

Prevalence of Hypertension in Québec: A Comparison of Health Administrative Data and Survey Data

This leaflet reproduces an article from the *Bulletin Épidémiologique Hebdomadaire* (BEH); Blais C, Rochette L, Hamel D. "Prévalence de l'hypertension artérielle au Québec : comparaison entre les données médico-administratives et les données d'enquêtes." Bull Epidemiol Hebd. 2013; (Hors-série): 23-9.

Introduction

Among the risk factors for cardiovascular disease, hypertension is the leading factor since 13% of deaths overall are attributed to it.¹ Given the considerable weight of this risk factor from the standpoint of public health, it is necessary that population-based studies be conducted to measure its prevalence and evolution over time. In Québec, the universal healthcare system is administered, among other things, by means of health administrative databases that are constantly being updated and can be linked. Population-based health surveys are conducted on a regular basis and provide other types of data. The data collected through the surveys can be self-reported or measured. The main objective of this study is to compare the prevalence of estimated hypertension based on three data sources: 1) linked health administrative data; 2) self-reported data from the Canadian Community Health Survey (CCHS); and 3) measured data from the Canadian Health Measures Survey (CHMS).

Methodology

Data sources

Health administrative data

The methodology used to monitor hypertension is based on the Canadian Chronic Disease Surveillance System, a collaborative network of provincial and territorial surveillance systems supported by the Public Health Agency of Canada (PHAC).² The Institut national de la santé publique du Québec (INSPQ)'s Québec Integrated Chronic Disease Surveillance System (QICDSS) is used to determine whether an individual has been diagnosed with hypertension. The QICDSS links five health administrative databases covering the period from January 1, 1996 to March 31, 2011 and is updated annually. The profile of the five health administrative databases has been described.^{3,4} To summarize, it comprises 1) the health insurance registry (FIPA); 2) the hospitalization file; 3) the death registry; 4) the fee-for-service file; and 5) the pharmaceutical services file.

Statistics Canada survey data

The Canadian Community Health Survey (CCHS)

The CCHS has been conducted annually since 2007 and seeks to collect information on the state of health, the use of services and health determinants in the Canadian population aged 12 years and over.⁵ Prior to 2007, data were collected on a biennial basis. Data on the self-reported prevalence of hypertension are available for the periods from 2000-2001 to 2011. The inhabitants of reserves and other Aboriginal populations, individuals

living in institutions, full-time members of the Canadian Armed Forces and the inhabitants of sparsely-populated regions are excluded. Data are collected by means of telephone interviews or interviews in respondents' homes.

The Canadian Health Measures Survey (CHMS)

The CHMS seeks to collect information on health through interviews conducted in participants' homes and physical measurements obtained in a mobile clinic.⁶ It covers individuals between 6 and 79 years of age living in private households in Canada. Respondents from four sites representative of the province of Québec were interviewed in each of the two cycles of the survey (2007-2009 and 2009-2011). Each respondent's blood pressure was measured on the right arm six times at one-minute intervals, in the seated position, following a five minutes rest period, according to the new CHMS protocol.⁷ An automated oscillometric device was used to make the measurements and the average of the last five is selected.^{8,9}



Definitions

Health administrative data

To be considered hypertensive, an individual aged 20 years and over had to be eligible for Québec health insurance and have: a) ≥ 2 diagnoses of hypertension recorded in the fee-for-service file within a period of 730 days, OR b) a primary or secondary diagnosis of hypertension recorded in the hospitalization file.² The following diagnostic codes were included: 401 to 405 for the 9th International Classification of Diseases (ICD-9) and I10 to I13 and I15 for ICD-10. In order to exclude cases of gestational hypertension, diagnoses of hypertension for women between 20 and 54 years of age recorded in a window of 120 days before or 180 days after any pregnancy or childbirth-related hospitalization were not considered. In such cases, the codes used were: 641 to 676 and V27 for ICD-9 and O10-O19, O21-O95, O98, O99 and Z37 in ICD-10. This definition has been validated in three Canadian provinces with a sensitivity of 73-75%, a specificity of 94-95%, and positive and negative predictive values of 81-87% and 88-92%, respectively.^{10,11}

Survey data

Participants in the CCHS were asked several questions related to hypertension but we have only retained the following question, which was present in all cycles: "Do you have high blood pressure?" (*Remember that we are interested in health problems diagnosed by a health professional that have lasted or should last six months or more.*) Roughly 1% of Quebecers do not declare their hypertension when they are taking an antihypertensive drug. This bias is therefore deemed to be negligible. As for the CHMS, hypertension is defined by an elevated average of measured systolic and diastolic blood pressure ($\geq 140/90$ mm Hg) or the notion of treatment with an antihypertensive medication in the past month (measured/medication).⁸



Statistical analyses

For the three data sources, only the population between 20 and 79 years of age in Québec is considered, excluding pregnant women. The prevalence calculated using health administrative data is obtained by dividing the total number of individuals diagnosed as hypertensive by the estimated insured Québec population. As regards the survey data, the weighted proportions of hypertensive individuals are obtained by using the survey weight calculated in order to ensure the representativeness of the population targeted. Crude prevalences are presented for each combination of age group and sex. For the total population, age-adjusted prevalences according to the direct standardization method on the age structure of the Québec population aged 20 to 79 years in 2001 are also produced to monitor changes in prevalences over time. All of the estimates are accompanied by their confidence interval (CI) to a level of 95%. When the CIs do not overlap for two estimates coming from different sources, it follows that there is a significant difference, although this test is deemed to be conservative (the real threshold is less than 5%). For survey data, chi-square tests have been conducted to compare prevalences between both sexes for a given age group. SAS® Enterprise Guide version 5.1 (Cary, NC, USA) was used to conduct the statistical analyses.

Results

Table 1 summarizes the characteristics of the three information sources used to measure the prevalence of hypertension in Québec.

Table 1 Characteristics of the three data sources for surveillance of arterial hypertension in Québec

	QICDSS	CCHS	CHMS
Type of data	Health administrative data	Survey data	Survey data
Years available	1996-1997 to 2010-2011	2000-2001 to 2011	2007-2009 to 2009-2011
Age available	All	≥ 12 years living in private households	6 to 79 years living in private households
Number of individuals insured or questioned	7,429,388 in 2000-2001 (20-79 years: 5,377,877) 7,931,533 in 2010-2011 (20-79 years: 5,824,242)	22,012 Québec respondents in 2000-2001 (20-79 years: 18,869) 12,007 Québec respondents in 2011 (20-79 years: 9,883)	1,545 Québec respondents in 2007-2009 (20-79 years: 942) 1,374 Québec respondents in 2009-2011 (20-79 years: 768)
Definition of hypertension (excluding pregnant women)	≥ 2 diagnoses in the fee-for-service file within a period of 730 days OR a diagnosis recorded in the hospitalization file	Self-reported “Do you have high blood pressure?”	Measured or self-reporting of medication: measured blood pressure ≥ 140/90 mm Hg OR use of an antihypertensive medication in the past month
Exclusion	<ul style="list-style-type: none"> • Pregnant women • Individuals living in institutions (collective households) • Non-existent or invalid health insurance number • Ineligibility of the insured party for health insurance • Health insurance card expired or returned (this exception does not apply to men 20 to 29 years of age and women 20 to 25 years of age) 	<ul style="list-style-type: none"> • Pregnant women • Individuals living in institutions (collective households) • Reserves and other Aboriginal settlements • Full-time members of the Canadian Armed Forces • Sparsely-populated regions (Nunavik and the James Bay Cree Lands) 	<ul style="list-style-type: none"> • Pregnant women • Individuals living in institutions (collective households) • Reserves and other Aboriginal settlements • Full-time members of the Canadian Armed Forces • Sparsely-populated regions (Nunavik and the James Bay Cree Lands)

QICDSS: Québec Integrated Chronic Disease Surveillance System.

CCHS: Canadian Community Health Survey.

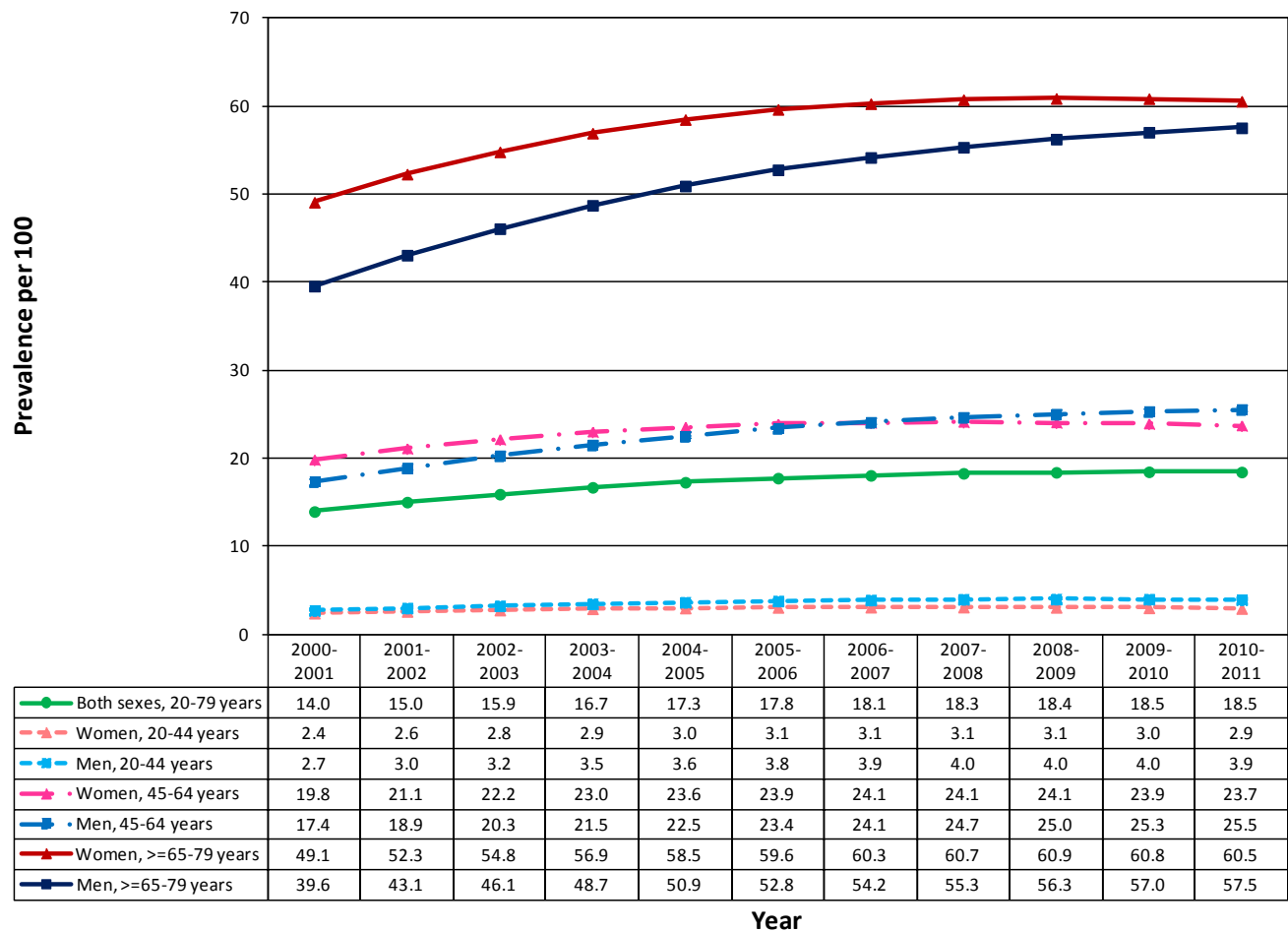
CHMS: Canadian Health Measures Survey.

 **Health administrative data**

In 2010-2011, the number of Quebecers between 20 and 79 years of age diagnosed as hypertensive stood at 1,195,207, equivalent to a crude prevalence of 20.5% [CI 95%: 20.5-20.6] and a age-adjusted prevalence of 18.5% [CI 95%: 18.4-18.5]. Figure 1 reveals that prevalence, among Quebecers 20 to 44 years of age, is always slightly higher among men than among women. Prevalence among individuals between 45 and 64 years of age is higher among

women until 2006-2007 and subsequently among men. However, in the 65 to 79 age group, prevalence is much higher among women during the entire period under study ($p < 0.05$). Accordingly, in 2010-2011, age-adjusted prevalence stood at 60.5% [CI 95%: 60.3-60.8] among women of that age and at 57.5% [CI 95%: 57.3-57.8] among men. We should also emphasize a relative increase of 32.1% in diagnosed age-adjusted hypertension between 2000-2001 and 2010-2011 ($p < 0.05$).

Figure 1 Evolution of the age-standardized* prevalence of diagnosed hypertension according to age group and sex for the population aged 20 to 79 years in Québec, 2000-2001 to 2010-2011



* Prevalence adjusted according to the age structure of the population aged 20 to 79 years in Québec in 2001.

Note: The confidence intervals for health administrative data are not presented because of their limited range.

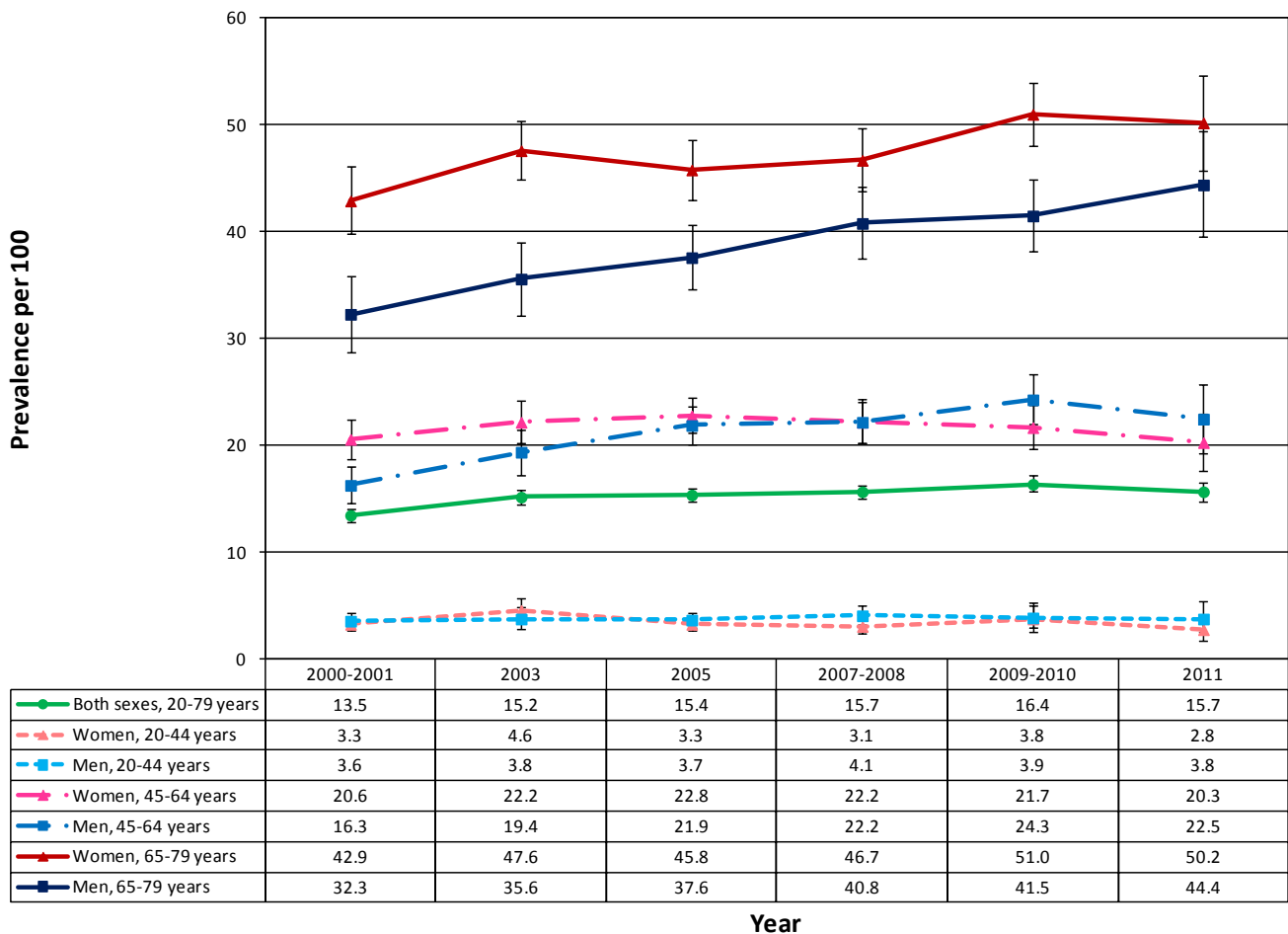
Source: Québec Integrated Chronic Disease Surveillance System (QICDSS) of the Institut national de santé publique du Québec (INSPQ).

 **Self-reported survey data**

In 2011, within the framework of the CCHS, the number of Quebecers aged 20 to 79 years who said they had been diagnosed with hypertension is estimated at 1,006,690, equivalent to a crude prevalence of 17.5% [CI 95%: 16.5-18.6] and a age-adjusted prevalence of 15.7% [CI 95%: 14.8-16.6]. Figure 2 reveals that the difference between men and women by age group is quite similar to that observed with the health administrative data throughout the period. Men and women aged 20 to 44 years appear

to display similar prevalence of hypertension. The self-reported prevalence of hypertension among women aged 45 to 64 years tends to be higher than that of men the same age until 2007-2008, after which the opposite was true. Among individuals aged 65 to 79 years, women display a higher prevalence than men except in the last year ($p = 0.0861$). As with health administrative data, there is also a relative increase of 16.3% in the self-reported age-adjusted prevalence of hypertension between 2000-2001 and 2011, ($p < 0.05$).

Figure 2 Evolution of the age-standardized* prevalence of self-reported hypertension according to age group and sex for the population aged 20 to 79 years in Québec, 2000-2001 to 2011



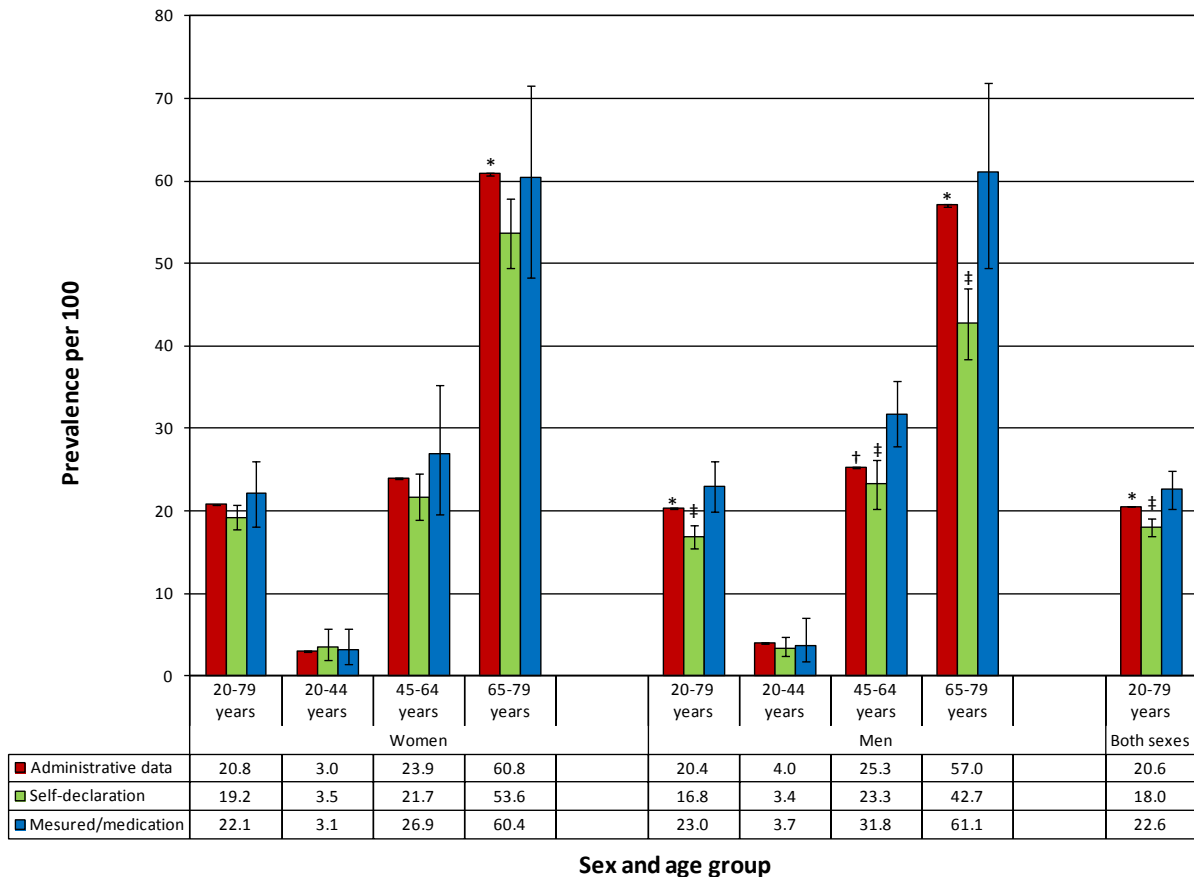
* Prevalence adjusted according to the age structure of the population aged 20 to 79 years in Québec in 2001.
 Source: Cycles 1.1 (2000-2001) to 2011 of Statistics Canada's Canadian Community Health Survey (CCHS).

Comparison of the prevalence of hypertension in 2009

The number of hypertensive Quebecers aged 20 to 79 years is estimated at 1,275,290 according to the two combined cycles of the CHMS. As Figure 3 shows, in 2009, the CHMS indicated a prevalence of hypertension of 22.6% [CI 95%: 20.3-24.8]. It is not statistically different from the prevalence calculated by means of the health administrative data, which

stands at 20.6% [CI 95%: 20.5-20.6], while the self-reported prevalence of hypertension is significantly lower, i.e., 18.0% [CI 95%: 16.9-19.1], compared with the prevalences estimated using the other two data sources ($p < 0.05$). It should be noted that the biggest difference between the data sources occurs among individuals aged 65 to 79 years and, more specifically, men, with estimates ranging from 42.7% for self-reported data to 61.1% for data that combine measurements and medication.

Figure 3 Prevalence of hypertension based on health administrative database, survey data, self-reported hypertension and blood pressure measurements/medication use, according to age and sex for the population aged 20 to 79 years in Québec, 2009



* Statistically different between the hypertension from health administrative data and hypertension from the self-reported CCHS data, $p < 0.05$.

† Statistically different between the hypertension from health administrative data and the CHMS measured/medication hypertension data, $p < 0.05$.

‡ Statistically different between the CCHS self-reported hypertension and the CHMS measured/medication hypertension, $p < 0.05$.

Source: Québec Integrated Chronic Disease Surveillance System (QICDSS) of the Institut national de santé publique du Québec (INSPQ) (health administrative data for 2009-2010), Statistics Canada's Canadian Community Health Survey (CCHS), 2009 only, and cycles 1 and 2 combined (from 2007 to 2011) of Statistics Canada's Canadian Health Measures Survey (CHMS).

Discussion

In 2009, among Quebecers aged 20 to 79 years, the prevalence of hypertension calculated by means of health administrative data is comparable to that calculated using measured survey data, while self-reported data revealed a slight underestimation. The biggest difference between the data sources is observed among individuals aged 65 to 79 years, more specifically men. According to the most recent health administrative data, hypertension was diagnosed among 1,195,207 Quebecers aged 20 to 79 years in 2010-2011 (20.5%). The prevalence of hypertension increases over time, whether it is estimated using health administrative data or the CCHS's self-reported data. Moreover, in 2009, according to these two data sources, the difference observed between men and women is especially striking among individuals aged 65 to 79 years, thus categorizing women of that age as being a group at high risk, although this is no longer true according to the CHMS's measured data.

The relatively lower self-reported prevalence of hypertension when compared with the prevalences obtained by the other two data sources is not surprising and may be explained by the fact that hypertension is often asymptomatic, and is therefore frequently unrecognized by individuals participating in surveys in which data are self-reported. In addition, certain individuals fail to declare their hypertension when it is being treated and is under control. Conversely, when the data are measured, as is the case with the CHMS, certain individuals may discover their hypertension. The increase in the prevalence of hypertension observed in this study may be partly explained by the fact that more patients are detected and diagnosed by physicians and, consequently, more people are aware of their condition. Mention should also be made of the reduction in mortality among hypertensive individuals.¹² While women aged 65 to 79 years were more hypertensive in 2009 according to the health administrative data and the self-reported data, the trend declined in the following year, partly because of better management of hypertension among men, whose prevalence reached that of women. Furthermore, it has been clearly shown that men are less aware of their hypertension, which may possibly contribute to underreporting in health administrative data and self-reported surveys in

comparison to measured survey data. Indeed, according to the CHMS measured data, more men than women display hypertension. Lastly, by way of comparison, it should be noted that the prevalence of hypertension in Québec as measured in 2009 (22.6%) was lower than that measured in France in 2006-2007 (31.0%) in the 18 to 74 age group¹³ or in the United States in 2007-2008 (30.7%) among individuals 18 years of age or over.¹⁴ One of the key explanations for the lower prevalence in Québec appears to be Canadian efforts to prevent and control hypertension. Indeed, Canada has earned a reputation as a world leader in the prevention, treatment and control of hypertension following the implementation in the mid-1990s of a strategic national plan to combat it.¹²

Limits

The prevalence of hypertension can be underestimated since individuals living in care homes or in other types of healthcare institutions are not included in the sample of the three data sources. Self-reported data from the two surveys may be subject to misunderstanding and a recall bias. In addition, the small sample of the surveys, more specifically the CHMS, generates estimates of limited accuracy and statistical tests therefore reveal less frequently significant differences, particularly in respect of comparisons between age groups and sexes. However, it would be more costly to obtain larger samples with measured data than health administrative data that are constantly updated and cover almost the entire population. In the CHMS, although blood pressure is measured six times according to a standard protocol, the measurements are made during a single visit, which differs from the clinical definition of hypertension that involves high values measured under various circumstances. The difference might possibly overestimate the prevalence of hypertension obtained by means of the CHMS. Lastly, the health administrative data are including only individuals who are in contact with the healthcare system, i.e., individuals who have consulted a physician or who have been hospitalized. Moreover, in the presence of numerous comorbidities such as diabetes, hypertension might not appear in the fee-for-service file. Since 75% of diabetics also have hypertension, this situation may be very common.¹⁵

Conclusion

The three data sources studied reveal a similar prevalence of hypertension in 2009 despite a slight underestimation of the prevalence obtained through self-reported data. This study clearly shows the increase in diagnosed or self-reported hypertension since 2000-2001, both in respect of health administrative data and survey data. Québec's health administrative data should, nonetheless, be used more extensively to monitor cardiovascular diseases such as coronary heart disease or cerebrovascular disease. Indeed, the data are accessible and are constantly updated in respect of all Quebecers, regardless of age and socioeconomic status. Moreover, the linked health administrative data make it possible to determine incidence, mortality^{2, 16, 17} and the use of medications. The results of this study are important from the standpoint of healthcare planning and public health and confirm the need to reduce the heavy burden that hypertension represents among Quebecers, especially among the elderly.

Acknowledgements

The authors wish to thank Carole Blanchet from the Institut national de santé publique du Québec, who revised the original French-language version of this article.

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AUTHORS

Claudia Blais
Louis Rochette
Denis Hamel

Bureau d'information et d'études en santé des populations

DOCUMENT REVISION (French version)

Carole Blanchet

Bureau d'information et d'études en santé des populations

PAGE LAYOUT AND LINGUISTIC REVISION

Sylvie Muller

Bureau d'information et d'études en santé des populations

TRANSLATION

The translation of this publication was made possible with funding from the Public Health Agency of Canada.

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ISSN: 1922-1762 (FRENCH PDF)
ISBN: 978-2-550-72891-7 (FRENCH PDF)
ISBN: 978-2-550-73155-9 (PDF)

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