (19).

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Hypertension was defined as a mean systolic BP 140 mmHg or higher or a mean diastolic BP 90 mmHg or higher, or current treatment with antihypertensive medication.

Detailed descriptions of the survey methods, as well as the statistical analysis and results for this survey, have been published elsewhere (20).

CONCLUSIONS

In partnership with the HSFO, an epidemiological study on prevalence, awareness and treatment status of hypertension was implemented in Ontario. This was a large-scale study of BP distribution in Canada based on direct observation and using a fully automated BP measurement device.

A wealth of information was collected on the contemporary status of pharmacotherapy, adoption of nonpharmacological lifestyle strategies, socioeconomic correlations with hypertension, and differences in awareness and treatment of high BP in various ethnic population groups.

The principal findings, ie, prevalence of hypertension, awareness and treatment status of the ON-BP survey, were recently published in the *Canadian Medical Association Journal* (20). Additional papers about the profile of pharmacotherapy of hypertension and adoption of lifestyle changes conducive to hypertension control will be published in the near future.