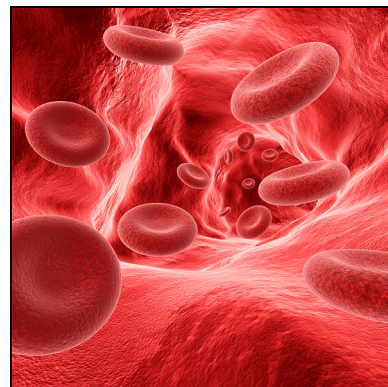


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Health Reports



Volume 23, Number 4



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- . not available for any reference period
- .. not available for specific reference period
- ... not applicable
- P preliminary
- r revised
- x suppressed to meet the confidentiality requirements of the Statistics Act
- E use with caution
- F too unreliable to be published

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Peer reviewers

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Seeking medical help to conceive

by Tracey Bushnik, Jocelynn Cook, Edward Hughes and Suzanne Tough

Released online October 17, 2012

Abstract

Background

The demand for therapies to assist conception is growing in a number of countries including Canada. This study provides estimates of the number and characteristics of couples who sought medical help for conception and identifies the interventions and/or techniques they used.

Data and methods

The data are from the Infertility Component of the 2009/2010 Canadian Community Health Survey. The analysis examines couples in which the woman was aged 18 to 44, resulting in 3,656 respondents. Percentages, means and confidence intervals were calculated. Two logistic regression models were run to estimate associations between socio-demographic characteristics and seeking medical help to conceive.

Results

About three in four couples reported having tried to become pregnant. Of these, 15% had sought medical help for conception. Among those who had sought help for conception, 68% reported tracking the menstrual cycle and ovulation; 42% reported using fertility-enhancing drugs; 19% reported using assisted reproductive techniques; and 29% reported "other" medical treatment.

Interpretation

Given the trend toward delayed childbearing, the demand for medical help to conceive may be greater in the future.

Keywords

Assisted reproductive techniques, fertility, infertility, pregnancy

Authors

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Since 1990, the percentage of married or cohabitating women in Canada who report that they intend to have a child has hovered around 92%.¹ Recent studies, however, have found that 4% to 17% of couples in industrialized countries experience an involuntary absence of conception lasting at least 12 months.^{2,3} In Canada, the prevalence of past-12-month infertility rose from 5% in 1984 to a range of 12% to 16% in 2009/2010.⁴

Although not every couple with problems conceiving seeks medical help,⁵ the demand for therapies is growing. Data in the Canadian Assisted Reproduction Technologies Register (CARTR) on the use of assisted reproductive techniques (ART) show a steady increase in the number of procedures performed between 1999 and 2008.⁶ Similar increases have been observed in Australia and New Zealand,⁷ the United States,⁸ and Europe.⁹

CARTR contains information about the per-cycle outcomes of specific types of ART, but information about ART at the patient level is limited. As well, other methods employed to improve the chances of conception, such as fertility-enhancing drugs are not included in CARTR.

The purpose of this analysis was to determine the number and characteristics of couples who seek medical help for conception, and to identify the medical

interventions and/or techniques they used. Based on data from the Infertility Component of the 2009/2010 Canadian Community Health Survey, this study estimated the prevalence of help-seeking among couples trying to get pregnant. The association between seeking help and the couples' socio-demographic characteristics was examined, as were the methods they used to try to achieve pregnancy.

Methods

Data source

The data are from the Infertility (IFT) Component of the 2009/2010 Canadian Community Health Survey (CCHS) conducted by Statistics Canada. The target population of the IFT Component consisted of opposite-sex couples in the 10 provinces, with a female spouse or partner aged 18 to 49, who were living

together in the same household. The CCHS was not administered to full-time members of the Canadian Forces or to residents of the three territories, Indian Reserves or Crown lands, institutions, and certain remote regions.

The CCHS used a multistage stratified cluster sampling strategy.¹⁰ Data for the IFT Component were collected from September through December, 2009, and in July and August, 2010. Of the households selected during these periods, 41,501 were in-scope for the CCHS, and 33,468 agreed to participate, resulting in a CCHS household-level response rate of 80.6%. In each responding household, one person was selected to participate in the survey. Responses were obtained for 29,858 individuals, resulting in a CCHS person-level response rate of 89.2%. Among these respondents, 6,520 were eligible for the IFT Component and 5,617 completed it, for an IFT person-level response rate of 86.2%. Multiplying the CCHS household-level response rate, the CCHS person-level response rate and the IFT person-level response rate yields an estimated IFT Component response rate of 62.0%.¹¹

This study pertains to couples who had a baby while together, reported a pregnancy in the past 12 months, or responded “yes” to the question, “In the time that you and your partner have been together, have you ever tried to become pregnant?” These couples were considered to have attempted pregnancy at some point in their relationship and comprised 4,297 respondents. The analysis was limited to couples in which the woman was aged 18 to 44 at the time of interview, resulting in 3,656 respondents in the study population.

Measures

The socio-demographic characteristics examined in this study were the age group of the woman (18 to 24, 25 to 29, 30 to 34, 35 to 39, or 40 to 44) and the man (18 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44, or 45 or older), the woman’s highest level of education (less than secondary, secondary graduation, or postsecondary graduation), the couple’s

marital status (married or common-law), their parity (zero or at least one child), and their household income. To examine the potential interaction between parity and the woman’s age group, a composite measure was derived (parity 0, age 18 to 34; parity 0, age 35 to 44; parity 1+, age 18 to 34; and parity 1+, age 35 to 44). Household income quartiles (\$28,250 or less; more than \$28,250 to \$42,400; more than \$42,400 to \$60,850; and more than \$60,850) were derived using a modified version of the equivalence score method, which adjusts household income by household size.¹² This method uses a weight factor based on the “40/30” rule. For each respondent in the study population, a household weight factor was calculated based on the number of people in the household. The first household member was assigned a weight of 1; the second member, a weight of 0.4; and the third and all subsequent members, a weight of 0.3. The household weight factor was calculated as the sum of these weights. For example, the weight factor for a four-member household would be 2.0 ($1 + 0.4 + 0.3 + 0.3$). Household income was divided by the household weight factor to derive income adjusted for household size. The adjusted household incomes were grouped into quartiles (four groups, each containing one-fourth of the study population).

Definitions

Sought medical help. Couples were categorized as having sought medical help to become pregnant if they responded “yes” to the question, “In the time that you have been together, have you had any problems in conceiving a child and seen a doctor or other medical care provider about this?”

Age when most recent medical help was received. Respondents were asked the year in which they received their most recent medical help to become pregnant. This information and age at interview were used to calculate the partners’ ages when they most recently received medical help.

Methods used to become pregnant.

Respondents who sought help were asked, “While you were trying to become pregnant, did you use any of the following . . . ?” and were read a list of methods: techniques to track menstrual cycle and ovulation; fertility-enhancing drugs prescribed by a doctor; assisted reproductive techniques (ART); and other medical treatment.

Mutually exclusive categories of methods used were derived hierarchically. The categories were: ART (including other methods if reported); fertility-enhancing drugs (excluding ART); other medical treatment (excluding ART and fertility-enhancing drugs); and tracking menstrual cycle and ovulation only.

Analytical techniques

Because the variables of interest were attributes of the couple (seeking medical help, methods used to become pregnant, etc.), analyses were weighted with the couple-level survey weight rather than the person-level weight. The couple-level weight ensured that estimates were representative of the number of couples in Canada in 2009/2010 rather than the number of individuals.¹¹ The data were analyzed with SAS¹³ and SUDAAN¹⁴ software. Percentages, means and confidence intervals were calculated. Two separate logistic regression models were run to estimate the association between the study population’s socio-demographic characteristics and seeking medical help for problems conceiving. Model 1 included age group of the woman and parity as separate variables, while Model 2 included the composite measure of age group of the woman and parity. Risk ratios were estimated to compare help seeking between groups in the study population, when controlling for differences in their covariate distributions.¹⁵ Variance estimation (95% confidence intervals) and significance testing (t-test or Wald F-statistic) of differences between estimates were done using the replicate weights to account for the survey’s complex sampling design. Statistical significance was set at $p < 0.05$,

but was Bonferroni-adjusted depending on the number of comparisons.¹⁶

Results

According to data from the Infertility Component of the 2009/2010 CCHS, 77% of opposite-sex couples in Canada with a female partner aged 18 to 44 had tried to become pregnant at some point in their relationship. Among these couples, slightly more than half (55%) of the women were aged 35 to 44, and 68% of the men were older than 35 (Table 1). About 81% of these couples were married; 89% had at least one child; and 73% of the women had a postsecondary degree or diploma.

Sought medical help

Approximately 15% of these couples (around 380,000 couples) reported seeking medical help to assist conception. Couples in which the woman was aged 35 to 44 were more likely to have sought such help than were couples in which the woman was aged 25 to 29 (Figure 1). Childless couples were more likely to have sought help than were couples with at least one child. Among childless couples, those in which the woman was aged 35 to 44 were twice as likely to have sought help (63%) as were those in which the woman was younger than 35 (30%). The highest level of female educational attainment was associated with an increased prevalence of seeking medical help, compared with the lowest

level of education. Couples in the highest household income quartile had the highest prevalence of help-seeking of all income groups.

Even when controlling for other socio-demographic characteristics (excluding the man's age group) in two multivariable logistic regression models, associations between the woman's age, parity and marital status and having sought medical help to become pregnant persisted (Table 2). In Model 1, which includes the woman's age group and parity as separate variables, couples in which the woman was aged 30 to 44 were two to three times more likely to have sought help than were couples in which the woman was aged 25 to 29. Childless couples were four to five times more likely to have sought help than were couples with at least one child. Married couples were more likely to have sought help than were common-law couples. The woman's education and the couple's household income were not associated with help-seeking.

In Model 2, which includes the composite measure of parity and age group of the woman, marital status was significantly associated with seeking medical help to achieve pregnancy. Compared with couples with at least one child and in which the woman was younger than 35, childless couples, regardless of the woman's age, were significantly more likely to have sought help, as were couples with at least one child but in which the woman was aged 35 to 44. As in Model 1, the woman's education and the couple's household income were not associated with help-seeking.

Methods used

Among couples who had ever sought help for conception, 68% reported tracking the menstrual cycle and ovulation; 42% reported fertility-enhancing drugs; 19% reported assisted reproductive techniques (ART); and 29% reported "other" medical treatment. (Because couples could report more than one method, the percentages add to over 100%.)

Most (61%) couples who sought medical help reported using only

Table 1
Percentage distribution of socio-demographic characteristics of opposite-sex couples who ever attempted pregnancy, Canada excluding territories, 2009/2010

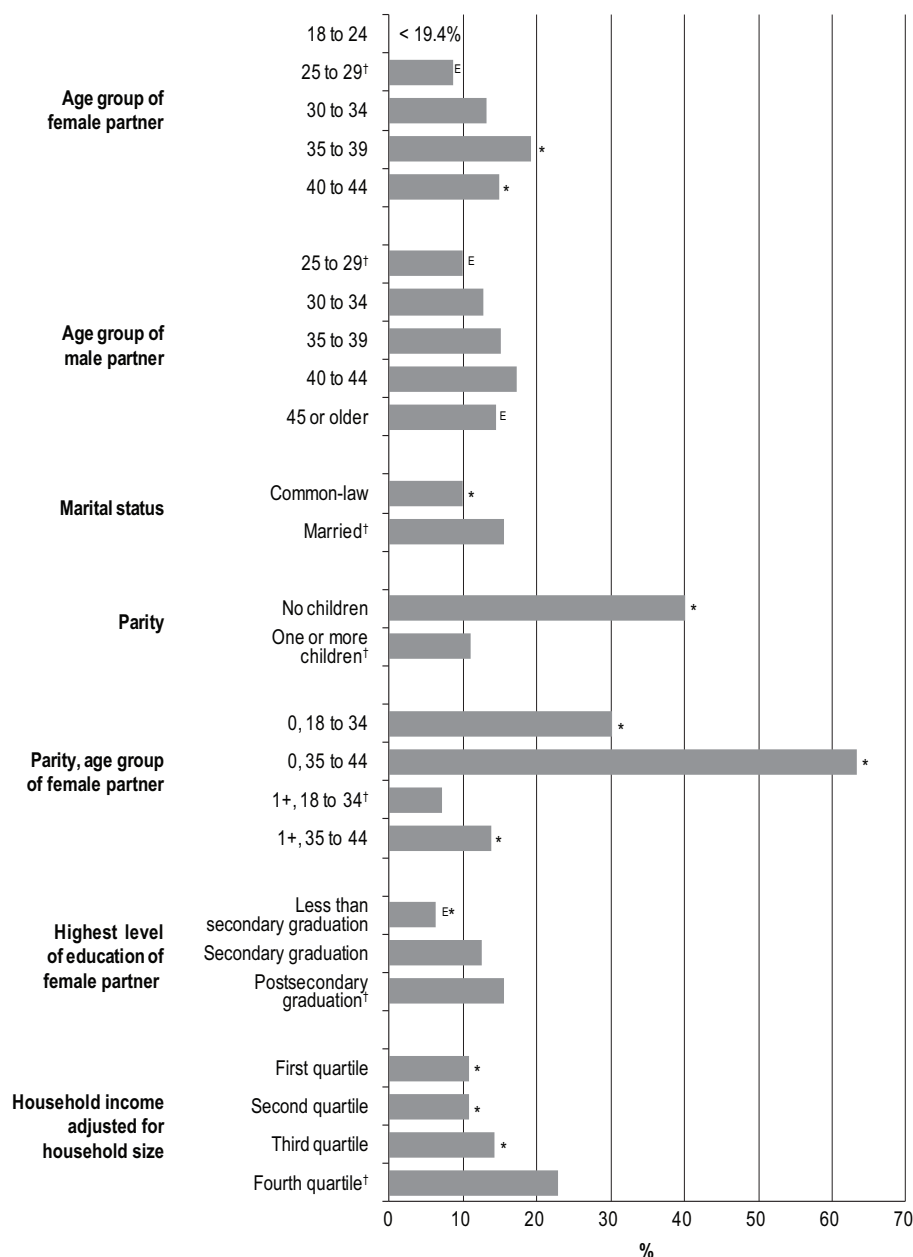
Characteristics	%	95% confidence interval	
		from	to
Age group of female partner			
18 to 24	5.2	4.5	6.0
25 to 29	14.9	13.9	16.1
30 to 34	25.0	24.0	26.1
35 to 39	27.1	26.0	28.2
40 to 44	27.7	25.9	29.7
Age group of male partner			
18 to 24	1.9	1.5	2.6
25 to 29	10.0	8.8	11.2
30 to 34	20.3	18.8	21.9
35 to 39	24.7	23.2	26.3
40 to 44	25.1	23.1	27.3
45 or older	17.9	16.0	20.0
Marital status			
Common-law	19.2	17.6	21.0
Married	80.8	79.0	82.4
Parity			
No children	11.5	10.1	13.0
One or more children	88.5	87.0	89.9
Parity, age group of female partner			
0, 18 to 34	8.1	6.9	9.4
0, 35 to 44	3.4	2.8	4.2
1+, 18 to 34	37.1	35.4	38.9
1+, 35 to 44	51.4	49.7	53.1
Highest level of education of female partner			
Less than secondary graduation	5.7	4.6	6.9
Secondary graduation	21.3	19.4	23.3
Postsecondary graduation	73.1	70.9	75.1

Source: 2009/2010 Canadian Community Health Survey, Infertility Component.

one method. Tracking ovulation was reported most frequently (50%), followed by “other” medical treatment (24%), and fertility-enhancing drugs (20%). Because of extreme sampling

variability, the point estimate for ART cannot be reported; however, the upper 95% confidence interval indicated that the percentage likely fell below 14%.

Figure 1
Prevalence of seeking medical help because of problems conceiving among opposite-sex couples who ever attempted pregnancy, by selected characteristics, Canada excluding territories, 2009/2010



† reference category

* significantly different from reference category ($p < 0.05$, adjusted for number of comparisons)

E use with caution

Note: The age group 18 to 24 was excluded from age group of male partner because of small sample sizes. Linear education trend and linear household income trend were statistically significant ($p < 0.001$). If the coefficient of variation of an estimate exceeds 33.3%, that estimate is indicated as being less than the upper limit of the 95% confidence interval.

Source: 2009/2010 Canadian Community Health Survey, Infertility Component.

More than one method was used by 39% of couples. Those who reported ART or fertility-enhancing drugs were more likely to report at least one additional method (83% and 71%, respectively) than were those who reported “other” medical treatment (48%) or tracking ovulation (55%).

The age at which couples last received medical help for conception varied by the methods they used. Among couples who reported ART, the women were, on average, 34, and the men, 37 (Figure 2). Couples who did not use ART but reported one of the other mutually exclusive method categories were younger when they had last received help: 29, on average, for the women, and 32 for the men.

Discussion

In 2009/2010, slightly more than three in four couples in Canada with a female partner aged 18 to 44 reported having tried to become pregnant at some point in their relationship. Of these, 15% (about 380,000 couples) reported seeking medical help for conception, a percentage very similar to what has been reported for Australia and the United Kingdom (14% to 16%).¹⁷⁻¹⁹

The characteristics of couples who sought medical help differed from those of couples who did not, notably, age group of the woman, parity, and marital status.

Couples in which the woman was aged 30 to 44 were more likely to seek help than were couples in which the woman was younger. This is certainly intuitive, given that older age, particularly beyond 35, is strongly associated with decreased rates of spontaneous conception and increased rates of pregnancy loss.²⁰⁻²³

While parity was associated with help-seeking regardless of the woman’s age group, the *strength* of the association increased with age. Compared with couples with at least one child and in which the woman was aged 18 to 34, the likelihood of seeking help was almost four times greater among childless couples in which the woman was aged 18 to 34, and eight times greater among

Table 2

Adjusted risk ratios of seeking medical help because of problems conceiving among opposite-sex couples who ever attempted pregnancy, by selected characteristics, Canada excluding territories, 2009/2010

Characteristics	Model 1			Model 2		
	Risk ratio	95% confidence interval		Risk ratio	95% confidence interval	
		from	to		from	to
Age group of female partner						
18 to 24	1.06	0.47	2.38	...	...	...
25 to 29 [†]	1.00	1.00	1.00	...	...	...
30 to 34	1.94*	1.12	3.37	...	...	...
35 to 39	3.37*	1.96	5.80	...	...	...
40 to 44	2.73*	1.46	5.13	...	...	...
Marital status						
Common-law	0.66*	0.47	0.92	0.62*	0.44	0.87
Married [†]	1.00	1.00	1.00	1.00	1.00	1.00
Parity						
No children	4.71*	3.66	6.05	...	...	...
One or more children [†]	1.00	1.00	1.00	...	...	...
Parity, age group of female partner						
0, 18 to 34	...	...	...	3.81*	2.67	5.41
0, 35 to 44	...	...	...	8.21*	5.84	11.52
1+, 18 to 34 [†]	1.00	1.00	1.00
1+, 35 to 44	...	...	...	1.67*	1.25	2.24
Highest level of education of female partner						
Less than secondary graduation	0.63	0.34	1.15	0.59	0.31	1.10
Secondary graduation	1.08	0.72	1.63	1.05	0.70	1.58
Postsecondary graduation [†]	1.00	1.00	1.00	1.00	1.00	1.00
Household income adjusted for household size[‡]						
First quartile	0.72	0.42	1.21	0.68	0.41	1.15
Second quartile	0.65	0.40	1.03	0.63	0.40	1.01
Third quartile	0.72	0.48	1.10	0.70	0.46	1.07
Fourth quartile [†]	1.00	1.00	1.00	1.00	1.00	1.00

[†] reference category

[‡] adjusted using 40/30 formula; those who did not provide a response (343) were grouped into a "missing" category, which was not significant and is not shown.

* significantly different from reference category ($p < 0.05$)

... not applicable

Note: A risk ratio greater than 1.0 indicates a greater risk of seeking medical help because of problems conceiving.

Source: 2009/2010 Canadian Community Health Survey, Infertility Component.

childless couples in which the woman was aged 35 to 44.

A growing number of couples in Canada are delaying childbirth. Since 1984, the percentage of first-born children whose mother is 35 or older has tripled to 11%.²⁴ Recent data suggest that many people may be unaware of the risks to fertility and childbearing associated with older female age,^{25,26} or may trust that ART will allow them to bear a child regardless of age.^{27,28}

Married couples were more likely than common-law couples to seek help to become pregnant. Because marriage is often a trigger for childbearing,²⁹ married

couples may be more likely to monitor conception and thereby recognize signs of subfecundity and seek help.³⁰

The association between higher education of the woman and couples' help-seeking did not persist when other characteristics were taken into account. While a similar result was reported in a recent study of women in the United Kingdom,³¹ a 2008 analysis of the National Survey of Family Growth in the United States found that being a college graduate was associated with an increased likelihood of seeking medical help to conceive.³² These inconsistent results suggest that more research is needed to

What is already known on this subject?

- Demand for medical therapies to help conception is growing in a number of countries, including Canada.
- Data about the use of methods to improve the chance of conception, such as assistive reproductive techniques (ART) and fertility-enhancing drugs, are limited.
- In Canada, an increasing number of couples are delaying childbirth.

What does this study add?

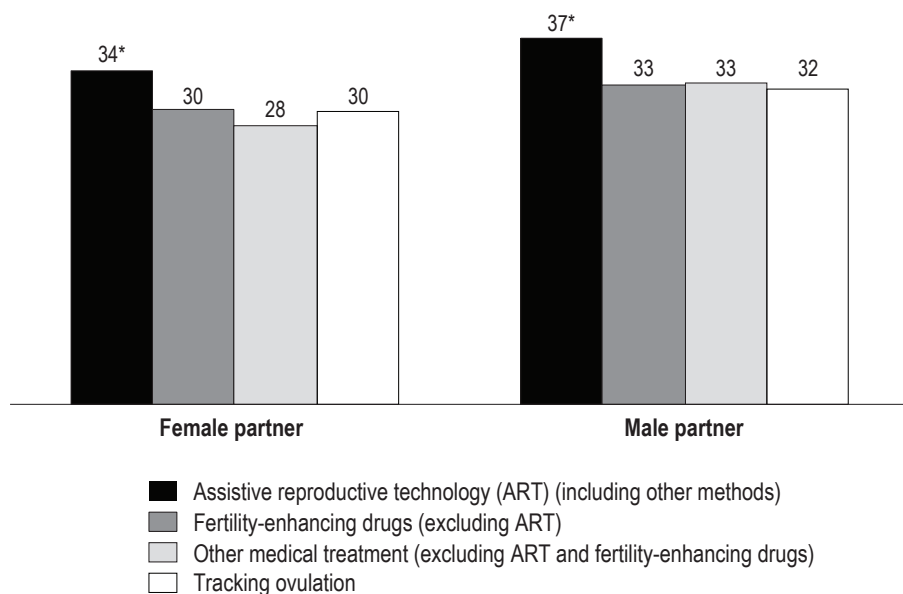
- The 2009/2010 Canadian Community Health Survey is the first national population-based survey to ask about ART use.
- In 2009/2010, slightly more than three in four couples with a female partner aged 18 to 44 reported having tried to become pregnant at some point during their relationship; of these, 15% reported seeking medical help for conception.
- Most (61%) couples who sought medical help reported using only one method.
- Those who reported using ART or fertility-enhancing drugs were more likely to report at least one additional method than were those who reported "other" medical treatment or tracking ovulation.

understand the role of education in help seeking.

Seeking medical help was most common among couples in the highest income quartile, but as with education, the association did not persist when other characteristics were taken into account. This may reflect the type of help sought and access to primary health care in Canada. Other studies have found an association between income and seeking medical help in the United States where primary care involves fees.^{32,33} By

Figure 2

Average age of female and male partner when most recent medical help was received, by mutually exclusive category of method used to try to achieve pregnancy, Canada excluding territories, 2009/2010



* significantly different from other categories within gender grouping ($p < 0.05$)

Source: 2009/2010 Canadian Community Health Survey, Infertility Component.

contrast, couples in Canada do not pay for non-specialized primary care services related to reproductive health.

About 20% of Canadian couples who sought medical help for problems conceiving used ART. Because the 2009/2010 CCHS is the first national population-based survey to ask about ART, whether this is an increase from previous periods is not known. However, the steady increase over the past 10 years in the number of ART cycles reported in the CARTR database suggests that ART use may continue to grow, particularly if provinces begin to provide coverage for the cost of treatments, as is now the case in Quebec.³⁴

Users of ART and fertility-enhancing drugs often reported another method as well. While the order in which couples tried each method was not known, it could be that they used ART and fertility-enhancing drugs after methods such as tracking the menstrual cycle and ovulation were unsuccessful. Couples who used ART were, on average, older when they

last received medical help than were couples who reported other methods. This suggests that ART represents the “top-step-of-the-staircase” approach to treatment, in which identification and correction of all fertility factors occur first, followed by increasingly invasive procedures.³⁵

Limitations

This study has a number of limitations. Because couples were asked if they *ever* had problems conceiving that had led them to consult a medical care provider, it was not possible to examine associations between problems conceiving and *current* measures of health and lifestyle. Many factors contribute to sub-fertility, including irregular ovulation,³⁶ obesity,³⁷ smoking,³⁸ and a history of gynecologic problems³⁵ among women, and sperm abnormalities³⁶ among men. Impaired thyroid function,^{39,40} exposure to environmental pollutants such as phthalates, bisphenol A and heavy metals,⁴¹ and a history of sexually

transmitted infections⁴²⁻⁴⁴ are risk factors for infertility in both sexes. These could not be examined in this study.

Because of small sample sizes, the main effects of age of the woman, parity, and the interaction between them could not be estimated in the same model. Nonetheless, the two models indicate a significant interaction between female age and parity.

Of the various methods used to become pregnant, ART and “other” medical treatment were not explicitly defined, so the exact type of ART and/or medical treatment was unknown. Similarly, because couples were not asked about the frequency and timing of their use of each method, a complete history could not be established. Sample sizes were too small to examine how the use of the various methods differed by the characteristics of the couples. Finally, it was not possible to determine if the methods used resulted in a pregnancy or birth, as these questions were not asked on the survey.

Conclusion

About one in seven couples who attempted pregnancy sought medical help for conception. These couples share certain characteristics including being married, being childless, and having a female partner aged 35 or older. Among couples seeking help, about two in five reported using fertility-enhancing drugs and one in five reported using ART. Given the trend toward delayed childbearing and the presence of risk factors for infertility, the demand for medical help to conceive may be even greater in the future. ■

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The physical and mental health of Inuit children of teenage mothers

by Anne Guèvremont and Dafna Kohen

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Abstract

Background

The physical and mental health of children of teenage mothers differs from that of children of older mothers. Compared with the overall population of Canada, Inuit experience first-time pregnancy earlier. However, little population-based research has examined health outcomes for Inuit children of women who began childbearing in their teens.

Data and methods

This study uses data from the 2006 Aboriginal Children's Survey to compare physical and mental health outcomes of 2- to 5-year-old Inuit children of teenage and older mothers.

Results

The physical and mental health outcomes of Inuit children differed depending on whether their mother had been a teenager or aged 25 or older when she began childbearing. Although some differences were explained by socio-economic factors, others, namely, ear infections, dental problems and hyperactivity/inattention, were not.

Interpretation

Further research is needed to determine what underlies differences in the mental and physical health of Inuit children of teenage and older mothers.

Keywords

Aboriginal, child behaviour, child rearing, maternal age, parenting, socio-economic factors

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The demographic characteristics of Inuit youth in Canada differ from those of non-Inuit youth. Children aged 0 to 4 make up a larger percentage of the Inuit population (12%) than they do of the non-Aboriginal population (5%).¹ At ages 15 to 19, the fertility rate of Inuit females substantially exceeds national rates. In 2009, 20% of births in Nunavut (where 85% of the population self-identified as Inuit in 2006) were to 15- to 19-year-olds, compared with 4% of births in Canada overall.²

Few studies have focused specifically on Inuit children of teenage mothers. Archibald³ interviewed 53 Inuit women and youth on their views of adolescent pregnancy. While respondents acknowledged the cultural and social importance of children in Inuit society, they also recognized that the circumstances of Inuit women who have children at an early age can be challenging.³ In a study based on census data, Garner, Sénécal, and Guimond⁴ found that Inuit women who first gave birth when they were teenagers had lower family income and were more likely to live in homes that were overcrowded and in need of major repairs, compared with Inuit women who began childbearing at older ages.

Canadian and American research has found that children of teenage mothers in general tend to have less favourable health and behavioural outcomes than do children of older mothers.⁵⁻⁸ However, children of teenage mothers are also more likely to live in low-income and lone-parent families, and to have mothers who are not secondary school graduates.⁹⁻¹¹ Some studies have found that when these factors are taken into account, the differences between the outcomes of children of teenage and older mothers are not significantly different.^{12,13}

For Inuit children, however, having a teenage mother might not be associated with negative health outcomes. In Inuit communities, teenage pregnancy may be perceived differently than it is in non-Inuit communities.^{14,15}

Examining the health of Inuit children is important because, compared with children in Canada overall, they have been shown to be at a risk for a range of physical health conditions, such as ear infections,¹⁶ respiratory infections,¹⁶ and dental problems.¹⁷ Less research has pertained to their mental health, particularly in the preschool years.

During the preschool period, the foundations are laid for emotional well-being and social skills.^{18,19} Children who show a disadvantage in behavioural outcomes at this time may be at risk for future behaviour problems and poor social skills, peer relations, school adjustment, and academic achievement.²⁰⁻²⁵

Based on the results of the 2006 Aboriginal Children's Survey (ACS),²⁶ this study compares physical health and behavioural outcomes for 2- to 5-year-old Inuit children of teenage (began childbearing at ages 12 to 19) and older (began childbearing at age 25 or older) mothers. Because teenage mothers (and their children) are more likely to live in disadvantaged socio-economic circumstances,⁴ it is important to consider the role of these conditions in the association between maternal age at first birth and child outcomes.^{7,27} Such information makes it possible to determine whether differences in socio-economic conditions explain differences in physical and mental health between Inuit children of teenage and older mothers.

Methods

Data source

The 2006 Aboriginal Children's Survey (ACS)²⁶ collected information on the early development of Aboriginal children and the socio-economic conditions in which they are growing and learning. The ACS provides extensive data about Inuit, Métis, and off-reserve First Nations children younger than age 6 in urban, rural, and northern areas across Canada.

This study focuses on 2- to 5-year-olds, because ACS data on behavioural outcomes are available only for children

aged 2 or older. Inuit children were identified for this analysis based on the question, "Is _____ an Aboriginal person, that is, North American Indian, Métis, or Inuk?" If the parent reported that the child was Inuk (responding Inuk only, or Inuk and another Aboriginal identity), the child was included in this study. Four out of five mothers (83%) of 2- to 5-year-old Inuk children self-identified as Inuk. Close to nine in ten (86%) Inuit children of teenage mothers had mothers who reported Inuit identity, compared with 66% of children of mothers who started childbearing at age 25 or older. Exploratory analyses excluding Inuit children with non-Inuit mothers yielded similar results (available from authors upon request).

Inuit children were included in the study only if the person who responded to the ACS was their birth mother, which was true for 61% of Inuit 2- to 5-year-olds. Children were excluded if the respondent was not their birth mother, because the age of the child's mother (and whether she had given birth as a teenager) was unknown. Of the 39% of cases that were not included, the respondent was the birth father (17%), an adoptive parent (12%), a grandparent (4%), or other family member or non-family person (5%). The sample used for this analysis consisted of 774 Inuit children aged 2 to 5, weighted to represent a population of 3,211.

Compared with Inuit children excluded from this study, those who were included were less likely to have ACS respondents with more than secondary graduation (20% versus 27%) and who were aged 25 or older (74% versus 93%), and more likely to be in households in the lowest income quartile (27% versus 20%) and in lone-parent families (29% versus 19%).

The likelihood of living in Inuit Nunangat did not differ between children who were included or excluded. The 2006 Census counted about 7,000 Inuit children younger than age 6, 84% of whom lived in one of four regions that comprise Inuit Nunangat, which means "Inuit homeland" in the Inuit language. These regions are Nunatsiavut in

northern Labrador, Nunavik in northern Quebec, the territory of Nunavut, and the Inuvialuit region in the Northwest Territories.

Age of mother at first birth

The age of the child's mother when she began childbearing was calculated as the difference between her current age and the age of the oldest sibling living in the household (or the age of the survey child if he/she was the oldest). If the difference was less than 20 years, she was considered a teenage mother.^{4,8} If the difference was greater than or equal to 25 years, she was considered an "older" mother. If the difference was less than 12 years, the child was excluded from this study. Results for mothers who were aged 20 to 24 when they had their first child are also shown in the tables, but are not discussed in the text.

The age of the mother when she started having children does not reflect her age at the time of the ACS. About half of the children (51%) in the study with mothers who began childbearing as teenagers had mothers who were aged 25 or older at the time of the ACS interview. The age of the mother when she began having children, rather than her age when she gave birth to the survey child, was used for this study because factors that led her to begin childbearing during adolescence and the experience of motherhood as a teenager, would likely influence children who were born later.^{28,29}

Physical health

Four measures of the child's physical health, based on maternal report, were examined: 1) excellent/very good versus good/fair/ poor health; 2) presence of a chronic condition (asthma, chronic bronchitis, tuberculosis, diabetes, hypoglycemia, heart disease, kidney disease, epilepsy, cerebral palsy, Down's Syndrome, spina bifida, attention deficit/hyperactivity disorder, anxiety/depression, fetal alcohol spectrum disorder, autism, hearing impairment, visual impairment, speech or language difficulties, iron deficiency anaemia, any other long term condition or disease); 3) ever

had an ear infection; and 4) ever had dental problems. The ACS sample was too small for the presence of multiple conditions to be examined.

Mental health

Children's behaviours and relationships were assessed in the ACS with the Goodman Strengths and Difficulties Questionnaire (SDQ), a parent-reported instrument consisting of 25 items grouped into five subscales.

The questionnaire and its subscales have been validated for use with First Nations living off reserve, Métis, and Inuit children in the ACS; four of the five subscales are valid for Inuit children (the peer problems subscale was omitted because of low reliability).³⁰ Similar findings have been reported elsewhere.³¹ All questions had three possible responses: not true (score 1), somewhat true (score 2), or certainly true (score 3). Appendix Table A contains the exact wording of all items.

This analysis used the four subscales suggested by Oliver et al.³⁰: pro-social behaviour (10 items; for example, how readily the child shares with other children); emotional symptoms (5 items; for example, having many worries and being fearful); conduct problems (10 items; for example, fights with other children); and hyperactivity/inattention (3 items; for example, being easily distracted and unable to stay still for long). If the mother responded to at least 80% of the items on a subscale, the mean score was calculated, with a range of 1 to 3 for each subscale.

Socio-economic variables

Several socio-economic factors were examined to determine their role in explaining differences in outcomes between Inuit children of teenage and older mothers: mother's education (currently in school, not currently in school and not a secondary graduate, or not currently in school and at least secondary graduation); household income quartile (based on the 2006 Census and adjusted for household size); number of people in household (based on the 2006 Census);

and family structure (lone-parent or two-parent family). Although children may be living with only one parent, they may have other support in the household such as grandparents or other family or non-family members.

Analysis

Descriptive analyses (percentages and means) were used to describe the socio-economic characteristics and physical and mental health outcomes of Inuit children according to the age of their mother when she began childbearing. Differences between the characteristics of Inuit children of teenage and older mothers were assessed with t-tests. For outcomes that differed for Inuit children of teenage and older mothers, multiple regression was used to examine the association between the age of the mother when she first gave birth and each outcome, while controlling for socio-economic characteristics. Analyses were based on survey data weighted to be representative of the 2006 Census counts of children younger than age 6 in Canada

according to different age groups.²⁶ The bootstrap method was used to account for the complex sampling design used by the survey.^{32,33}

Results

About two-fifths (40%) of the Inuit children in this study had mothers who began childbearing as teenagers, which is consistent with other research.⁴ The mothers of another 38% first gave birth at ages 20 to 24, and the remaining 22% of children had mothers who started having children at age 25 or older.

Socio-economic circumstances

Compared with Inuit children whose mothers had given birth at age 25 or older, Inuit children with teenage mothers were more likely to have mothers who were still in school or who had left before secondary graduation (Table 1). For example, 15% of Inuit children of teenage mothers had mothers who were still in school, compared with 5% of those whose mothers first gave birth at

Table 1
Percentage distribution of selected characteristics of Inuit children aged 2 to 5, by age of mother at first birth, Canada, 2006

Characteristics	Age of mother at first birth		
	12 to 19 (N=306) [†]	20 to 24 (N=289) [†]	25 or older (N=147) [†]
	%		
Mother's education			
Currently in school	14.8*	10.5 ^E	5.1 ^E
Not currently in school			
Less than secondary graduation	57.9*	52.8*	41.8
Secondary graduation	14.8	20.1*	10.9 ^E
More than secondary graduation	12.6 ^E	16.7*	42.2
Family structure			
Married	22.7*	33.1*	45.3
Common-law	45.9	35.0	38.7
Lone parent	31.4*	31.9*	16.0 ^E
Household income quartile			
Low	30.6*	21.7	20.4 ^E
Middle-low	25.3	28.0*	18.2 ^E
Middle-high	24.2	24.8	25.5
High	19.8*	25.5	35.9
Residence			
Does not live in Inuit Nunangat	16.1*	15.9 ^E	34.2
Lives in Inuit Nunangat	83.9*	84.1*	65.8

[†] unweighted sample size for each group

* significantly different from children of mothers aged 25 or older at their first birth (p<0.05)

^E use with caution

Note: The sample is restricted to Inuit children whose birth mothers responded to the survey (61% of Inuit 2- to 5-year-olds).

Source: 2006 Aboriginal Children's Survey.

age 25 or older. As well, Inuit children of teenage mothers were more likely than Inuit children of older mothers to live in lone-parent families (31% versus 16%), and less likely to have married mothers (23% versus 45%) or to live in households in the highest income quartile (20% versus 36%).

Physical health

Inuit children of teenage mothers were less likely to be rated as being in excellent/very good health, compared with Inuit children whose mothers had first given birth at age 25 or older (Table 2). They were also more likely to have had an ear infection and dental problems. However, Inuit children of teenage mothers were no more or less likely than those of older mothers to be reported as having a chronic condition.

When socio-economic factors such as the mothers' education and household

income were taken into account, the difference in the likelihood of being in excellent/very good health between Inuit children of teenage and older mothers was not significant (Table 3). However,

Inuit children of teenage mothers were still more likely to have had an ear infection and dental problems.

Table 2
Physical health and behavioural outcomes of Inuit children aged 2 to 5, by age of mother at first birth, Canada, 2006

Outcome	Age of mother at first birth		
	12 to 19	20 to 24	25 or older
Physical health (percentage)			
Excellent/Very good health	73.9*	74.1*	83.4
Chronic condition	33.4	34.7	36.6
Ever had ear infection	60.6*	46.7	41.9
Ever had dental problem	47.5*	43.0*	27.3
Behavioural (mean score (standard deviation))			
Pro-social behaviour	2.62 (0.29)	2.65 (0.29)	2.68 (0.30)
Emotional symptoms	1.41 (0.32)*	1.35 (0.30)	1.29 (0.32)
Conduct problems	1.65 (0.39)	1.63 (0.47)	1.57 (0.52)
Inattention/Hyperactivity	1.75 (0.54)*	1.70 (0.51)*	1.50 (0.47)

* significantly different from children of mothers aged 25 or older at their first birth ($p < 0.05$)

Note: The sample is restricted to Inuit children whose birth mothers responded to the survey (61% of Inuit 2- to 5-year-olds).

Source: 2006 Aboriginal Children's Survey.

Table 3
Unadjusted and adjusted odds ratios relating selected characteristics to physical health outcomes among Inuit children aged 2 to 5, Canada, 2006

Characteristics	Excellent/Very good health						Ever had ear infection						Ever had dental problem					
	Unadjusted odds ratio			95% confidence interval			Unadjusted odds ratio			95% confidence interval			Unadjusted odds ratio			95% confidence interval		
	ratio	from	to	ratio	from	to	ratio	from	to	ratio	from	to	ratio	from	to	ratio	from	to
Age of mother at first birth																		
12 to 19	0.57*	0.33	0.96	0.74	0.43	1.27	2.13*	1.35	3.38	2.63*	1.64	4.21	2.61*	1.68	4.05	1.94*	1.24	3.04
20 to 24	0.57*	0.33	0.97	0.62	0.36	1.07	1.22	0.77	1.92	1.42	0.89	2.27	2.12*	1.37	3.29	1.63*	1.05	2.53
25 or older†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Age of child (years)‡																		
	0.99	0.86	1.15	0.96	0.83	1.12	1.02	0.91	1.15	1.03	0.91	1.17	1.44*	1.27	1.63	1.41*	1.23	1.60
Male (versus female)																		
	0.65*	0.46	0.93	0.65*	0.45	0.93	1.06	0.78	1.44	1.06	0.77	1.45	0.86	0.64	1.15	0.82	0.60	1.11
Mother's education																		
Currently in school	...	...	...	0.47*	0.23	0.95	...	...	...	1.02	0.57	1.82	...	...	...	1.05	0.61	1.80
Not currently in school																		
Less than secondary graduation	...	...	...	0.46*	0.30	0.69	...	...	...	0.71	0.49	1.03	...	...	...	1.34	0.93	1.94
Secondary graduation or more†	...	...	...	1.00	...	...	...	...	...	1.00	...	...	...	...	...	1.00	...	...
Lone-parent (versus two-parent) family																		
	...	...	...	0.94	0.65	1.34	...	...	...	0.97	0.68	1.39	...	...	...	1.22	0.84	1.77
Household income (\$10,000s)‡																		
	...	...	...	1.07	0.97	1.19	...	...	...	1.06	0.97	1.15	...	...	...	0.98	0.90	1.06
Number of people in household‡																		
	...	...	...	0.99	0.91	1.07	...	...	...	0.94	0.88	1.02	...	...	...	1.06	0.98	1.14
Living in (versus outside) Inuit Nunangat																		
	...	...	...	0.59	0.29	1.19	...	...	...	0.82	0.48	1.42	...	...	...	1.83*	1.01	3.34

† reference category

‡ continuous variable

* significantly different from reference category ($p < 0.05$)

... not applicable

Note: Adjusted odds ratio controls for other characteristics in model.

Source: 2006 Aboriginal Children's Survey.

Table 4

Unadjusted and adjusted regression coefficients relating selected characteristics to emotional symptoms and inattention/hyperactivity among Inuit children aged 2 to 5, Canada, 2006

Characteristics	Emotional symptoms				Inattention/Hyperactivity			
	Unadjusted coefficient	Standard error	Adjusted coefficient	Standard error	Unadjusted coefficient	Standard error	Adjusted coefficient	Standard error
Age of mother at first birth								
12 to 19	0.12*	0.03	0.06	0.03	0.24*	0.06	0.21*	0.06
20 to 24	0.05	0.03	0.02	0.03	0.20*	0.06	0.20*	0.06
25 or older†	1.00	...	1.00	...	1.00	...	1.00	...
Age of child (years)‡	0.03*	0.01	0.02	0.01	-0.01	0.02	-0.01	0.02
Male (versus female)	-0.05	0.02	-0.05*	0.02	0.12*	0.04	0.12*	0.05
Mother's education								
Currently in school	...	...	0.13*	0.05	...	...	0.10	0.09
Not currently in school								
Less than secondary graduation	...	...	0.06*	0.03	...	...	0.01	0.05
Secondary graduation or more†	...	...	1.00	...	...	...	1.00	...
Lone-parent (versus two-parent) family	...	...	0.10*	0.03	...	...	0.03	0.05
Household income (\$10,000s)‡	...	...	-0.02*	0.01	...	...	-0.02*	0.01
Number of people in household‡	...	...	0.01*	0.01	...	...	0.02	0.01
Living in (versus outside) Inuit Nunangat	...	...	0.04	0.03	...	...	-0.10	0.07

† reference category

‡ continuous variable

* significantly different from reference category ($p < 0.05$)

... not applicable

Note: Adjusted coefficient controls for other characteristics in model.

Source: 2006 Aboriginal Children's Survey.

Mental health

Mean scores for pro-social behaviour and conduct problems did not differ between the two groups of Inuit children, but those with teenage mothers had higher mean scores for emotional symptoms and inattention/hyperactivity (Table 2). When socio-economic differences were taken into account, mean scores for Inuit children of teenage and older mothers did not differ for emotional symptoms, although differences in inattention-hyperactivity scores persisted (Table 4).

Discussion

This study used data from the population-based 2006 Aboriginal Children's Survey to compare physical and mental health outcomes for Inuit children of teenage and older mothers. The two groups of Inuit children did not differ in terms of the presence of chronic conditions or mean scores for pro-social behaviour or conduct problems. And while Inuit children with teenage mothers were less

likely to be reported to be in excellent/very good health, this association was not significant when socio-economic factors were taken into account. However, even when the influence of socio-economic differences was considered, Inuit children of teenage mothers were more likely than Inuit children with older mothers to have had an ear infection and dental problems. Ear infections have been associated with hearing loss and speech and language problems,³⁴ and dental problems have been associated with pain, infection, and behaviour problems.³⁵

Mean scores for emotional symptoms and inattention/hyperactivity were higher for Inuit children of teenage versus older mothers, although there were no differences in emotional symptoms when socio-economic factors were taken into account. Inattention/hyperactivity, particularly in the preschool years, has been negatively associated with early literacy skills and later school achievement.^{23,24}

Strengths and limitations

The strengths of this study include a population-based sample that was nationally representative of Inuit children living in Canada, examination of both physical and mental health outcomes, information on the mother's age when she began childbearing, and inclusion of socio-economic factors. All outcomes were based on maternal reports rather than measures created for or assessed by non-Inuit individuals.

The study has several limitations. Maternal age at first birth was calculated according to the age of the oldest sibling in the household. It is possible that this was a step-, foster, or adopted child, and not a birth child, which could result in an incorrect determination of the mother's age when she began childbearing. As well, it is possible that the oldest sibling might not be living in the household (for example, he or she might be living with another relative), which would also lead to an inaccurate calculation of the mother's age when she first gave birth.

What is already known on this subject?

- Pregnancy rates among Inuit teenagers are relatively high, compared with rates among teenagers in the Canadian population overall.
- Inuit women who begin childbearing as teenagers generally have less favourable socio-economic conditions than do Inuit women who first give birth at older ages.
- Canadian and American research has found that, in general, children of teenage mothers are more likely to have poor physical and mental health, compared with children of older mothers.
- Little population-based research has examined outcomes for Inuit children of teenage mothers.

What does this study add?

- Preschool-aged Inuit children of teenage mothers were less likely to be in very good/excellent health, more likely to have ever had an ear infection or dental problems, and had higher scores for emotional problems and inattention-hyperactivity, compared with preschool-aged Inuit children of older mothers.
- Some differences—being in very good/excellent health and emotional problems—were explained by socio-economic factors, but other differences were not—ear infection, dental problems, and inattention-hyperactivity.

Children were included in this study if the survey respondent was their birth mother, which was true for 61% of Inuit children. For the Inuit children of other respondents, the age of their biological mother at first birth was not available from the ACS, and this group differed in their socio-economic conditions.

The physical and mental health outcomes were based on maternal reports. Mothers could be influenced by how they believe they should respond, by their experiences, or by subjective views of their child.³⁶ Thus, differences between Inuit children of teenage and older mothers may reflect mothers' reporting patterns rather than true differences in child physical or mental health. Nonetheless, maternal reports are a mother's expert perceptions (versus those of an unfamiliar observer), and were provided by both younger and older mothers.

This analysis could not explore many other factors that may have contributed to the differences in physical and mental health outcomes of Inuit children, such as parenting behaviours, cultural activity participation, and the availability of social and other supports including father and extended family involvement.^{29,37-39}

Conclusion

Analysis of data from the 2006 Aboriginal Children's Survey shows that physical and mental health outcomes for Inuit children of women who were teenagers when they began childbearing differed from outcomes for Inuit children whose mothers first gave birth at age 25 or older. Some differences were explained by socio-economic variables, but others were not. These differences may be related to factors that were not explored in this study. Additional qualitative and quantitative research would increase the understanding of what underlies the differences in outcomes between the Inuit children of teenage and older mothers. ■

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Appendix

Table A
Wording of mental health items

Pro-social behaviour

Considerate of other peoples' feelings
Shares readily with other children, for example, toys, treats, pencils
Helpful if someone is hurt, upset or feeling ill
Kind to younger children
Often offers to help others including parents, teachers, other children
Generally well-behaved, usually does what adults request
Has at least one good friend
Generally liked by other children
Can stop and think things out before acting
Good attention span, sees work through to the end

Emotional symptoms

Often complains of headaches, stomachaches or sickness
Many worries or often seems worried
Often unhappy, depressed or tearful
Nervous or clingy in new situations, easily loses confidence
Many fears, easily scared

Conduct problems

Often loses temper
Often fights with other children or bullies them
Often argumentative with adults
Can be spiteful to others

Hyperactivity/Inattention

Restless, overactive, cannot stay still for long
Constantly fidgeting or squirming
Easily distracted, concentration wanders

Social participation and the health and well-being of Canadian seniors

by Heather Gilmour

Released online October 17, 2012

Abstract

Background

Social participation has been associated with health and well-being in older adults.

Data and methods

Data from the 2008/2009 Canadian Community Health Survey (CCHS)—Healthy Aging were used to examine the relationship between frequent social participation and self-perceived health, loneliness and life dissatisfaction in a sample of 16,369 people aged 65 or older. Multivariate logistic regression was used to identify significant relationships, while adjusting for potential confounders. The mediating role of social support and the prevalence of reported barriers to greater social participation were also examined.

Results

An estimated 80% of seniors were frequent participants in at least one social activity. As the number of different types of frequent social activities increased, so did the strength of associations between social participation and positive self-perceived health, loneliness, and life dissatisfaction. The associations generally remained significant, but were attenuated by individual social support dimensions. The desire to be more involved in social activities was reported by 21% of senior men and 27% of senior women.

Interpretation

Social participation is an important correlate of health and well-being in older adults. It may be that social support gained through social contacts is as important in these associations as the number of activities in which one participates frequently.

Keywords

Aging, cross-sectional study, health survey, social support

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Older age is a transitional period when people experience changes not only in physical health, but also in social roles (for example, retirement, children are grown) that can influence opportunities for social participation.¹ Epidemiological studies suggest that social activities may be particularly important for older adults.² The possible health benefits include reduced risk of mortality,^{3,4} disability⁵⁻⁷ and depression,^{8,9} and better cognitive health,¹⁰⁻¹² self-rated health^{13,14} and health-related behaviours.² Thus, social participation has been integrated into research and policy frameworks of aging. For instance, social engagement—involvement in meaningful activities and maintaining close relationships—is a component of successful aging.¹⁵

The relationships between social participation and health are not well understood, and may operate through multiple pathways.^{2,16} For example, the physiological impact of social isolation is hypothesized to influence the neuroendocrine and immune systems.¹⁶ As well, social ties may encourage individuals to engage in health-promoting behaviours such as physical activity and seeking medical care, or to refrain from damaging ones such as smoking.^{2,16}

The psychological effects of social connectedness may include feelings of self-efficacy, a sense of meaning and purpose, and better mental health.^{2,16} In particular, interactions that provide social support are thought to be facilitators of health, in which case, perceived social support would act as a mediating factor between social participation and health and well-being.⁹ Moreover, an individual's perceptions of the availability of social support are thought to be more

important than received support, which is confounded with need.¹⁷

This study examines the relationship between the number of social activities in which seniors “frequently” participate and three measures of health and well-being: self-perceived health, loneliness, and life dissatisfaction. The extent to which social *support* mediates the effect of social *participation* on health and well-being is considered. In addition, for the first time in a nationally representative Canadian study, reported barriers to greater social participation are examined.

Data source

The data for this analysis are from the 2008/2009 Canadian Community Health Survey (CCHS)—Healthy Aging. This cross-sectional survey collected information about factors, influences and processes that contribute to healthy aging from people aged 45 or older living in private dwellings in the ten provinces. The sampling frame excluded full-time members of the Canadian Forces and residents of the three territories, Indian reserves, Crown lands, institutions, and some remote areas. The survey was conducted from December 1, 2008 through November 30, 2009, using computer-assisted personal interviewing. Response rates were 80.8% (household level), 92.1% (person level), and 74.4% (combined), for a final sample of 30,865 respondents. This analysis uses a sample of 16,369 seniors (65 or older), representing 4.4 million people.

Definitions

Frequent social participation

Respondents were asked how often in the past 12 months (at least once a day, at least once a week, at least once a month, at least once a year, never) they participated in eight different activities. *Frequent participation* was classified as *at least weekly* for:

- family or friendship activities outside the household
- church or religious activities such as services, committees or choirs
- sports or physical activities with other people

- other recreational activities involving other people, including hobbies, bingo and other games

Frequent participation was classified as *at least monthly* for activities typically done less often:

- educational and cultural activities involving other people such as attending courses, concerts or visiting museums
- service club or fraternal organization activities
- neighbourhood, community or professional association activities
- volunteer or charity work

Health and well-being

CCHS—Healthy Aging respondents were asked: “In general, would you say your health is. . . .” The response options were dichotomized to reflect positive (excellent/very good/good) versus poor (fair/poor) *self-perceived health*.

The Three-Item Loneliness Scale¹⁸ measures an individual’s loneliness. On a three-point Likert scale (hardly ever, some of the time, often), respondents answered the questions: “How often do you feel:

- that you lack of companionship?”
- left out?”
- isolated from others?”

Higher scores indicated greater loneliness; the distribution was skewed toward lower scores. Scores were dichotomized to classify respondents in the top quintile of the frequency distribution as experiencing *loneliness*. Those classified as experiencing loneliness responded “some of the time” to two or more questions, or “often” to one or more questions.

Respondents were asked, “How do you feel about your life as a whole right now?” and answered based on a scale where 0 meant “very dissatisfied” and 10 meant “very satisfied.” Respondents in the bottom quintile of the frequency distribution (a score of 6 or less) were classified as having *life dissatisfaction*.

In this study, the three measures of health and well-being were mildly to moderately correlated with each other.

The Pearson correlation coefficients were -0.17 for self-perceived health and loneliness; -0.36 for self-perceived health and life dissatisfaction; and 0.23 for loneliness and life dissatisfaction. Despite some overlap in the three variables, they are treated as individual constructs in this analysis.

Covariates

Three *age groups* were defined: 65 to 74, 75 to 84, and 85 or older. In logistic regression models, *age* was measured as a continuous variable and contained values of 65 or more.

Household income quintiles were defined: lowest, low-middle, middle, high-middle and highest.

Highest level of *education* was categorized as: less than secondary graduation, secondary graduation, some postsecondary, and postsecondary graduation.

Retirement status, based on Statistics Canada’s standard definition of retirement (<http://www.statcan.gc.ca/concepts/definitions/retirement-retraite-eng.htm>), was categorized as completely retired and not completely retired. To be considered completely retired, the respondent could not be in the labour force and had to have received income from “retirement-like sources” during the past 12 months.¹⁹ Respondents older than 75 were excluded from the labour force module of the CCHS—Healthy Aging, and so were considered to be completely retired for this analysis. Retirement-like income sources included dividends and interest; benefits from the Canada or Quebec Pension Plan; job-related retirement pensions, superannuation and annuities; RRSP or RRIF; and Old Age Security and Guaranteed Income Supplement.

The Health Utilities Index (HUI) Mark III assesses functional health status in eight domains: vision, hearing, speech, ambulation, dexterity, emotion, cognition, and pain and discomfort.^{20,21} Overall scores were categorized into four levels of disability: none (1.00), mild (0.89 to 0.99), moderate (0.70 to 0.88), and severe (less than 0.70).

The number of *behavioural risk factors* was based on whether respondents reported heavy drinking (five or more drinks on one or more occasions monthly); were smokers (daily smoker or had quit less than 15 years ago), and were physically inactive (a score below the mean on the Physical Activity Scale for the Elderly).²²

Social support was measured based on the Medical Outcomes Study (MOS) Social Support Survey.¹⁷ This is a measure of *perceived* rather than actual social support received. All questionnaire items measuring social support use a standard preamble: “How often is each of the following kinds of support available to you if you need it?” Each item was scored according to the frequency with which support was available: none of the time (score 0), a little of the time (1), some of the time (2), most of the time (3), and all of the time (4).

- *Positive social interaction social support* reflects the availability of people for positive interaction, based on four questions about whether the respondent has someone with whom to have a good time, to relax, to get his/her mind off things, or to do something enjoyable. The maximum score was 16.
- *Tangible social support* assesses the availability of someone to provide material and/or behavioural assistance, based on four questions about whether the respondent has someone to help if confined to bed, to take him/her to the doctor, to prepare meals, or to do daily chores. The maximum score was 16.
- *Emotional or informational social support* refers to the expression of positive affect, empathetic understanding, encouragement of expressions of feelings, and offering of advice, guidance or feedback. It is based on eight questions about whether the respondent has someone to listen and to advise them in a crisis, to give information and confide in and talk to, or who

understands his/her problems. The maximum score was 32.

- *Affection social support* involves expressions of love and affection, based on three questions about whether the respondent has someone who shows him/her love, to hug or to love him/her, and to make him/her feel wanted. The maximum score items was 12.

For each dimension of social support, a variable was derived based on the summed scores of responses to the individual items. The frequency distribution of responses for each dimension was skewed toward higher scores. For ease of interpretation in univariate and bivariate analysis, each variable was dichotomized so that respondents with scores in the lowest tercile of the frequency distribution were considered to have low social support (12 or less for positive interaction; 12 or less for tangible support; 25 or less for emotional or informational support; 10 or less for affection). Social support scores were used in their continuous forms (based on their summed scores) in multiple logistic regression models.

Analytical techniques

Frequencies and cross-tabulations weighted to be representative of the population aged 65 or older who resided in the provinces in 2008/2009 were produced to estimate the prevalence of social participation and barriers to social participation in the household population, and to examine characteristics associated with the health and well-being outcomes (Appendix Table A).

Logistic regression models were used to assess associations between the number of social activities in which a person frequently participated and measures of health and well-being. All analyses combined men and women in the same sample. An initial series of models controlled for the number of social activities in which respondents frequently participated, and age and sex. A second series added socio-demographic and health covariates that might also be associated with health

and well-being: household income, education, retirement status, disability, and behavioural risk factors. To assess the mediating role of social support, the final models included the four social support dimensions. Because of the potential for multicollinearity, each social support variable was entered singly into the fully controlled models. This study presents only the results of the final models.

To account for the complex design of the CCHS, standard errors, coefficients of variation and confidence intervals were estimated with the bootstrap technique.^{23,24} The statistical significance level was set at <0.05.

Results

Social support related to health and well-being

On the whole, Canadian seniors tended to report positive health and well-being—more than three-quarters perceived their health to be good, very good or excellent; less than one in five was classified as lonely or dissatisfied with life (Table 1). Younger seniors (65 to 74) were more likely than older seniors to have positive self-perceived health, and less likely to be lonely or to report life dissatisfaction. Women were more likely than men to be lonely.

Seniors with higher levels of household income and education, and who were not completely retired, were more likely to report positive self-perceived health, and less likely to be lonely or dissatisfied with life than were those in lower-income households, with less education, and who were retired.

The more severe the disability and the greater the number of behavioural risk factors, the less likely were seniors to report positive self-perceived health, and the more likely they were to be lonely or dissatisfied with life.

Seniors with low social support were less likely than were those with high social support to report positive self-perceived health, and more likely to be lonely and dissatisfied with life.

Table 1
Prevalence of positive self-perceived health, loneliness and life dissatisfaction, by selected characteristics, household population aged 65 or older, Canada excluding territories, 2008/2009

Characteristics	Positive self-perceived health	Loneliness	Life dissatisfaction
Total	76.5	19.6	17.0
Number of frequent social activities			
None [†]	63.1	29.0	27.8
One	71.3*	20.2*	21.2*
Two	78.5*	18.1*	15.2*
Three	84.0*	17.0*	13.0*
Four	86.2*	14.3*	10.0*
Five	88.3*	14.5*	6.6*
Six or more	89.6*	12.8*	5.7 ^{E*}
Age group			
65 to 74 [†]	80.3	18.7	15.3
75 to 84	73.2*	19.5	18.1*
85 or older	67.7*	25.1*	22.7*
Sex			
Men [†]	76.7	14.2	16.4
Women	76.3	24.1*	17.5
Household income			
Lowest [†]	69.0	24.3	23.2
Low-middle	77.6*	20.1*	15.5*
Middle	82.4*	16.6*	13.4*
High-middle	85.6*	14.1*	9.1*
Highest	86.6*	12.0*	10.4*
Education			
Less than secondary graduation [†]	69.1	22.0	21.4
Secondary graduation	80.2*	18.8*	15.1*
Some postsecondary	80.7*	18.8	16.0*
Postsecondary graduation	82.7*	17.7*	13.1*
Retirement status			
Retired [†]	75.4	21.0	17.6
Not completely retired	88.4*	14.4*	11.6*
Disability			
None [†]	94.6	8.8	6.3
Mild	89.6*	13.1*	8.1
Moderate	74.4*	23.6*	18.7*
Severe	50.3*	32.2*	35.7*
Risk behaviours			
None [†]	88.2	15.6	9.5
One	71.4*	21.3*	20.3*
Two	62.5*	24.5*	26.3*
Three	58.3*	35.1 ^{E*}	30.4 ^E
Social support			
Low positive social interaction [†]	71.2	37.3	26.4
High positive social interaction	80.4*	10.7*	12.0*
Low tangible [†]	71.7	33.7	24.1
High tangible	79.3*	12.0*	13.2*
Low emotional/Informational [†]	72.1	32.7	24.0
High emotional/Informational	79.5*	11.6*	12.7*
Low affection [†]	71.2	34.0	25.2
High affection	79.7*	11.7*	12.5*

[†] reference group

* significantly different from reference group (p<0.05)

^E interpret with caution

Source: 2008/2009 Canadian Community Health Survey—Healthy Aging.

Frequent social participation

The majority of seniors (80%) were frequent participants in at least one social activity (Appendix Table A). As the number of activities increased, their likelihood of reporting positive self-perceived health rose, and their likelihood of reporting loneliness or life dissatisfaction decreased (Table 1).

Activities with family or friends were the most common, with just over half of senior men and women participating frequently in this type of social activity (Figure 1). Women were more likely than men to be frequent participants in family and friend, church, educational and “other” activities, while men were more likely to be frequent participants in sports. With the exception of church and “other” activities, participation in most types of social activities was lower at older ages (Figure 2).

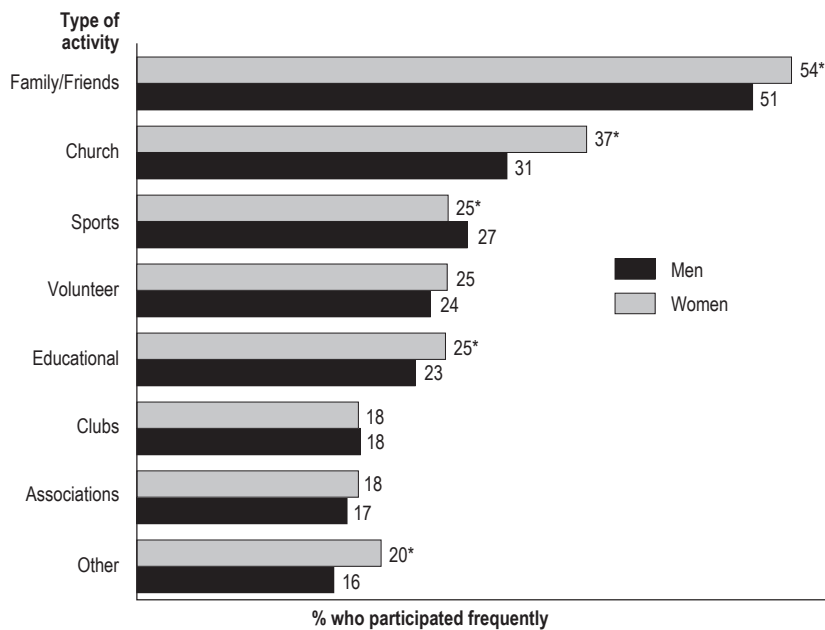
Associations with health and well-being persist

The number of social activities in which individuals frequently participated was strongly and significantly related to each of the health and well-being outcomes, independent of age and sex (data not shown). Even when socio-demographic and health characteristics were taken into account, the relationships between social participation and each health and well-being measure persisted, although they were attenuated (data not shown).

In the full models, which also controlled individually for the four dimensions of social support, the relationships between social participation and health and well-being were further attenuated, but remained significant in all but one instance (Table 2). Social participation was not significantly associated with loneliness when positive social interaction was controlled. In all other instances, a gradient in odds ratios was apparent with each increase in the number of activities, although to varying degrees for each outcome. Except for the association between affection and positive self-perceived health, each dimension of social support was, itself,

Figure 1

Percentage who participated frequently in social activities, by type of activity and sex, household population aged 65 or older, Canada excluding territories, 2008/2009

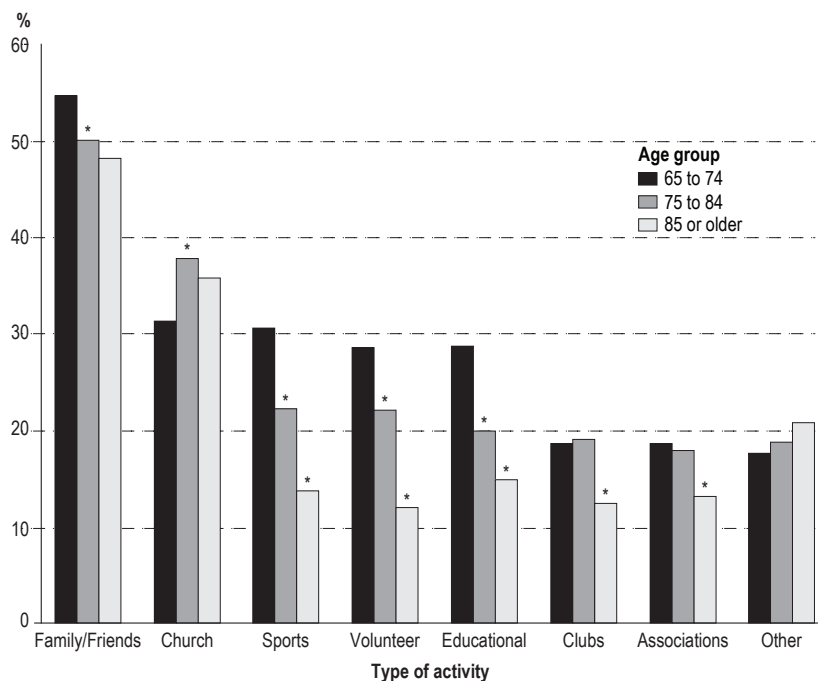


* significantly different from men ($p < 0.05$)

Source: 2008/2009 Canadian Community Health Survey—Healthy Aging.

Figure 2

Percentage who participated frequently in social activities, by type of activity and age group, household population aged 65 or older, Canada excluding territories, 2008/2009



* significantly different from previous age group ($p < 0.05$)

Source: 2008/2009 Canadian Community Health Survey—Healthy Aging.

significantly associated with each health and well-being outcome.

In multivariate analysis that controlled for age, sex and socio-demographic and health characteristics (but not social support), some factors that were significant in the bivariate analysis, such as income, disability and health behaviours (Table 1), remained significantly associated with each outcome, but education and retirement status were significantly associated only with self-perceived health (data not shown). When social support dimensions were added, the results for socio-demographic and health covariates were similar, except that the association between household income and loneliness was significant only for the highest income category.

Barriers to social participation

Nearly one in four seniors (24%) reported that they would have liked to have participated in more social, recreational or group activities in the past year. Younger seniors and women were more likely to have felt this way (Table 3).

The most commonly mentioned obstacle to participating in more activities was a health limitation (33% of men, 35% of women). Being too busy was also a leading reason, but more so among men (28%) than women (16%). Personal or family responsibilities prevented about 1 in 10 seniors from participating in more activities. Women were more likely than men to report not wanting to go alone to an activity (17% versus 9%) or transportation problems (11% versus 4%).

Social participation may not be entirely dependent upon personal choice—external factors can play a role. For example, the cost and the availability of activities in the area or at a suitable time or location can influence participation. Such barriers were reported by 4% to 9% of Canadian seniors.

Table 2

Adjusted odds ratios relating number of frequent social activities and social support dimensions to positive self-rated health, loneliness and life dissatisfaction, household population aged 65 or older, Canada, excluding territories, 2008/2009

Social support model and number of frequent social activities	Positive self-perceived health			Loneliness			Life dissatisfaction		
	Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
		from	to		from	to		from	to
Positive social interaction model									
Number of frequent social activities									
None†	1.0	...	...	1.0	...	...	1.0	...	...
One	1.0	0.9	1.2	0.9	0.7	1.1	0.9	0.8	1.1
Two	1.4*	1.1	1.7	0.9	0.7	1.1	0.8*	0.6	1.0
Three	1.5*	1.2	2.0	0.9	0.7	1.1	0.8*	0.6	1.0
Four	1.9*	1.5	2.6	0.8	0.6	1.1	0.5*	0.4	0.7
Five	2.0*	1.4	2.9	0.8	0.6	1.1	0.4*	0.2	0.6
Six or more	1.7*	1.2	2.5	0.8	0.5	1.1	0.3*	0.2	0.6
Positive social interaction social support	1.03*	1.01	1.05	0.81*	0.79	0.82	0.90*	0.88	0.91
Tangible social support model									
Number of frequent social activities									
None†	1.0	...	...	1.0	...	...	1.0	...	...
One	1.0	0.9	1.2	0.7*	0.6	0.9	0.9	0.7	1.0
Two	1.4*	1.1	1.7	0.7*	0.6	0.9	0.7*	0.5	0.8
Three	1.6*	1.2	2.0	0.7*	0.5	0.9	0.7*	0.5	0.9
Four	2.0*	1.5	2.6	0.5*	0.4	0.8	0.4*	0.3	0.6
Five	2.0*	1.4	2.9	0.6*	0.4	0.8	0.3*	0.2	0.5
Six or more	1.8*	1.2	2.5	0.5*	0.4	0.8	0.3*	0.2	0.5
Tangible social support	1.02*	1.00	1.04	0.85*	0.84	0.86	0.92*	0.90	0.93
Emotional or informational social support model									
Number of frequent social activities									
None†	1.0	...	...	1.0	...	...	1.0	...	...
One	1.0	0.9	1.3	0.8*	0.6	1.0	0.9	0.7	1.1
Two	1.4*	1.1	1.7	0.8*	0.6	0.9	0.7*	0.6	0.9
Three	1.6*	1.2	2.0	0.7*	0.6	0.9	0.7*	0.5	0.9
Four	2.0*	1.5	2.7	0.6*	0.4	0.9	0.5*	0.3	0.6
Five	2.0*	1.4	2.9	0.7*	0.5	0.9	0.3*	0.2	0.5
Six or more	1.8*	1.2	2.6	0.6*	0.4	0.9	0.3*	0.2	0.5
Emotional or informational social support	1.01*	1.00	1.02	0.92*	0.91	0.92	0.95*	0.95	0.96
Affection social support model									
Number of frequent social activities									
None†	1.0	...	...	1.0	...	...	1.0	...	...
One	1.1	0.9	1.3	0.8	0.7	1.0	0.9	0.7	1.1
Two	1.4*	1.2	1.7	0.7*	0.6	0.9	0.7*	0.6	0.9
Three	1.6*	1.2	2.0	0.7*	0.6	0.9	0.7*	0.5	0.9
Four	2.0*	1.5	2.6	0.6*	0.5	0.9	0.5*	0.3	0.7
Five	2.1*	1.4	3.0	0.7*	0.5	0.9	0.3*	0.2	0.5
Six or more	1.8*	1.3	2.6	0.6*	0.4	0.9	0.3*	0.2	0.5
Affection social support	1.02	1.00	1.05	0.78*	0.76	0.80	0.87*	0.85	0.89

† reference group

* significantly different from reference group ($p < 0.05$)

... not applicable

Note: Each model also controls for age (continuous), sex, household income, education, retirement status, disability, and behavioural risk factors.

Source: 2008/2009 Canadian Community Health Survey—Healthy Aging.

Table 3

Percentage reporting desire to have participated in more social activities in past 12 months, by age group and factors preventing participation, household population aged 65 or older, Canada excluding territories, 2008/2009

	Men			Women		
	%	95% confidence interval		%	95% confidence interval	
		from	to		from	to
Total	20.7	19.1	22.2	26.6[†]	25.1	28.2
Age group						
65 to 74 [†]	22.0	19.9	24.1	29.9 [†]	27.5	32.3
75 to 84	19.3	16.8	21.8	24.0* [‡]	21.9	26.1
85 or older	16.8*	13.8	19.8	19.8*	17.0	22.5
Factors preventing more social participation						
Health condition/limitation	33.0	29.4	36.5	34.8	31.9	37.6
Too busy	28.4	24.6	32.2	16.2 [‡]	13.7	18.7
Personal/Family responsibilities	10.1	7.2	13.0	10.4	8.0	12.7
Don't want to go alone	9.0	6.8	11.3	16.7 [‡]	14.3	19.2
Cost	7.6	4.8	10.3	8.6	6.4	10.7
Activities not available in area	7.0	5.2	8.8	8.0	6.4	9.7
Time of activities not suitable	6.7	5.0	8.5	8.1	6.2	10.1
Location too far	4.2	2.5	5.9	5.6	4.0	7.2
Transportation problems	3.7	2.2	5.1	11.2 [‡]	9.3	13.1
Other	16.0	13.1	18.9	14.0	12.0	16.1

[†] reference group

* significantly different from reference group ($p < 0.05$)

[‡] significantly different from men ($p < 0.05$)

Source: 2008/2009 Canadian Community Health Survey—Healthy Aging.

Discussion

The results of this study support other research,²⁻¹⁴ in that social relationships were shown to be significantly associated with health and well-being independent of socio-demographic and health factors. In earlier research, each outcome examined in this study—self-perceived health,²⁵ loneliness,²⁶ and life dissatisfaction²⁷—has been linked to poor health and mortality.

While the optimal amount of social participation depends on the individual, a gradient, or dose-response relationship, appears to exist. The greater the number of frequent social activities, the higher the odds of positive self-perceived health, and the lower the odds of loneliness and life dissatisfaction. This is consistent with research that has found seniors with a wider range of social ties have better well-being.²⁸

The associations between social participation and health and well-being were attenuated, but persisted, when socio-demographic and health

factors were controlled. When social support was included in the models, the associations were further attenuated, but generally remained. However, when positive social interaction was taken into account, the association between frequent social participation and loneliness was no longer significant.

The elements in the positive social interaction dimension of social support (has someone to have a good time with, get together with for relaxation, do things with to get his/her mind off things, or do something enjoyable with) seem closely aligned with social participation. However, social participation and the positive social interaction dimension of social support were only mildly correlated (Pearson correlation 0.20), indicating that multicollinearity does not account for the finding. This indicates that the measure of interaction used here (number activities in which one frequently participates) and the perceived availability of positive social interaction are not interchangeable concepts.

What is already known on this subject?

- Epidemiological studies have established social participation as a factor associated with positive health outcomes for seniors.
- A possible mechanism by which social participation is associated with health is through the social support gained by relationships with other people.

What does this study add?

- Based on recent data, the majority of Canadian seniors were frequent participants in at least one type of social activity
- Greater social participation was positively associated with self-perceived health and negatively associated with loneliness and life dissatisfaction.
- Social support was a mediating factor in these associations, corroborating the hypothesis that the quality of social relationships is an important aspect of how social participation is associated with health.
- Frequent barriers to social participation included health limitations, being too busy, personal or family responsibilities, and not wanting to go alone to activities.

Some research suggests that it is the quality, not the size, of social networks that matters for the relationship with health and well-being.^{2,9,29-32} In this study, dimensions of perceived social support were used to approximate the quality of social interactions. The fact that social support partially or completely mediated the associations, and that individual dimensions of social support were, themselves, independently associated with measures of health and well-being, corroborates this hypothesis.

The strong associations between social participation and health and well-being emphasize the importance of addressing the barriers faced by the nearly one-quarter of seniors who reported a desire to participate in more social activities.

Limitations

Because this is a cross-sectional study, the possibility of reverse causality cannot be ruled out; that is, people in poor health may be unable to maintain social participation, and those who participate frequently may be in better health. Nonetheless, the relationship between social participation and health and well-being persisted even after accounting for functional health status. Some longitudinal studies have found similar results.^{33,34}

People who are not healthy may still benefit from social participation, perhaps more so. However, tests for interaction effects between level of disability and social participation in models of health and well-being outcomes were not significant in this analysis (data not shown). It is also likely that there are reciprocal effects between social participation and health and well-being,² such that better health allows for greater

social participation, which, in turn, improves or maintains health, allowing for the maintenance or increase in the level of social participation.

Seniors in care institutions were excluded from the survey. However, results were similar in a study of institutionalized seniors.³⁵ Specifically, seniors who participated in social and recreational activities were more likely than those who did not participate in such activities to report positive self-perceived health.

The types of social activities about which respondents to the survey were asked did not include the internet or social media. Seniors' use of the internet tends to be for communication,³⁶ and has been associated with lower levels of loneliness.³⁷ Exclusion of online activity from this study may underestimate seniors' social participation, and also, the extent of associations between social participation and health and well-being.

Conclusion

According to the 2008/2009 Canadian Community Health Survey—Healthy Aging, four-fifths of seniors were frequent participants in social activities. The results of this analysis highlight

the importance of frequent social participation to maintaining quality of life. Of particular relevance to policy and program development are the reported barriers to seniors' social participation. In addition to the frequency of social participation, future research could focus on seniors' satisfaction with social participation and longitudinal associations with health and well-being. ■

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Appendix

Table A
Percentage distribution of selected
characteristics, household population
aged 65 or older, Canada excluding
territories, 2008/2009

Characteristics	%
Total	100.0
Number of frequent social activities	
None	20.4
One	23.3
Two	19.4
Three	14.4
Four	10.4
Five	6.5
Six or more	5.6
Age group	
65 to 74	55.1
75 to 84	33.6
85 or older	11.2
Sex	
Men	45.1
Women	54.9
Household income	
Lowest	33.9
Low-middle	27.7
Middle	17.6
High-middle	12.1
Highest	8.7
Education	
Less than secondary graduation	41.3
Secondary graduation	15.4
Some postsecondary	4.6
Postsecondary graduation	38.6
Retirement status	
Retired	87.6
Not completely retired	12.4
Disability	
None	7.9
Mild	45.8
Moderate	19.5
Severe	26.8
Risk behaviours	
None	36.9
One	51.2
Two	11.1
Three	0.9
Social support	
Low positive social interaction	32.9
High positive social interaction	67.1
Low tangible	37.3
High tangible	62.7
Low emotional/Informational	40.2
High emotional/Informational	59.8
Low affection	37.8
High affection	62.2

Source: 2008/2009 Canadian Community Health Survey—
 Healthy Aging.

The difference in hypertension control between older men and women

by Kathryn Wilkins, Marianne Gee and Norm Campbell

Released online October 17, 2012

Abstract

Background

In Canada, as elsewhere, control of hypertension in older persons who are using antihypertensive medication is more likely in men than in women. The reasons for the observed difference are not known.

Data and methods

Data are from cycle 1 of the 2007 to 2009 Canadian Health Measures Survey (CHMS). The CHMS includes a comprehensive questionnaire, automated blood pressure (BP) measures, and a variety of biological and anthropometric assessments. Frequencies, means, cross-tabulations and multivariate models were produced to study differences between the sexes in hypertension control in a weighted sample representative of the household population aged 60 to 79.

Results

The prevalence of hypertension was nearly equal among older men (60%) and women (59%), and the percentage of those with hypertension who were receiving pharmaceutical treatment was not statistically different (84% and 89%, respectively). However, despite current treatment, hypertension was uncontrolled in a substantially higher percentage of women (30%) than men (17%). The difference persisted when age, socio-economic status, co-morbidity, category of medication, anthropometry, and other correlates of hypertension were taken into account.

Interpretation

The factors considered in the analysis do not account for the advantage to older men in hypertension control. The findings underscore the importance of efforts to control blood pressure in older women.

Keywords

Antihypertensive agents, high blood pressure, population surveillance, prevalence, sex factors

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Hypertension is a major health risk factor, and its control is an important clinical concern. In Canada, among people younger than 60 who are using medication for hypertension, control is nearly equal between the sexes, at well over 90%.¹ At older ages, however, control is more likely in men than in women—consistent with observations elsewhere.²⁻⁸

To date, investigation of the underlying causes of the male-female difference in hypertension control has been limited. Differences in cardiovascular co-morbidity and risk factors, hormonal influences, arterial stiffness and treatment regimens may contribute to the discrepancy,^{7,9,10} but no conclusive explanations have emerged.

Using data from the Canadian Health Measures Survey (CHMS), which includes measures of blood pressure (BP), anthropometry and biochemical parameters, and information on diagnosed chronic diseases, health-related behaviours and risk conditions and medication use, this study explores the disparity in hypertension control between men and women aged 60 to 79.

Methods

The analysis is based on CHMS data collected from March 2007 through February 2009 at 15 sites across Canada.¹¹ The CHMS is representative

of approximately 96% of the Canadian household population aged 6 to 79.¹¹ It does not include residents of Indian Reserves, Crown lands, institutions and certain remote regions, or full-time members of the regular Canadian Forces. The response rate for the 2007 to 2009 cycle—calculated as the product of response fractions for the household (69.6%), the household questionnaire (88.3%), the mobile examination centre component (84.9%), with an adjustment for the sampling strategy—was 51.7%.¹¹ Ethics approval for the CHMS was obtained from Health Canada's Research Ethics Board. Written consent was requested from respondents before participation.¹¹⁻¹⁶ This analysis focuses on the sub-population (n=658) of respondents aged 60 to 79 who met at least one of the criteria for hypertension (see *Definitions*).

During an in-home interview, respondents completed a questionnaire covering socio-demographic characteristics, medical history, current

health status, prevalent conditions and health-related behaviours. Information on use in the past month of “medicine for high blood pressure” was collected in the home, and also during a subsequent appointment at the mobile examination centre. From each medication container, the name and Drug Identification Number (DIN) were recorded. About 1% (n=14) of respondents in the study sample reported using antihypertensive medication, but either the DIN was not available, or the reported DIN did not correspond to any of the codes used to define antihypertensive medications. These respondents were not classified as users of antihypertensive medication.

At the mobile examination centre, height, weight and BP were measured. Blood samples were collected using a standardized venipuncture technique; specimens were processed and shipped to a reference laboratory according to a quality-assurance protocol.¹¹ Respondents unwilling or unable to go to the mobile examination centre (n=16 in the 60 to 79 age group) were offered and accepted the option of a home visit; the BP measurement protocol was the same as in the mobile examination centre.¹⁷ BP was measured with the BpTRU™ BP-300 device (BpTRU Medical Devices Ltd., Coquitlam, British Columbia) at the mobile examination centre, and with the BpTRU™ BP-100 device during home visits. The BpTRU™ is an automated electronic monitor.^{18,19}

Definitions

Measures of BP were calculated as the average of the first set (last five of six measures taken one minute apart) of valid measurements.¹⁷ Consistent with recommendations of the Canadian Hypertension Education Program,²⁰ *hypertension* was defined as mean systolic BP (SBP) of ≥ 140 mm Hg, or mean diastolic BP (DBP) of ≥ 90 mm Hg, or antihypertensive medication use in the past month, as verified by the name and DIN on the medication container. Among respondents with diabetes, a more stringent definition of hypertension was applied: mean SBP of ≥ 130 mm

Hg, or mean DBP of ≥ 80 mm Hg, or antihypertensive medication use in the past month.²⁰ *Pulse pressure* (PP) is the difference (in mm Hg) between SBP and DBP. *Uncontrolled hypertension* was defined as DIN-verified BP medication use in the past month together with measured mean BP value(s) in the hypertensive range.

During data processing, medications reported in current use by respondents were assigned codes from the Anatomical Therapeutic Chemical (ATC) Classification System.¹¹ The following categories of antihypertensive medications were specified: *beta blockers* (ATC codes C07, excluding C07AA07, C07AA12 and C07AG02), *agents acting on the renin-angiotensin system* (ATC codes C09), *thiazide diuretics* (ATC codes C03, excluding C03BA08 and C03CA01), *calcium channel antagonists* (ATC codes C08), and *miscellaneous antihypertensives* (ATC codes C02, excluding C02KX01). Only 13 respondents reported use of medications classified as miscellaneous antihypertensives, so this category was not retained in the analysis; however, these respondents were classified as antihypertensive medication users.

Age was defined as years of age at the time of the visit to the mobile examination centre.

Variables for *marital status*, *income*, *secondary school graduation*, *having a regular doctor*, *co-morbidity (diabetes and heart disease)* and *current daily smoking* were based on information reported by the respondent during the household interview.

Household income adjusted for household size was defined as total household income, divided by the number of people in the household. When income was reported as a range, the midpoint of the range was used. In linear regression analysis, adjusted household income was divided by 10,000.

Level of *leisure-time physical activity* was defined as inactive or moderate/active, based on total daily energy (kcal/kg/day) expended in specific activities reported by the respondent.²¹

Body mass index (BMI) is calculated as weight in kilograms divided by height in metres squared (kg/m^2). BMI was based on measured data; respondents with a BMI of 30.0 kg/m^2 or more were classified as *obese*.

“High-risk” *waist circumference* was defined as ≥ 102 cm for men, and ≥ 88 cm for women.²²

Values of *blood glucose* (mmol/L) and *blood lipids* (ratio of total cholesterol to high-density lipoprotein (HDL) cholesterol) were available as derived variables.

Prevalent *heart disease* and *diabetes* were determined by asking respondents to report conditions that “are expected to last or have already lasted six months or more and that have been diagnosed by a health professional.”

Analytical techniques

Based on weighted data, frequencies, means and cross-tabulations were produced for sex-specific descriptive analysis of people aged 60 through 79 with hypertension. Distributions of SBP, DBP and PP were plotted and smoothed using a three-year moving average. Multivariate linear regression models were fitted to examine associations of selected variables with SBP. Logistic regression modeling was used to study the association between female sex and uncontrolled hypertension, while adjusting for possible confounders.

Variance was calculated using the bootstrap technique^{23,24}; in multivariate analysis, the number of degrees of freedom was restricted to 11 to account for the number of CHMS collection sites and sampling stratification.¹¹

Results

The estimated prevalence of hypertension at ages 60 to 79 did not differ significantly between the sexes: 60% of men and 59% of women met at least one of the criteria for this condition (data not shown).

Moreover, the average age of these men and women with hypertension was not statistically different: 68.4 and 68.6 years, respectively (Table 1). Men with

hypertension were significantly more likely than their female counterparts to be married or in a common-law relationship. The average household income (adjusted for household size) of men with hypertension significantly exceeded that of women: \$44,500 versus \$35,900.

The prevalence of smoking among men and women with hypertension was similar (9% and 10%, respectively). A significantly higher percentage of women than men reported a level of leisure-time physical activity classified as inactive (62% and 51%, respectively). Although average BMI and the percentages classified as obese did not differ significantly between the sexes, the data suggest that a higher percentage of women (66%) than men (55%) with hypertension were in the high-risk range for waist circumference ($p=0.08$).

A large majority of men (94%) and women (97%) with hypertension reported having a regular doctor. Heart disease was reported by a significantly higher percentage of men (25%) than women (16%). The mean ratio of total to HDL cholesterol was also higher in men (4.2) than women (3.7). No statistically significant differences emerged for blood glucose level or diabetes.

Systolic blood pressure, diastolic blood pressure and pulse pressure

SBP in women with hypertension (including those using antihypertensive medication and those with diabetes) averaged 132.5 mm Hg, significantly above the corresponding average in men: 125.3 mm Hg. Average DBP did not differ significantly between women and men (72.4 and 73.7 mm Hg, respectively).

Supplementary analysis showed that in people with hypertension, SBP and PP were higher in women than in men whether or not they were using antihypertensive medication. The respective SBP values in women and men using medication were 129.9 and 121.3 mm Hg, and in those who were not, 153.6 and 146.9 mm Hg (data not shown). PP averaged 58.8 and 49.7,

Table 1

Selected characteristics of people with hypertension, by sex, household population aged 60 to 79, Canada, 2007 to 2009

Characteristics	Men			Women		
	% or mean	95% confidence interval		% or mean	95% confidence interval	
		from	to		from	to
Demographic/Socio-economic						
Mean age (years)	68.4	67.6	69.1	68.6	67.6	69.6
Married/Common-law (%)	81.9*	76.8	86.1	62.3	54.0	69.9
Mean household income (\$, adjusted for household size)	44,520*	38,507	50,533	35,868	31,069	40,667
Secondary school graduation (%)	61.1	54.2	67.5	60.8	51.8	69.1
Has regular doctor (%)	94.2	87.6	97.4	97.0	94.0	98.5
Health behaviours						
Current daily smoker (%)	8.7 ^E	5.6	13.3	10.1 ^E	6.4	15.7
Inactive level of leisure-time physical activity (%)	50.6*	43.3	57.9	62.4	54.8	69.5
Physical measures						
Mean body mass index	29.3	28.4	30.1	29.6	28.5	30.6
Obese (%)	37.8	30.9	45.2	37.1	30.0	44.9
Waist circumference in high-risk range (%)	55.3	47.9	62.6	65.5	55.5	74.3
Mean blood glucose level (mmol/L)	5.7	5.5	5.9	5.6	5.0	6.2
Mean ratio of total to HDL cholesterol	4.2*	4.0	4.4	3.7	3.5	3.8
Co-morbidity (%)						
Diabetes	21.0	15.3	28.1	20.4	16.0	25.7
Heart disease	25.4*	19.8	32.0	15.5 ^E	10.5	22.2
Blood pressure (mm Hg)						
Systolic	125.3*	123.4	127.2	132.5	129.6	135.4
Diastolic	73.7	72.7	74.7	72.4	70.7	74.0
Pulse pressure	51.6*	53.3	49.9	60.1	61.9	58.3
Antihypertensive medication use (%)						
Any	84.4	79.7	88.3	89.3	84.7	92.7
Diuretic	18.5*	13.6	24.8	33.4	24.5	43.7
Calcium channel antagonist	22.3 ^E	14.7	32.5	21.7 ^E	14.3	31.5
Agent acting on renin-angiotension system	64.3	57.9	70.2	56.9	47.5	65.9
Beta-blocker	25.9	18.8	34.5	25.1 ^E	16.9	35.6
Number of antihypertensive types used (%)						
None	15.6	11.7	20.3	10.7	7.4	15.2
One	48.0	41.2	54.9	48.9	40.3	57.5
Two	26.8	20.1	34.8	31.8	24.3	40.4
Three or more	9.6 ^E	6.3	14.3	8.6 ^E	5.3	13.6

* significantly different from women ($p<0.05$)

^E use with caution

Note: Hypertension is measured systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg (≥ 130 mm Hg or ≥ 80 mm Hg for those with diagnosis of diabetes), or use of antihypertensive medication in the month before the CHMS interview.

Source: 2007 to 2009 Canadian Health Measures Survey.

respectively, in women and men using antihypertensive medication, and 71.5 and 61.6 in those who were not.

In regression models controlling for age, household income, education, marital status, BMI, co-morbid conditions and cholesterol ratio, SBP was lower in men than in women by an average of 6.4 mm Hg (Table 2). Among men, heart disease was negatively related to SBP, but blood glucose level showed

a positive association with SBP. The pattern was similar in women, although the associations did not attain statistical significance.

Among people with hypertension, SBP was lower by an average of 4 mm Hg in those with at least secondary school graduation, compared with those who had not graduated from secondary school. Heart disease was also negatively related to SBP; the SBP of people with

Table 2**Regression coefficients relating selected characteristics to systolic blood pressure in people using antihypertensive medication, household population aged 60 to 79, Canada, 2007 to 2009**

Characteristics	Both sexes			Standardized regression coefficient (beta)	Men			Standardized regression coefficient (beta)	Women			Standardized regression coefficient (beta)
	Regression coefficient (B)	95% confidence interval from	to		Regression coefficient (B)	95% confidence interval from	to		Regression coefficient (B)	95% confidence interval from	to	
Demographic/Socio-economic												
Men [†]	-6.43*	-10.33	-2.52	-0.18	...	...	...	...	...	...	...	...
Age (years) [‡]	0.34*	0.01	0.67	0.11	0.26	-0.06	0.58	0.11	0.35	-0.16	0.86	0.11
Secondary school graduation [§]	-3.98*	-6.40	-1.57	-0.11	-0.84	-4.86	3.18	-0.03	-3.80*	-7.52	-0.07	-0.09
Household income (\$10,000) [‡]	-0.49	-1.02	0.03	-0.08	-0.06	-0.51	0.40	-0.01	-1.03	-2.15	0.09	-0.12
Married/Living with partner ^{††}	-0.23	-5.03	4.58	-0.01	-0.99	-6.70	4.72	-0.03	1.28	-5.94	8.49	0.03
Leisure-time physical activity level												
Inactive [†]	2.27	-2.25	6.78	0.06	1.35	-5.08	7.79	0.05	1.43	-4.88	7.74	0.03
Physical measures												
Height (cm) [‡]					-0.30	-0.61	0.02	-0.14	-0.54*	-1.00	-0.07	-0.18
Waist circumference (cm) [‡]	-0.08	-0.32	0.16	-0.07	-0.06	-0.17	0.04	-0.06	-0.03	-0.43	0.37	-0.02
Blood glucose level (mmol/L) [‡]	2.17*	0.01	4.34	0.27	1.34*	0.26	2.42	0.17	2.58	-2.23	7.39	0.33
Ratio of total to HDL cholesterol [‡]	0.98	-0.59	2.55	0.06	1.25	-0.39	2.88	0.10	0.68	-2.32	3.68	0.03
Co-morbidity												
Heart disease [†]	-6.39*	-10.97	-1.81	-0.15	-6.99*	-12.38	-1.61	-0.23	-5.70	-15.66	4.26	-0.10
Intercept	101.33				151.60				181.61			
R²	0.18				0.12				0.19			

[†] reference category is absence of characteristic[‡] used as continuous variable[§] reference category is less than secondary school graduation^{††} reference category is single/divorced

* significantly different from reference category (p<0.05)

... not applicable

Source: 2007 to 2009 Canadian Health Measures Survey.

heart disease was, on average, 6.4 mm Hg lower than that of people without heart disease. Blood glucose level was positively related to SBP.

Medication use

Similar percentages of men (84%) and women (89%) with hypertension were using at least one type of antihypertensive medication. Women were more likely than men to be using thiazide diuretics (33% and 19%, respectively). Use of agents acting on the renin-angiotensin system, calcium channel antagonists and beta-blockers did not differ significantly by sex. About 10% of men and women were taking three or more types of antihypertensive medication concurrently.

Among those who were using antihypertensive medication, the condition remained uncontrolled—that is, BP was in the hypertensive range—

in a significantly higher percentage of women (30%) than men (17%) (p=0.03; data not shown). The difference between the sexes in hypertension control was reflected in SBP values. Mean SBP was significantly higher in women than in men (129.9 versus 121.3 mm Hg) (data not shown), and a higher percentage of women had SBP values of 140 mm Hg or more (Figure 1). The distribution of DBP did not differ between the sexes (Figure 2). Average PP was significantly higher in women (60.1 mm Hg) than in men (51.6 mm Hg); the distribution plot indicates a larger area under the curve for women at values of 45 mm Hg or more (Figure 3).

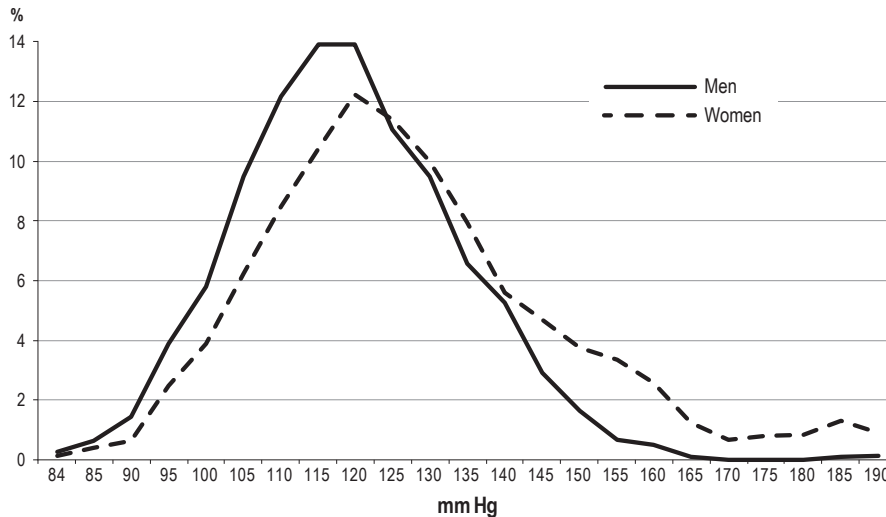
When the effects of age were taken into account, the odds of uncontrolled hypertension were twice as high in women as in men (Table 3). Adjustments for education, BMI, co-morbidity, cholesterol ratio, level

of leisure-time physical activity and category of antihypertensive medication did not attenuate the odds ratio. A supplementary model that considered waist circumference rather than BMI did not change the results (data not shown). Each antihypertensive category was included in a separate multivariate model, with similar results.

Discussion

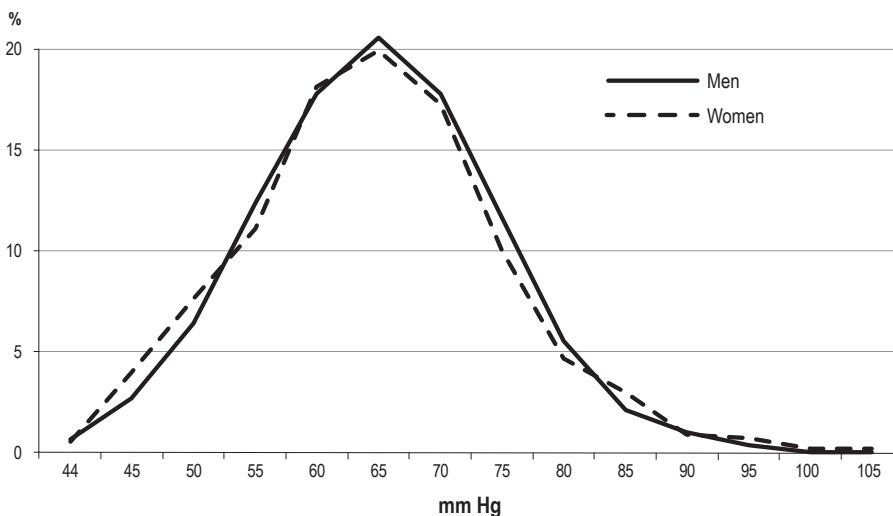
An estimated 60% of Canadians aged 60 to 79 have hypertension, and most of them are receiving pharmaceutical treatment for the condition. Although the likelihood of treatment does not differ significantly between men and women, among those receiving treatment, hypertension—due to higher SBP—is uncontrolled in almost one-third of women compared with one-sixth of men. Even when differences in category of

Figure 1
Percentage distribution of systolic blood pressure (mm Hg) in people with hypertension who are using antihypertensive medication, household population aged 60 to 79, Canada, 2007 to 2009



Source: 2007 to 2009 Canadian Health Measures Survey.

Figure 2
Percentage distribution of diastolic blood pressure (mm Hg) in people with hypertension who are using antihypertensive medication, by sex, household population aged 60 to 79, Canada, 2007 to 2009



Source: 2007 to 2009 Canadian Health Measures Survey.

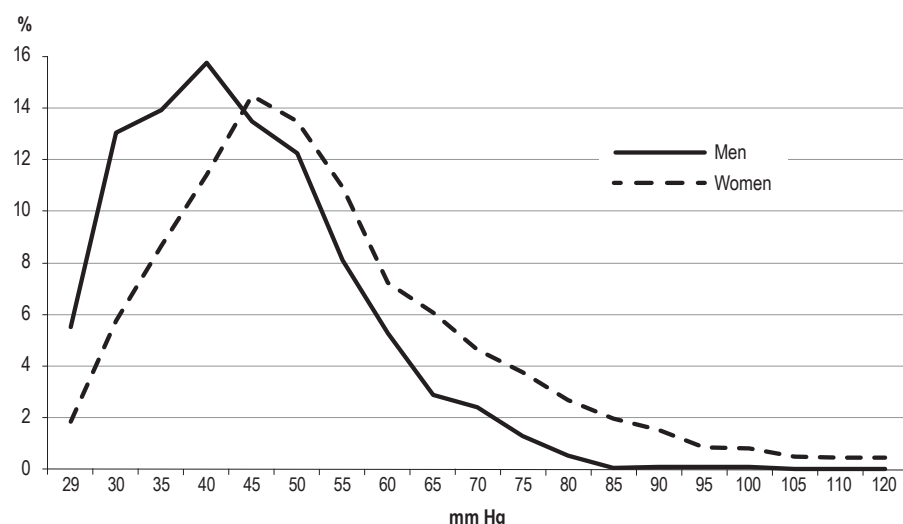
What is already known on this subject?

- Hypertension is a major risk factor for heart and vascular disease and is an important cause of death around the world.
- Hypertension is more common at older ages, and affects 6 in 10 people aged 60 to 79.
- In a number of countries, including Canada, hypertension control is more successful in older men than in older women.

What does this study add?

- Among people aged 60 to 79 who were using antihypertensive medication, the condition was controlled in a significantly higher percentage of men (83%) than women (70%).
- In people with hypertension aged 60 to 79, antihypertensive use was similar in men (84%) and women (89%).
- The number of medications used did not differ by sex, although women were more likely than men to be using thiazide diuretics (33% versus 19%).
- Even when age, co-morbidity, type of medication used, body mass index and socio-demographic characteristics were taken into account, women aged 60 to 79 using antihypertensive medication had higher measured systolic blood pressure and pulse pressure than did men.

Figure 3
Percentage distribution of pulse pressure (mm Hg) in people with hypertension who are using antihypertensive medication, by sex, household population aged 60 to 79, Canada, 2007 to 2009



Source: 2007 to 2009 Canadian Health Measures Survey.

antihypertensive medication used, age, co-morbidity and other risk factors for hypertension are taken into account, the odds of uncontrolled hypertension are nearly twice as high in women. The finding of higher SBP and PP in older women with hypertension than in their male counterparts is consistent with other observations.^{3,25}

Previous research has revealed higher levels of low density lipids (LDL) and blood glucose in hypertensive women than in men, factors that were also related to poor hypertension control.^{25,26} By contrast, analysis of the CHMS data indicated nearly equal average levels of blood glucose in women and men with hypertension, and a lower average ratio of total to HDL cholesterol (and thus a lower LDL level) in women with hypertension. Furthermore, multivariate analysis revealed no association between hypertension control and cholesterol,

Table 3
Odds ratios relating female sex and other characteristics to uncontrolled hypertension, household population aged 60 to 79, Canada, 2007 to 2009

Characteristics	Model 1			Model 2			Model 3			Model 4			Model 5		
	Odds ratio	95% confidence interval from	to	Odds ratio	95% confidence interval from	to	Odds ratio	95% confidence interval from	to	Odds ratio	95% confidence interval from	to	Odds ratio	95% confidence interval from	to
Demographic/Socio-economic															
Men [†]	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...	1.0	...	...
Women	2.1*	1.2	3.9	1.9*	1.0	3.7	2.0*	1.1	3.7	2.0*	1.1	3.7	2.1*	1.1	3.8
Age (years) [‡]	1.1*	1.0	1.1	1.1*	1.0	1.1	1.1*	1.0	1.1	1.1*	1.0	1.1	1.1*	1.0	1.1
Secondary school graduation [§]	0.8	0.4	1.3	0.8	0.5	1.3	0.8	0.5	1.3	0.8	0.5	1.3
Leisure-time physical activity level															
Inactive^{††}	...	...	...	1.4	0.6	3.3	1.4	0.6	3.4	1.4	0.6	3.3	1.4	0.6	3.3
Physical measures															
Body mass index [‡]	1.0	0.9	1.1	1.0	0.9	1.1	1.0	0.9	1.1	1.0	0.9	1.1
Ratio of total to HDL cholesterol [‡]	1.0	0.8	1.3	1.0	0.8	1.3	1.0	0.8	1.3	1.0	0.8	1.3
Co-morbidity															
Diabetes^{††}	...	...	...	2.6*	1.5	4.7	2.7*	1.5	4.8	2.6*	1.5	4.6	2.7*	1.5	4.6
Heart disease^{††}	...	...	...	0.6	0.3	1.2	0.6	0.3	1.1	0.6	0.3	1.2	0.6	0.3	1.2
Type of antihypertensive medication used															
Thiazide diuretics^{††}	...	...	...	1.5	0.7	3.0	...	...	...	...	...	...	...	...	...
Calcium channel antagonists^{††}	...	...	...	...	...	...	...	...	...	...	...	...	0.9	0.5	1.5
Agents acting on renin-angiotensin system^{††}	...	...	...	...	...	...	0.8	0.3	2.3	...	...	...	...	...	...
Beta blockers^{††}	...	...	...	...	...	...	...	...	...	1.2	0.4	3.4	...	...	...

[†] reference category

[‡] used as continuous variable

[§] reference category is less than secondary school graduation

^{††} reference category is absence of characteristic

* significantly different from reference category (p<0.05)

... not applicable

Note: Hypertension is measured systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg (≥130 or ≥80 mm Hg for people with diabetes).

Source: 2007 to 2009 Canadian Health Measures Survey.

although small sample size limited the analysis.

The negative association between SBP and heart disease is somewhat paradoxical, as it would be expected that people with heart disease would be more likely to have higher BP. The finding may reflect more careful medical management of persons with heart disease.

Patterns of pharmaceutical treatment for hypertension differ somewhat between older men and women. Men's lower likelihood of using thiazide diuretics has been noted elsewhere,^{7,8} and may stem from concern about the effects of these drugs on erectile function.^{27,28} Research suggests that diuretics are especially effective in reducing SBP, and should be the first drug used in treating hypertension.^{20,29} In this regard, the CHMS data provide no evidence that men are receiving preferential treatment. Nor are men being more aggressively treated: nearly equal percentages of men and women are using three or more types of antihypertensive medication.

The higher PP in women than in men has been observed in other older populations.^{10,30} Sex-related biological factors may explain the difference—specifically, lowered estrogen levels after menopause may contribute to a decrease in aortic diameter, resulting in a rise in PP.

Hypertension remains uncontrolled in one-sixth of men and nearly one-third of women aged 60 to 79 who are using antihypertensive medication. However, comparisons with data from the United States indicate a Canadian advantage in hypertension control. In 2005, among a representative sample of Americans aged 65 to 80 under care for hypertension, the condition was uncontrolled in 37% of men and 47% of women.⁸ Estimates from the population-

based 2007-2008 National Health and Nutrition Examination Survey indicate uncontrolled hypertension in more than 50% of older, community-dwelling Americans with the condition.³¹

Limitations

The CHMS response rate was just over 50%, meaning that in nearly half of households contacted, arrangements could not be made for a resident to participate. Although adjustments were made to the survey weights to ensure that the sample is representative of the target population according to socio-demographic characteristics, differences in health status (specifically, BP) were not accounted for.

The data are cross-sectional, so a temporal relationship between individual characteristics and hypertension control cannot be inferred. In particular, the sex disparity in uncontrolled hypertension may be partly due to incidence-prevalence bias.³² Because being male is a strong risk factor for cardiovascular mortality independent of hypertension,³³ men with uncontrolled hypertension are more likely to die sooner than their female counterparts. Thus, the higher prevalence of uncontrolled hypertension in women aged 60 to 79 may be partly because men with uncontrolled hypertension are more likely to die from causes related to the condition than are women, and at younger ages. As a result, by age 60, the higher prevalence of uncontrolled hypertension in women might be partly due to their better chance of survival with the condition at earlier ages, compared with men.

The validity of information based on self-reported data (education, income, marital status, physical activity, disease prevalence, smoking) is unknown.

A small percentage of respondents who were identified as having hypertension based on medication use may have been misclassified, because antihypertensive medication may occasionally be prescribed for other conditions. But, of current users of medications classified as antihypertensive agents (according to the DIN), equivalent percentages of men (13.6%) and women (13.7%) reported that they were *not* taking medication for “high blood pressure.” Therefore, this potential source of misclassification probably did not contribute to the differences observed between the sexes in BP control.

The CHMS provides no information on some potentially relevant characteristics, including medication adherence and daily sodium consumption.

Small sample size precluded examination of specific antihypertensive medications, or combinations thereof, in relation to hypertension. Also, in some instances, failure to attain statistical significance may have been due to small sample size.

Conclusion

This analysis suggests that the higher likelihood of hypertension control in older men than women is not explained by differences in age, co-morbidity, type of antihypertensive medication used, BMI, or socio-demographic characteristics. Because of the widespread prevalence of hypertension among older Canadians and its importance as a risk factor for cardiovascular disease and stroke, understanding of sex-specific factors related to hypertension control remains an important issue. Future cycles of the CHMS will provide an opportunity to continue to explore factors underlying the differences in hypertension control between older men and women. ■

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Iron sufficiency of Canadians

by Marcia Cooper, Linda Greene-Finestone, Hélène Lowell, Johanne Levesque and Stacey Robinson

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Abstract

Background

Iron deficiency is the most common nutritional deficiency in the world, but little is known about the iron status of people in Canada, where the last estimates are from 1970-1972.

Data and methods

The data are from cycle 2 (2009 to 2011) of the Canadian Health Measures Survey, which collected blood samples from a nationally representative sample of Canadians aged 3 to 79. Descriptive statistics (percentages, arithmetic means, geometric means) were used to estimate hemoglobin and serum ferritin concentrations, and other markers of iron status. Analyses were performed by age/sex group, household income, self-perceived health, diet, and use of iron supplements. World Health Organization reference values (2001) were used to estimate the prevalence of iron sufficiency and anemia.

Results

The overall prevalence of anemia was low in the 2009-to-2011 period—97% of Canadians had sufficient hemoglobin levels. Generally, hemoglobin concentration increased compared with 1970-1972; however, at ages 65 to 79, rates of anemia were higher than in 1970-1972. Depleted iron stores were found in 13% of females aged 12 to 19 and 9% of females aged 20 to 49. Lower household income was associated with a lower prevalence of hemoglobin sufficiency, but was not related to lower serum ferritin sufficiency. Self-perceived health and diet were not significantly associated with hemoglobin and serum ferritin levels.

Interpretation

The lack of a relationship between iron status and diet may be attributable to the use of questions about food consumption frequency that were not specifically designed to estimate dietary iron intake. Factors other than iron intake might have contributed to the increase in the prevalence of anemia among seniors.

Keywords

Anemia, dietary supplements, ferritin, hemoglobin, nutritional status

Authors

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Iron is essential for biochemical functions in the body at every stage of life. The physiological manifestations of iron-deficiency anemia include reduced immune function and resistance to infection, impaired cognitive performance and behaviour, decreased thermoregulatory performance and energy metabolism, diminished exercise or work capacity, and increased incidence of preterm deliveries and low birthweight infants.^{1,2} In developed countries, iron deficiency and iron-deficiency anemia may be caused by inadequate intake of dietary iron, consumption of poorly available forms of iron, or diminished iron absorption due to dietary inhibitors. Increased demands for iron because of growth, menstrual losses, or pregnancy may also be factors.³

Iron deficiency affects 20% to 25% of the world population,⁴ with iron-deficiency anemia the most common type of anemia. In the United States, the prevalence of iron-deficiency anemia among youth and adults is estimated at 2% to 5% in females and 1% to 2% in males.⁵ The last national estimates of the iron status of Canadians were based on the 1970-1972 Nutrition Canada Survey.⁶ At that time, the overall prevalence of “high risk” of anemia (Hb < 100 g/L) was minimal (less than 1.5%) among women

overall.⁷ At ages 10 to 19, “high risk” of anemia was 0.4% among males and 0.0% among females.⁷

This study uses data from cycle 2 (2009 to 2011) of the Canadian Health Measures Survey (CHMS) to update estimates of the iron status of Canadians. These data allow for the examination of associations between selected socio-demographic and health variables and measures of iron status.

Stages of iron depletion

Body iron is found primarily in hemoglobin, the protein in red blood cells that carries oxygen to tissues.⁸ The amount of iron stored in the body is directly related to the serum ferritin level (amount of ferritin in the blood). Iron deficiency is typically defined in three stages of increasing severity: iron storage depletion as indicated by low serum ferritin; mild iron deficiency without anemia, based on laboratory evidence of iron-deficient erythropoiesis; and overt iron-deficiency anemia.

Although serum ferritin is a valid measure of total iron storage,^{9,10} as a sole indicator of iron deficiency, it must be interpreted cautiously; concentrations could increase as a result of infections and disorders such as chronic inflammation, malignancy and liver disease.¹¹ In developed countries, this usually occurs too infrequently at the population level to change the value of serum ferritin in nutrition surveys.¹¹

During the second stage of iron deficiency, transport iron decreases. A reduction in the size of circulating red blood cells, measured as the mean corpuscular volume, is a reliable indication of reduced hemoglobin synthesis; low values can indicate iron-deficient erythropoiesis.¹¹

The final stage—iron-deficiency anemia—is often characterized by a reduction in the blood concentration of hemoglobin.⁸ Because micronutrient deficiencies (notably, vitamin B₁₂, folate and vitamin A) and infections that lead to inflammation are other (less frequent) causes of anemia,¹² hemoglobin concentration should be combined with other measures to establish iron deficiency as the cause of anemia.¹³

Methods

Data source

The CHMS covers the population aged 3 to 79. The cycle 2 sample represented approximately 96% of the population. Residents of Indian reserves and Crown lands, institutions and certain remote regions, and full-time members of the

Canadian Forces were excluded. Data were collected at 18 sites across Canada from August 2009 through November 2011.¹⁴ The survey consisted of a face-to-face household interview to obtain demographic, socio-economic, health, nutrition and lifestyle information, and a subsequent visit to a mobile examination centre for a series of direct physical measurements including collection of blood and urine samples.¹⁴

About three-quarters (75.9%) of the households selected for cycle 2 agreed to participate; 90.5% of them completed the household questionnaire, and 81.7% of those that completed the household questionnaire attended the mobile examination centre. The total sample was comprised of 6,395 respondents. The overall response rate was 55.5%.¹⁴ Because two people were selected in some households, this rate is not the result of multiplying the household and person response rates. Survey weights produced for the CHMS were used to account for the different stages of non-response. Characteristics of the sample can be found in Appendix Table A.

Data for 1970-1972 from Nutrition Canada^{7,15} were used as a reference to compare iron status prevalence estimates.

Blood collection

Blood was collected by venipuncture. A lavender-top EDTA vacutainer of whole blood specimen was collected for the complete blood count analysis. Blood was collected in SST-Red/Grey or Gold top vacutainers, and the serum was separated and processed for the ferritin analysis. The sample size for all hemoglobin, serum ferritin and mean corpuscular volume results was 6,008 respondents.

Standardized procedures and quality control monitoring were developed for the collection, processing, aliquoting and analysis of biospecimens and for shipping them to the testing laboratory.

Complete blood count analysis

Whole blood was analyzed for the complete blood count at the mobile examination centre laboratory using the

Beckman Coulter HmX Hematology Analyzer. The laboratory participates in proficiency testing programs and has strict quality control procedures. The complete blood count analysis included determination of hemoglobin and of mean corpuscular volume.

Ferritin analysis

Serum aliquots were frozen at -20°C and shipped once a week on dry ice to the Health Canada Nutrition Laboratory. Serum was analysed for ferritin by solid phase, two-site chemiluminescent immunometric assay using the Immulite 2000 (Siemens HealthCare Diagnostics).

Internal quality control and standardized procedures were developed for every assay performed in this laboratory. The Health Canada Nutrition Laboratory participates in the College of American Pathologists Proficiency Testing Program.

Vitamin B₁₂ and red blood cell folate analysis

Vitamin B₁₂ and folate deficiency were investigated to determine if factors other than iron deficiency contributed to the prevalence of anemia. Serum vitamin B₁₂ and red blood cell folate analyses were performed on the Immulite 2000.

Reference values

World Health Organization reference values by sex and age group¹⁶ were used to estimate iron sufficiency (Appendix Table B). Hemoglobin concentration alone was used as a measure of anemia.¹⁷ Serum ferritin concentration is commonly used as an indicator of iron deficiency because it reflects tissue stores.^{9,10} Mean corpuscular volume was also used to determine if low hemoglobin concentrations were associated with iron deficiency. Measures above serum ferritin and hemoglobin reference values provided estimates of the prevalence of sufficient iron stores and/or the absence of anemia.

For the most part, the analysis, presents estimates of *sufficiency* (at or above reference values), because this measure yielded larger sample sizes,

resulting in a significant decrease in sampling variability, and thus, more reliable estimates than measures of deficiency (below the reference values). The reference values for vitamin B₁₂ deficiency and red blood cell folate deficiency were: < 148 pmol/L¹⁸ and < 320 nmol/L, respectively.¹⁹

Covariates

Age, sex, household income and self-perceived health were examined for associations with hemoglobin and serum ferritin levels. Six age groups were specified: 3 to 5, 6 to 11, 12 to 19, 20 to 49, 50 to 64, and 65 to 79 years. Household income during the past 12 months was based on the total income (before taxes and deductions) of all household members divided by the number of people in the household. Respondents reported total household income as a best estimate or within a range, the midpoint of which was used for calculations. These adjusted household income values were grouped into approximate quartiles.

Respondents' self-perceived health was categorized as excellent/very good/good or fair/poor.

Associations between diet and iron sufficiency status were determined based on responses to questions in the household interview about the frequency of consumption of: red meat (including beef, pork, lamb, liver and other organ meats), beef/pork hot dogs, and sausage or bacon; fortified non-heme iron sources (including hot/cold cereal, brown/white bread and pasta); and vegetables and fruit.

Respondents answered questions about medication use in the past month, including prescriptions, over-the-counter medications, and health products and herbal remedies. Reported medications were classified based on the Anatomical Therapeutic Chemical Classification System and the Defined Daily Dose.²⁰ Iron supplement users were categorized as: 1) those consuming only multivitamins containing 5 to 30 mg of ferrous iron (Fe²⁺) per defined daily dose (with corresponding limits for the

various ferric iron (Fe³⁺) salts); and 2) those consuming iron preparations and all combination products containing more than 30 mg Fe²⁺ (or corresponding amounts of Fe³⁺ salts) per defined daily dose, with or without multivitamins.

Statistical analyses

All analyses used the CHMS survey weights generated by Statistics Canada to represent the Canadian population aged 3 to 79. Analyses were conducted in SAS²¹ and SUDAAN²² softwares (using DDF=13 in SUDAAN). Percentages, arithmetic means, geometric means for serum ferritin, and 95% confidence intervals were calculated. Student's t-test was used to test differences between percentages, arithmetic means, and geometric means. Statistical significance was determined at $p < 0.05$, but was Bonferroni-adjusted depending on the number of comparisons.²³

Results

Hemoglobin

The mean hemoglobin concentration among Canadians aged 3 to 79 was 142 g/L. Concentrations were significantly higher among males than females (Table 1). For both sexes, hemoglobin values tended to be relatively low among the youngest and oldest age groups, with the lowest mean among children aged 3 to 5 (127 g/L). The mean concentration among males was highest at ages 20 to 49 (153 g/L). For females older than age 5, mean concentrations were relatively consistent across age groups (132 to 136 g/L), although women aged 50 to 64 had a significantly higher concentration than did girls aged 6 to 11.

For 97% of people aged 3 to 79, hemoglobin levels were at or above age group and sex reference values, indicating that they were not anemic. Hemoglobin sufficiency ranged from

Table 1
Mean hemoglobin, mean corpuscular volume, and ferritin concentrations, by age group and sex, household population aged 3 to 79, Canada, 2009 to 2011

Age group (years)/ Sex	Hemoglobin (g/L)			Mean corpuscular volume (fL)			Serum ferritin (µg/L)		
	Arithmetic mean	95% confidence interval		Arithmetic mean	95% confidence interval		Geometric mean	95% confidence interval	
		from	to		from	to		from	to
Total 3 to 79	142	141	143	90	90	91	81	79	84
Male	149*	148	150	90	90	91	128*	123	133
Female	134	133	135	90	90	91	52	48	55
Total 3 to 5	127	126	128	83	83	84	33	29	38
Males									
6 to 11	131	130	133	84	83	85	40	36	45
12 to 19	148**†	146	150	88†	87	89	58**†	53	64
20 to 49	153**†‡	151	154	91†	90	91	164**†	152	177
50 to 64	150**†‡	148	151	92†	91	93	166**†	148	187
65 to 79	147**§	145	150	93†	92	94	155**†	138	175
Females									
6 to 11	132	130	134	85	83	87	42	38	45
12 to 19	134	132	136	89†	88	90	32†	28	36
20 to 49	135	134	136	91†‡	90	91	41†	38	44
50 to 64	136†	134	137	92†§	91	93	85†§	73	98
65 to 79	133	131	135	92†§	91	93	89†§	74	107

* significantly different from females ($p < 0.05$)

† significantly different from ages 6 to 11 of same sex ($p < 0.05$ adjusted for number of comparisons)

‡ significantly different from ages 12 to 19 of same sex ($p < 0.05$ adjusted for number of comparisons)

§ significantly different from estimate for ages 20 to 49 of same sex ($p < 0.05$ adjusted for number of comparisons)

Source: 2009 to 2011 Canadian Health Measures Survey.

a low of 90% among women aged 65 to 79 to nearly 100% for males aged 12 to 19. Hemoglobin sufficiency was significantly higher for males than females, a reflection of percentages close to 100% among males aged 12 to 19 and 20 to 49 (Table 2). In total, based on their hemoglobin concentration, 4% of females were anemic.

A comparison of 2009 to 2011 CHMS data with results of the 1970-1972 Nutrition Canada Survey, taking differences in age groups and hemoglobin reference values into account, suggests that at most ages, the percentage of people with hemoglobin concentrations above reference values has risen during the past 40 years (Table 2). The exception is the 65-to-79 age group, among whom the prevalence of hemoglobin sufficiency is now lower (90% for women; 93% for

men) than in the early 1970s (94% for women; 96% for men).¹⁵

Serum ferritin

According to the 2009 to 2011 CHMS, the geometric mean serum ferritin concentration among Canadians was 81 µg/L. Concentrations were significantly higher among males than females. The range among females was from 32 µg/L (ages 12 to 19) to 89 µg/L (ages 65 to 79), and among males, from 40 µg/L (ages 6 to 11) to 166 µg/L (ages 50 to 64) (Table 1).

Although 96% of Canadians had sufficient serum ferritin concentrations, the figure was significantly higher among males (99%) than females (92%). This difference reflected higher sufficiency for males than females at ages 12 to 19 (99% versus 87%) and 20 to 49 (99% versus

91%) (Table 3). The highest prevalence of *insufficient* serum ferritin was among females aged 12 to 19 (13%).

Anemia

Approximately 3% of Canadians had anemia (low hemoglobin). Anemia, however, can be caused not only by low iron, but by other factors.

Serum ferritin and mean corpuscular volume concentrations indicate if low hemoglobin is due to iron depletion—very low percentages of sufficiency in these measures would be expected if that was the case. Yet among low-hemoglobin individuals, 75% had mean corpuscular volume concentrations above reference values, and 62% had serum ferritin concentration or mean corpuscular volume above reference values (data not shown). If the low hemoglobin was primarily a result of low iron, these percentages would be drastically lower. This suggests that the anemia may not have been due to iron deficiency.

Overall, 85% of people with anemia had sufficient vitamin B₁₂ levels. However, at ages 65 to 79, the ages at which anemia was most prevalent, vitamin B₁₂ sufficiency was low (72%), particularly for women (59%).

Red blood cell folate levels were sufficient for all age/sex groups, and therefore, did not appear to be associated with anemia.

Income, health, diet, and supplement use

Mean hemoglobin concentrations were significantly lower among residents of households in the lowest income quartile, compared with those in the highest: 140 g/L versus 143 g/L (data not shown). Similarly, the prevalence of hemoglobin sufficiency was significantly lower among people in the lowest income quartile, compared with the highest. Mean serum ferritin concentrations did not differ significantly by household income quartile (data not shown).

People in good/very good/excellent health had significantly higher mean hemoglobin concentrations than did

Table 2
Prevalence of sufficient hemoglobin, by age group and sex, household population aged 3 to 79, Canada, 1970-1972 and 2009 to 2011

Age group (years)/ Sex	Greater than or equal to reference value for age group			
	1970-1972 [†]		2009 to 2011	
	%	%	95% confidence interval	
			from	to
3 to 5	99.0	99.5	98.0	100.9
6 to 11				
Males	95.4	96.9	94.0	99.8
Females	95.4	97.1	94.3	100.0
12 to 19				
Males	98.6	99.8*	99.5	100.1
Females	96.1	96.8	95.1	98.5
20 to 49				
Males	98.7	99.1*	97.4	100.8
Females	94.4	96.3	94.8	97.9
50 to 64				
Males	96.5	98.9	97.9	99.9
Females	94.4	96.6	93.5	99.7
65 to 79				
Males	94.3	92.8	90.2	95.5
Females	96.0	89.9	84.0	95.8

* significantly different from females (p<0.05)

[†] Nutrition Canada age groups (years) are 0 to 4, 5 to 9, 10 to 19, 20 to 39, 40 to 64, and 65 or older

Source: 2009 to 2011 Canadian Health Measures Survey; 1970-1972 Nutrition Canada Survey.

Table 3
Prevalence of sufficient serum ferritin, by age group and sex, household population aged 3 to 79, Canada, 2009 to 2011

Age group (years)/ Sex	Greater than or equal to reference value for age group		
	%	95% confidence interval	
		from	to
3 to 5	96.8	95.0	98.6
6 to 11			
Males	97.6	95.0	100.2
Females	98.7	97.9	99.4
12 to 19			
Males	99.1*	98.3	99.8
Females	86.9	82.4	91.4
20 to 49			
Males	98.7*	97.5	99.9
Females	90.9	87.2	94.6
50 to 64			
Males	98.6	97.1	100.1
Females	94.3	89.4	99.2
65 to 79			
Males	99.9	99.6	100.1
Females	93.9	85.0	102.7

* significantly different from females (p<0.05)

Source: 2009 to 2011 Canadian Health Measures Survey.

Table 4

Prevalence of sufficient hemoglobin and serum ferritin, by use of iron supplements, age group and sex, household population aged 3 to 79, Canada, 2009 to 2011

Supplement use/ Age group (years)/ Sex	Greater than or equal to reference value for age group					
	Hemoglobin			Serum ferritin		
	%	95% confidence interval		%	95% confidence interval	
		from	to		from	to
No supplement use						
3 to 11	97.8	96.1	99.4	97.8	96.7	99.0
12 to 19						
Males	99.8	99.5	100.1	99.2	98.4	99.9
Females	96.6	94.5	98.7	88.0	83.5	92.5
20 to 79						
Males	98.3	96.9	99.6	99.1	98.5	99.7
Females	95.9	94.1	97.7	92.4	89.8	95.0
Multivitamins						
3 to 11	97.9	95.2	100.6	97.0	94.3	99.7
12 to 19						
Males	100.0	100.0	100.0	98.1	92.3	103.9
Females	98.0	93.0	103.1	87.7	73.1	102.2
20 to 79						
Males	98.6	96.7	100.5	96.9	92.2	101.5
Females	96.0	93.2	98.8	96.2	93.1	99.3
Iron preparations						
3 to 11	F	...	...	F	...	...
12 to 19						
Males	F	...	...	F	...	...
Females	96.4	83.5	109.3	60.4 ^E	17.5	103.3
20 to 79						
Males	86.5	65.7	107.3	F	...	...
Females	88.7	80.8	96.6	81.8	63.0	100.5

... not applicable

^E use with caution

F too unreliable to be published

Note: The iron preparations group includes 20 respondents who also took multivitamins.

Source: 2009 to 2011 Canadian Health Measures Survey.

those who rated their health fair/poor (data not shown). Mean serum ferritin concentrations and the prevalence of hemoglobin and serum ferritin sufficiency did not differ significantly by self-perceived health (data not shown).

No association emerged between mean hemoglobin or serum ferritin concentrations and the consumption of red meat, grains, and fruit and vegetables (data not shown).

An estimated 13% of Canadians aged 3 to 79 took iron-containing multivitamins, and 2% took iron

preparations (containing a therapeutic dose) with or without multivitamins. No significant differences in hemoglobin and serum ferritin sufficiency were apparent between those who took iron-containing multivitamins, compared with those who reported no iron supplementation (Table 4). However, adults aged 20 to 79 taking iron preparations had a lower hemoglobin concentration (130 g/L) than did those not taking supplements (144 g/L) and those taking multivitamins only (143 g/L) (data not shown). Similarly, the mean serum ferritin concentration of

adults consuming iron preparations was significantly lower (41 µg/L) than that of adults not consuming supplements (100 µg/L) (data not shown).

Discussion

Based on data from the 2009 to 2011 CHMS, the majority of Canadians are not anemic—90% to 100% of individuals in each age/sex group had hemoglobin concentrations considered sufficient. As well, 93% had both hemoglobin and serum ferritin levels above reference values, suggesting that iron-deficiency anemia was not widespread.

However, at ages 12 to 19, only 85% of females had both hemoglobin and serum ferritin sufficiency, indicating a higher risk of iron-deficiency anemia; 13% had serum ferritin levels below the reference values. These results are consistent with four small-scale Canadian studies that documented similar or higher percentages of adolescents (male and female) with low serum ferritin.²⁴⁻²⁷

Although this analysis focused on iron *sufficiency*, it is possible to report some estimates of iron *deficiency*. Around 5% of Canadians 3 to 79 (8% of females) had low serum ferritin concentrations, suggesting low iron stores.

The comparison with 1970-1972 Nutrition Canada data suggests that the prevalence of anemia is currently lower in all age groups younger than 65. But among seniors, the prevalence of anemia is now higher, particularly for women. Even so, nearly 80% had either sufficient mean corpuscular volume (normally sized red blood cells) or sufficient serum ferritin levels. Therefore, the apparent increase in the prevalence of anemia at ages 65 to 79 may be attributable to factors other than iron deficiency. For example, vitamin B₁₂ deficiency is a cause of pernicious anemia, with an average age at diagnosis of 60.²⁸ Nonetheless, according to the 2009 to 2011 CHMS, approximately three-quarters of 65- to 79-year-olds with anemia were sufficient in vitamin B₁₂. Red blood cell folate did not appear to contribute to anemia. As well, blood lead levels are low among Canadians.²⁹

What is already known on this subject?

- Iron deficiency is associated with health risks, such as reduced immune function and diminished exercise or work capacity.
- Although iron deficiency is common in the world population, the 1970-1972 Nutrition Canada Survey reported a low risk of iron-deficient anemia among Canadians.
- More recent smaller-scale studies have indicated some Canadian subgroups are at a greater risk of low iron status.

What does this study add?

- The prevalence of anemia remains low in the Canadian population overall.
- Compared with 40 years ago, higher rates of anemia were found among seniors.
- Self-perceived health and selected dietary items were not significantly associated with hemoglobin and serum ferritin levels.

Socio-economic status may influence determinants of iron status. For instance, higher-income households could have greater access to iron-rich foods.²⁴ Based on the CHMS results, residents of households in the lowest income quartile had a lower mean concentration of hemoglobin and a lower prevalence of hemoglobin sufficiency than did people in the highest income quartile. However, this pattern did not persist when serum ferritin was used as a measure of iron stores.

Self-perceived health was not associated with hemoglobin or serum ferritin sufficiency. However, mean hemoglobin was higher among people who reported that they were in good/very good/excellent health. This is consistent with other research findings for young women with depleted iron stores,^{30,31} though in contrast to those with anemia.³¹

Although diet is related to iron status, no relationship was found with red meat, grain, or fruit and vegetable consumption. However, CHMS data on dietary iron intake were limited. The questionnaire assessed the frequency, not the amount, of consumption of a partial list of dietary sources of iron. Hence, the variables may not have been specific enough to estimate iron intake and its dietary inhibitors and enhancers. Additionally, information about meat did not include the full scope of meat consumption, thereby potentially underestimating heme iron intake. A recent study³² found a weak association between red meat consumption and iron status. As well, other evidence indicates adequate dietary iron intake by much of the population. In the 2004 Canadian Community Health Survey—Nutrition, the prevalence of inadequate dietary intake of iron was generally low (less than 3%) for most age/sex groups; the exception was females aged 14 to 50 (12% to 18%).³³

Use of iron-containing multivitamins was not related to hemoglobin and serum ferritin levels or their adequacy. This may reflect insufficient absorption of the non-heme iron (5 mg to 30 mg per tablet) in the supplement as a result of iron inhibitors such as calcium in the diet. Furthermore, absorption of iron from multivitamins may be reduced in iron-replete individuals.³⁴ People taking higher, therapeutic doses of iron (ferrous

fumarate, ferrous sulphate, ferrous gluconate) appeared to be a different group, as evidenced by their lower hemoglobin and serum ferritin levels. These findings should be interpreted cautiously, as no information was collected about dosage, frequency of use, timing of intake, or reason for taking high-dose supplements.

Limitations

A number of limitations are associated with this analysis.

The CHMS excluded infants and Aboriginal people living on reserves. Furthermore, because this is a national sample, regional differences cannot be determined.

Using hemoglobin alone to identify iron deficiency anemia tends to yield overestimates, because anemia due to other causes is included.⁸ However, this study attempted to account for some of these causes, such as vitamin B₁₂ and red blood cell folate deficiency.

The CHMS did not include other iron indices such as soluble transferrin receptor, which could have been helpful in distinguishing iron-deficiency anemia from all-cause anemia.³⁵

Conclusion

For the first time since the early 1970s, iron indices were measured for the Canadian population. The prevalence of anemia was generally low, although depleted iron stores were detected in 9% of women aged 20 to 49, and 13% of females aged 12 to 19. While this study found higher rates of anemia among seniors, factors other than iron deficiency may have contributed to this result. ■

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Appendix

Table A
Percentage distribution of sample with valid whole blood hemoglobin, mean corpuscular volume and serum ferritin concentrations, by sex, age group, household income and self-perceived health, household population aged 3 to 79, Canada, 2009 to 2011

Sex/Age group/ Household income quartile/ Self-perceived health	Number	%	95% confidence interval	
			from	to
Total	6,008	100.0	...	...
Sex				
Males	2,911	50.2	49.9	50.4
Females	3,097	49.8	49.6	50.1
Age group (years)				
3 to 5	487	2.8	2.6	3.1
6 to 11	950	6.2	5.9	6.5
12 to 19	991	10.2	9.9	10.4
20 to 49	2,042	47.2	45.5	48.9
50 to 64	874	22.8	20.8	25.0
65 to 79	664	10.8	10.0	11.6
Household income quartile (past 12 months)				
1 (lowest)	1,556	27.1	22.8	31.9
2	1,539	22.5	19.4	25.8
3	1,470	24.7	21.8	27.8
4 (highest)	1,443	25.7	21.2	30.9
Self-perceived health				
Excellent	1,502	16.9	15.5	18.4
Very good	2,273	38.2	35.6	40.9
Good	1,759	35.0	31.6	38.5
Fair	382	7.5	6.3	8.9
Poor	92	2.5 ^E	1.6	3.6

... not applicable

^E use with caution

Source: 2009 to 2011 Canadian Health Measures Survey.

Table B
World Health Organization hemoglobin, mean corpuscular volume and ferritin reference values for sufficiency, based on criteria, 2001

Age group (years)/ Sex	Hemoglobin (g/L)	Mean corpuscular volume (fL)	Serum ferritin (µg/L)
3 to 5	≥110	...	≥12
3 to 4	...	≥73	...
4	...	≥74	...
6 to 11	≥115	...	≥15
6 to 7	...	≥74	...
8 to 11	...	≥76	...
12 to 19	≥120	...	≥15
Females			
12 to 14	...	≥77	...
15 to 17	...	≥78	...
18 to 19	...	≥81	...
Males			
12 to 14	...	≥77	...
15 to 17	...	≥79	...
18 to 19	...	≥80	...
20 to 49	...	≥81	≥15
Non-pregnant women	≥120	...	...
Pregnant women	≥110	...	...
Men	≥130	≥80	...
50 to 79			
Non-pregnant women	≥120	≥80	≥15
Men	≥130	...	...

... not applicable

Source: World Health Organization (WHO)/UNICEF/UNU. *Iron Deficiency Anaemia: Assessment, Prevention, and Control. A Guide for Programme Managers*. Geneva: World Health Organization, 2001.

Health behaviour changes after diagnosis of chronic illness among Canadians aged 50 or older

by Jason T. Newsom, Nathalie Huguet, Pamela L. Ramage-Morin, Michael J. McCarthy, Julie Bernier, Mark S. Kaplan and Bentson H. McFarland

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Abstract

Changes in health behaviours (smoking, physical activity, alcohol consumption, and fruit and vegetable consumption) after diagnosis of chronic health conditions (heart disease, cancer, stroke, respiratory disease, and diabetes) were examined among Canadians aged 50 or older. Results from 12 years of longitudinal data from the Canadian National Population Health Survey indicated relatively modest changes in behaviour. Although significant decreases in smoking were observed among all groups except those with respiratory disease, at least 75% of smokers did not quit. No significant changes emerged in the percentage meeting physical activity recommendations, except those with diabetes, or in excessive alcohol consumption, except those with diabetes and respiratory disease. The percentage reporting the recommended minimum fruit and vegetable intake did not increase significantly among any group.

Keywords

Aged, cancer, diabetes, disease management, exercise, heart disease, lifestyle, middle age, nutrition, respiratory disease, secondary prevention, smoking cessation, stroke

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Heart disease, cancer, stroke, respiratory disease and diabetes are among the leading causes of death in Canada.¹ Worldwide, these chronic conditions account for 60% of all deaths.² Since they are influenced by modifiable behaviours, they are considered largely preventable.^{3,4} For people with a chronic illness, adopting a healthier lifestyle, such as smoking cessation, increased physical activity, eliminating heavy alcohol consumption and improving diet, can extend longevity, reduce the recurrence of an event and enhance quality of life.⁵⁻⁷

Population-level information about lifestyle changes among people diagnosed with chronic conditions is lacking. Previous studies have examined behaviour change among small samples of individuals with a specific condition, and many studies have been based on retrospective accounts.^{8,9} As well, most research on secondary prevention has taken place in the United States where access to health care and behaviour modification programs is variable. Only a handful of studies have been conducted in Europe or Australia where access to health care is more universal.^{10,11} A literature review did not reveal any studies that used population-based data for Canada.

The present analysis examines changes in smoking, physical activity,

alcohol consumption and diet in a representative sample of Canadians aged 50 or older diagnosed with a major chronic condition (see *The data*). Based on prospective design, in which behaviours are assessed before and after the diagnosis, the study avoids potential biases from retrospective accounts of post-diagnosis behaviour change.

Smoking cessation

Smoking cessation was the most commonly reported behaviour change—the percentage of people who smoked decreased significantly following the diagnosis of heart disease, diabetes, cancer and stroke (Table 1). Among people with heart disease, for example, the prevalence of smoking declined from around 14% to less than 11%. Those

Table 1**Prevalence of health behaviours pre- and post-diagnosis of selected chronic conditions by sex and age group, household population aged 50 or older, Canada, 1994/1995 to 2006/2007**

Selected chronic condition/ health behaviour	Total		Sex				Age group			
	Pre- diag- nosis	Post- diag- nosis	Men		Women		50 to 64		65 or older	
			Pre- diag- nosis	Post- diag- nosis	Pre- diag- nosis	Post- diag- nosis	Pre- diag- nosis	Post- diag- nosis	Pre- diag- nosis	Post- diag- nosis
Heart disease (number)	905		390		515		373		532	
Current smoker	14.4	10.8*	15.8	13.2 ^E	13.3	8.8 ^E	25.7	19.4 ^E	10.4	7.7
Physically active	51.6	53.9	54.3	60.2	49.4	48.7	47.1	58.5	53.5	51.9
Alcohol consumption										
Never or low	62.8	65.6	49.5	50.3	74.0	78.5 [†]	64.8	56.0	62.0	69.7 [‡]
Moderate	28.2	25.2	36.7	33.5	21.1	18.1 [†]	24.7 ^E	30.8	29.7	22.8 [‡]
Excessive	9.0	9.2 ^E	13.8	16.2 ^E	4.9 ^E	3.4 ^{†E}	10.6 ^E	13.3 ^E	8.3 ^E	7.5 ^E
5 or more daily fruit/vegetable servings	41.9	51.4	41.7 ^E	53.8	42.0 ^E	49.9	37.8 ^E	50.7	52.8 ^E	53.0 ^E
Diabetes (number)	478		196		282		253		225	
Current smoker	15.1	11.7*	16.5 ^E	13.1 ^E	14.1 ^E	10.7 ^E	20.7 ^E	14.7 ^E	12.3 ^E	10.1 ^E
Physically active	49.7	56.2*	53.5	64.2	47.0	50.7	48.4	64.2	50.4	51.7 [‡]
Alcohol consumption										
Never or low	66.8	72.5	53.2	61.8	76.3	80.6	64.2	71.6	68.2	73.1
Moderate	23.0	22.5	29.9	32.0	18.2 ^E	15.3 ^{†E}	25.6 ^E	21.5 ^E	21.6	23.1 ^E
Excessive	10.2 ^E	5.0 ^{*E}	16.9 ^E	F	5.5 ^E	F	10.2 ^E	6.9	10.2 ^E	F
5 or more daily fruit/vegetable servings	34.5 ^E	41.8	28.1 ^E	37.3 ^E	40.1 ^E	45.7 ^E	34.4 ^E	42.8 ^E	F	F
Cancer (number)	497		227		270		232		265	
Current smoker	17.2	13.5*	19.7 ^E	15.8 ^E	14.9 ^E	11.4 ^E	31.2 ^E	23.4 ^E	11.8 ^E	9.7 ^E
Physically active	49.8	51.9	51.4	57.1	48.4	47.3	44.6	57.3	52.1	49.6
Alcohol consumption										
Never or low	59.9	63.4	56.8	57.1	63.5	70.7	47.1	61.7	66.0	64.2
Moderate	30.5	29.9	33.5	F	27.2	F	40.7 ^E	26.4 ^E	25.7	31.5
Excessive	9.5 ^E	6.7 ^E	9.7 ^E	F	9.4 ^E	F	12.2 ^E	F	8.3 ^E	F
5 or more daily fruit/vegetable servings	37.9	43.2 ^E	33.9 ^E	32.9 ^E	40.8 ^E	50.9 ^E	39.9 ^E	54.9	32.5 ^E	F
Stroke (number)	368		156		212		100		268	
Current smoker	17.0	12.5 ^{*E}	16.2 ^E	14.7 ^E	17.6 ^E	10.6 ^E	34.7 ^E	26.2 ^E	13.8 ^E	10.0 ^E
Physically active	49.6	46.2	59.0	59.4	41.9	35.5 [†]	54.6 ^E	56.4 ^E	48.3	43.6
Alcohol consumption										
Never or low	70.1	77.4*	62.0	74.1	76.4	80.0	72.4	73.2	69.6	78.3
Moderate	19.2 ^E	F	F	F	F	F	F	F	F	F
Excessive	10.7 ^E	F	F	F	F	F	F	F	F	F
5 or more daily fruit/vegetable servings	F	33.0 ^E	F	F	F	F	F	F	F	F
Respiratory disease (number)	409		149		260		190		219	
Current smoker	25.2	23.9	26.3 ^E	24.7 ^E	24.5	23.4 ^E	36.2 ^E	33.0 ^E	21.0	20.4
Physically active	51.6	44.1*	58.2	52.5	47.2	38.6	55.4	59.3	49.9	37.4 [‡]
Alcohol consumption										
Never or low	64.0	56.7	56.6	43.6	68.4	64.5	46.0 ^E	48.1	71.6	60.4
Moderate	23.3	35.4*	22.8 ^E	F	23.5 ^E	F	27.6 ^E	38.3 ^E	21.4	34.1
Excessive	12.8 ^E	7.9 ^{*E}	20.6 ^E	F	F	F	26.4 ^E	F	7.0 ^E	F
5 or more daily fruit/vegetable servings	27.1 ^E	31.4 ^E	F	F	30.2 ^E	33.3 ^E	31.3 ^E	33.7 ^E	F	F

* significantly different from pre-diagnosis ($p < 0.05$)[†] pre- to post-diagnosis change significantly different from change among men ($p < 0.05$)[‡] pre- to post-diagnosis change significantly different from change among 50-to-64 age group ($p < 0.05$)^E use with caution

F too unreliable to be published

Notes: Tests of group differences by sex and age group were conducted using logistic regression in which post-test differences were predicted by group membership, controlling for pre-test differences. Significant differences indicate greater change from pre-test to post-test in one of the groups. Pre-values are based on the last interview wave in which respondents reported no diagnosis of the condition. Post-values are based on the same interview wave in which respondents reported diagnosis of the condition (0 to 2 years). Missing information for alcohol and fruit and vegetable consumption is due to small cell size ($n < 10$). Fruit and vegetable consumption data were available only for cycles 5 to 7.

Source: 1994/1995 to 2006/2007 National Population Health Survey, longitudinal square file.

diagnosed with respiratory disease were the exception—not only were they more likely to smoke before diagnosis (25%), but there was no significant decrease in the percentage who were smokers after diagnosis.

Except for those with respiratory disease, smokers' daily cigarette consumption fell significantly (Figure 1). This decline in smoking may, in part, be due to the new diagnosis, but it may also reflect a community-wide trend—even among the healthy comparison group, the percentage of current smokers ($N = 1,103$) decreased slightly over the two-year period from 23% to 21% ($p < .05$). However, regardless of the chronic

condition, the majority (approximately 75%) of those who smoked continued to do so after diagnosis (Table 1).

Leisure-time physical activity

Only people with diabetes reported a post-diagnosis increase in leisure-time physical activity. Initially, close to 50% of this population engaged in physical activity at least three times a week; after diagnosis, the figure was about 56%. In addition, only among people diagnosed with diabetes did average energy expenditure change significantly: from 1.1 to 1.4 kcal/kg/day ($p < .001$). Although significant, this increase is not large. Also, it was people aged 50 to

64 with diabetes who tended to become active; seniors were less likely to increase their activity.

And among people diagnosed with respiratory disease, the percentage who were physically active fell from 52% to 44%. Again, age was a factor, as seniors were more likely to become inactive post-diagnosis than were 50- to 64-year-olds.

This was in contrast to the pattern of physical activity among the healthy comparison group. Initially, this group ($N = 1,053$) was more likely to be physically active during leisure-time, and their likelihood of being active rose over the two-year period from 58% to 63% ($p < .05$).

The data

The longitudinal National Population Health Survey (NPHS) followed 17,276 individuals who were aged 12 or older in 1994/1995. Interviews were conducted every two years. The NPHS design, sampling procedures, data collection, and response rates by cycles are described in detail elsewhere.¹² Data for this study are from cycles 1 to 7 (1994/1995 to 2006/2007) and pertain to respondents aged 50 or older at the first cycle ($N=5,404$) who initially reported no chronic condition, but who, in a subsequent cycle, reported a new diagnosis of one of five chronic conditions. The mean age of the sample was 65.5 (SD = 10.3), and slightly more than half (54.1%) were women. The primary focus is a prospective comparison of pre- and post-diagnosis (two years) health behaviour among people reporting a new diagnosis during the 12 years covered by the study. Cycles 2 and 3 were used to examine health behaviour changes among a healthy comparison group who did not have any of the five health conditions.

At each cycle, respondents were asked, "Do you have any of the following long-term (lasting or expecting to last at least six months) conditions that have been diagnosed by a health care professional?" The five conditions selected for this analysis were "heart disease," "cancer" (skin cancer excluded), "effects of stroke," "chronic bronchitis or emphysema" (asthma excluded), and "diabetes."

The smoking measures used in this study were self-reported smoking status (never, former or current) and number of cigarettes per day.

Physical activity was measured by the reported frequency and duration of participation in 20 leisure-time activities (for example, walking for exercise, yoga) in the previous three months. Participation in any activity at least three times per week was considered "physically active." A continuous measure of energy expenditure (kcal/kg/day) was derived from the frequency and duration of activities.¹³

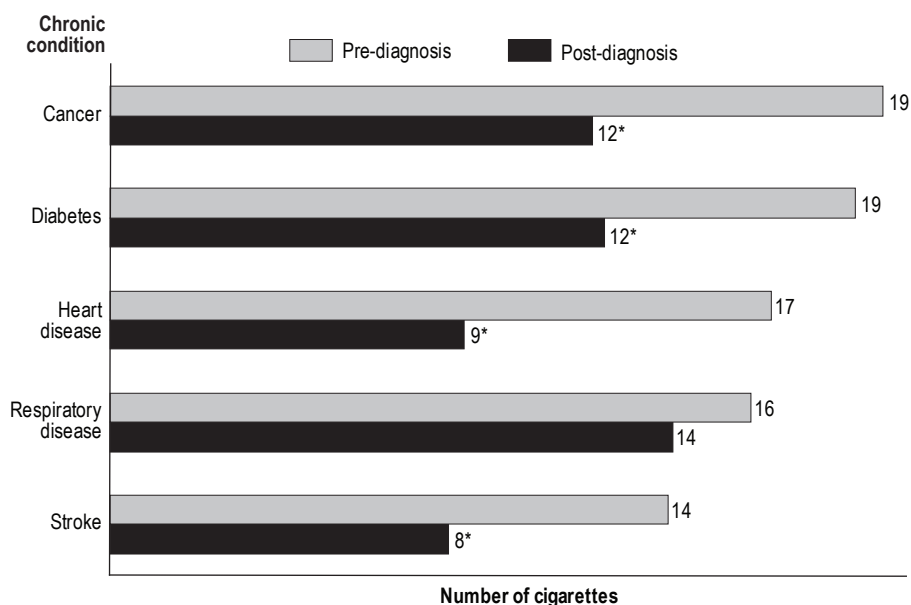
Respondents' alcohol consumption was defined as *never or low* (never drinks to less than 1 drink per week), *moderate* (2 or fewer drinks per day and 1 to 14 drinks per week for men; 2 or fewer drinks per day and 1 to 9 drinks per week for women), and *excessive* (more than 2 drinks per day or more than 14 drinks per week for men; more than 2 drinks per day or more than 9 drinks per week for women).¹⁴

Responses to six questions about the frequency of fruit and vegetable consumption were used to determine what percentage attained minimum recommended daily intake. The recommendation for servings per day is based on an average portion size of 80g, which, studies suggest, approximates the amount consumed on each occasion.¹⁵ The current target is seven servings of fruit and vegetables per day for Canadians older than age 50,¹⁶ but fewer than 12% of the sample reported consuming this amount. Therefore, respondents were classified as meeting the recommended minimum if they reported consuming fruit and vegetables five or more times per day. This is consistent with Canada's Food Guide recommendations before 1992,¹⁷ as well as the minimum recommended by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO),¹⁸ and in several other countries.¹⁷⁻²⁰ Diet information was available only for cycles 5, 6 and 7 of the NPHS.

Analyses were weighted and adjusted for the complex sampling design using SAS 9.2 or SUDAAN 10.0 with balance repeated replication. Rao-Scott chi-square²¹ obtained from SAS PROC SURVEYFREQ using discordant cells (0-1 versus 1-0 responses) was used to test for significant change between pre- and post-diagnosis.²² (The McNemar test, which is typically used for this comparison, is not available in SAS PROC SURVEYFREQ or SUDAAN.) Paired t-tests were used to compare pre- and post-diagnosis health behaviours with continuous measures. Logistic regression models controlling for pre-diagnosis levels of health behaviours were used to compare sex and age differences in health behaviour pre- and post-diagnosis. A significant coefficient for one of these socio-demographic variables indicates greater change from pre- to post-diagnosis in one of the groups.²³

This study has a number of limitations. Chronic conditions and health behaviours were based on self-reports. While it is unlikely that respondents would report having been diagnosed with a major condition if it did not exist,²⁴⁻²⁸ underreporting is possible.²⁹ Self-reported smoking status is generally considered accurate. The NPHS leisure-time physical activity measure was more extensive than those available in most large health surveys, but was, by definition, limited to leisure time. Other physical activity, for example, at work, for transport and for rehabilitation, was excluded. Fruit and vegetable consumption was based on the reported frequency of consumption, and may not correspond precisely to the number of servings. NPHS data were collected every two years, so behaviour changes between cycles may have been missed; for example, smoking cessation attempts and remission. Moreover, changes observed over a two-year period may not be maintained over the long-term.

Figure 1
Mean number of cigarettes smoked per day, pre- and post-diagnosis of chronic condition, current smokers aged 50 or older, Canada, 1994/1995 to 2006/2007

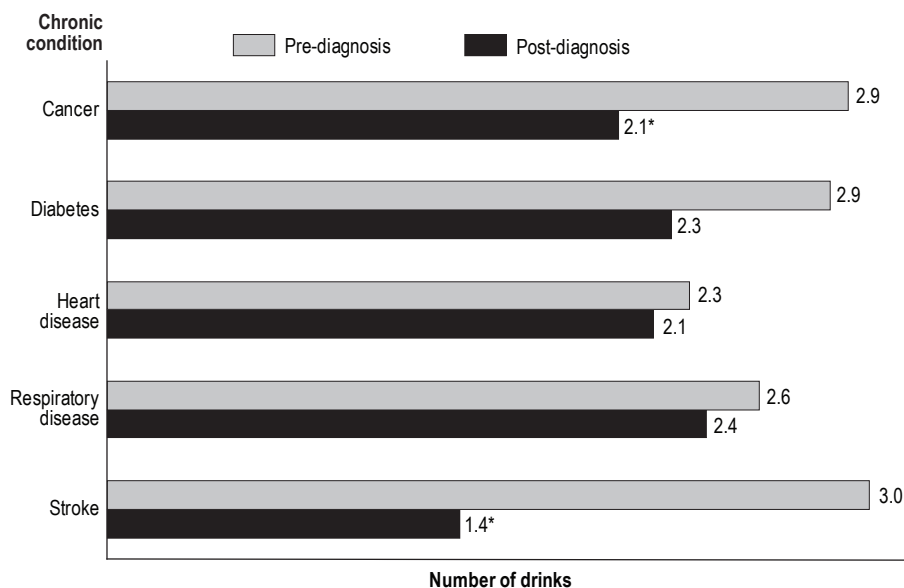


* significantly different from pre-diagnosis ($p < 0.05$)

Note: Because of rounding, bars indicating the same number of cigarettes may have different lengths.

Source: 1994/1995 to 2006/2007 National Population Health Survey, longitudinal square file.

Figure 2
Mean number of alcohol drinks consumed per week, pre- and post-diagnosis of chronic condition, current drinkers (past 12 months) aged 50 or older, Canada, 1994/1995 to 2006/2007



* significantly different from pre-diagnosis ($p < 0.05$)

Note: Because of rounding, bars indicating the same number of drinks may have different lengths.

Source: 1994/1995 to 2006/2007 National Population Health Survey, longitudinal square file.

Fear or concern that physical activity might be dangerous could be a deterrent for individuals with chronic conditions, particularly, heart-related ailments. However, for clinically stable patients without ischemia, exercise under the supervision of a physician has less risk than sedentary behaviour.³⁰

Alcohol consumption

Following a diagnosis of a chronic condition, individuals' alcohol consumption tended to decrease. For example, among those diagnosed with diabetes, the percentage who drank excessively (more than 2 drinks per day or more than 14 drinks a week for men; more than 2 drinks per day or more than 9 drinks a week for women) fell from about 10% to 5% (Table 1). Among those with respiratory disease, the prevalence of excessive drinking declined from almost 13% to 8%. Current drinkers diagnosed with cancer or stroke averaged significantly fewer drinks each week (Figure 2).

Alcohol consumption among the healthy comparison group remained stable over the study period—16% drank excessively, 55% drank moderately, and 29% abstained or drank very little.

Fruit and vegetable consumption

Before they were diagnosed, the percentage of the study population who averaged five or more servings of fruit and vegetables a day ranged from 27% to 42%. No significant post-diagnosis increases emerged in the percentages eating the minimum number of servings, although among those with diabetes, the average daily number of servings rose from 4.4 to 5.2 ($p < .01$). The fruit and vegetable intake of the healthy comparison group did not change over the study period, with approximately 32% consuming five servings a day.

Conclusion

Secondary prevention can improve longevity, enhance quality of life, and reduce medical expenses. This study reveals that people rarely made positive changes in lifestyle behaviours after they had been diagnosed with a chronic

condition. Smoking cessation and reductions in the number of cigarettes smoked were the changes most commonly reported, but the vast majority of smokers continued to smoke.

People with diabetes were the most likely to report positive behaviour changes, although the improvements were modest. Those diagnosed with diabetes reduced smoking and excessive

drinking and increased their leisure-time physical activity and fruit and vegetable consumption. By contrast, people diagnosed with respiratory disease reported no change in smoking or fruit and vegetable consumption, and were less likely to be physically active. Over the same period, a reduction in excessive drinking was the only change in health behaviours reported for this group. ■

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Seniors' use of and unmet needs for home care, 2009

by *Melanie Hoover and Michelle Rotermann*

Released online December 19, 2012

Abstract

Based on data from the 2009 Canadian Community Health Survey—Healthy Aging, this article provides current information about home care use and unmet home care needs of community-dwelling seniors aged 65 or older. Home care is assistance received at home for a health-related reason in the 12 months before the interview. It includes formal care provided by paid workers or volunteer organizations and informal care provided by family, friends and/or neighbours. In 2009, 25% of seniors received home care services. The percentage receiving home care increased with age and ill health. As well, seniors who lived alone were more likely to have received home care than were those who lived with others. Housework and transportation were the most common types of care reported. Family, friends and neighbours provided the majority of care across all care types. Nearly 180,000 seniors (4%) reported having unmet needs for professional home care.

Keywords

Activities of daily living, aged, caregiving, elderly, geriatrics, independent living, social support

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Population aging, increasing prevalence of chronic diseases, and changes to health care delivery contribute to the need for home care.¹⁻³ Home care services for seniors can alleviate demands for hospitalization,^{4,5} and can reduce readmissions⁵ and the likelihood of institutionalization.⁶ Home care can also be more cost-efficient than residential care.^{5,7,8}

This study uses data from the 2009 Canadian Community Health Survey—Healthy Aging (CCHS–HA) to provide a profile of community-dwelling seniors receiving home care and describe the types of care they receive from formal and informal sources. Seniors' unmet needs for professional home care are also examined.

One in four

In 2009, 25% of people aged 65 or older (just over 1 million) reported that they had received formal and/or informal home care in the past 12 months (Table 1). However, it is likely that the prevalence of the use of home care is actually greater. Some informal care, from a spouse, for instance, may not have been reported, since it may be perceived as part of usual support provided to family members.

A larger percentage of senior women than men reported having received home care (30% versus 18%). For both sexes, the percentages reporting home care rose with age from 12% of men and 18% of

women aged 65 to 74, to 44% of men and 59% of women aged 85 or older.

Seniors living alone were more likely than those living with others to have received home care. As well, a higher percentage of seniors who reported some form of social assistance as their main income source reported receiving home care, compared with those who reported another main source of income. These results are consistent with earlier findings showing that living alone^{9,10} and lower income are associated with higher rates of home care use.^{10,11}

As expected, seniors with limited functioning were more likely than those in better health to receive home care. For example, half of severely disabled seniors reported receiving home care, compared with 12% of those who had no or mild disability. A relatively high percentage of individuals with physical limitations received assistance with personal care activities such as bathing or toileting, compared with people who did not have these limitations.

The data

The CCHS–HA, conducted from December 2008 through November 2009, covered the household population aged 45 or older in the ten provinces. Full-time members of the Canadian Forces and residents of Indian reserves and some remote areas were excluded. The response rate was 74.4%.

The sample for this analysis numbered 16,369 respondents aged 65 or older, weighted to represent a population of approximately 4.4 million in 2009. Weighted frequencies and cross-tabulations were used to estimate the percentages of people who had received home care and/or had unmet needs for professional care. Covariates were selected based on the literature and/or data availability. To account for survey design effects, standard errors and coefficients of variation were estimated using the bootstrap technique.^{12,13} Results at the $p < 0.05$ were considered to be statistically significant. Details about the survey design and sampling techniques have been published elsewhere.¹⁴

Receipt of home care was derived from questions on formal and informal care. For *formal care*, respondents were asked, "During the past 12 months, did you receive short-term or long-term professional assistance at home, because of a health condition or limitation that affects your daily life, for any of the following activities?" (Professional assistance referred to both paid and unpaid workers.)

- Personal care such as assistance with eating, dressing, bathing, or toileting
- Medical care such as help taking medicine or help with nursing care (for example, dressing changes or foot care)
- Managing care such as making appointments
- Help with activities such as housework, home maintenance or outdoor work
- Transportation, including trips to the doctor or for shopping
- Meal preparation or delivery
- Other
- None

Respondents could select all that applied. For *informal care*, the question was repeated, but referred to "family, friends, or neighbours" instead of professionals. *Home care recipients* were those who reported having received at least one type of home care from formal and/or informal sources.

Unmet professional home care needs were identified by asking respondents, "During the past 12 months, was there ever a time when you felt that you needed professional home care services but you didn't receive them?" The same list of activities as the formal/informal home care questions was read to respondents. Respondents could give up to 15 reasons why they believed they had unmet homecare needs. These reasons were collapsed into three categories: health care system features (including availability and wait times), personal barriers (including inability to pay, ineligibility and lack of awareness), and both.

Socio-demographic variables included in the analysis were: *sex, age, province of residence, social assistance, and living arrangements*. Respondents were divided into three age groups: 65 to 74, 75 to 84, and 85 or older. Respondents were considered to be lower income if they cited Old Age Security, Guaranteed Income Supplement, or provincial/municipal social assistance or welfare as their main income source. For living arrangements, respondents were classified as living alone or with others.

Perceived tangible support was measured with four questions: "How often is each of the following kinds of support available to you if you need it: Someone to:

- help you if you were confined to bed?"
- take you to the doctor if you needed it?"
- prepare your meals if you were unable to do it yourself?"
- help with daily chores if you were sick?"

Respondents who reported "none of the time" or "a little of the time" to one or more of these questions were considered to be lacking tangible support.

The Health Utility Index (HUI) was used to define *disability level*. HUI considers eight dimensions of health: vision, hearing, speech, emotion, mobility, dexterity, cognition, and pain and discomfort. Each dimension has five or six levels, ranging from normal to severely limited functioning. HUI values range from -0.36 (the worst possible health state) to 1.0 (optimal health state), and were recoded to represent three disability levels: no or mild disability (0.89 to 1.00), moderate disability (0.70 to 0.88), and severe disability (less than 0.70).¹⁵

Respondents were considered to have a *severe personal care limitation* if they were "totally unable" to eat, dress, or bathe/take care of their appearance. Those who needed "some help" were considered to have *some personal care limitation*.

Respondents reporting that they were completely unable to walk were considered to have a *severe mobility limitation*; those who could walk with some help from a person and/or with mobility aids were considered to have *some mobility limitation*.

The CCHS–HA did not collect information about the frequency, intensity or duration of home care, and it is not possible to distinguish between government-funded and privately funded home care. Data on unmet home care needs reflect respondents' perceptions; no external validation was performed. Home care data from the CCHS–HA are not directly comparable to estimates based on CCHS 2.1 or 3.1 or the General Social Survey data, because of differences in question wording and/or ordering. It is thought that the CCHS–HA estimates are higher because the other surveys ask respondents if they had received home care before asking what types and from whom. This practice seems to disproportionately affect the reporting of informal care; without the more detailed prompting of the CCHS–HA, respondents tend to overlook much of the care provided by family and friends. While 13% of CCHS–HA respondents reported receiving home care exclusively from informal sources, the figure was 4% for CCHS 3.1 respondents (data not shown). The differences in the order of interview questions did not affect the reporting of formal and mixed home care to the same extent. Despite these survey/reporting differences, the relationships between socio-demographic and health status characteristics generally persisted, regardless of the dataset used.

Table 1
Number and percentage of seniors receiving home care, by selected characteristics, household population aged 65 or older, Canada, 2009

Characteristics	Total				Men				Women			
	Number	Percent	95% confidence interval		Number	Percent	95% confidence interval		Number	Percent	95% confidence interval	
			from	to			from	to			from	to
	'000	%			'000	%			'000	%		
Total	1,070	24.5	23.5	25.6	352	17.9	16.5	19.3	718	30.0[†]	28.6	31.4
Age group (years)												
65 to 74 [†]	363	15.1	13.9	16.4	134	11.7	10.1	13.4	229	18.2 [†]	16.5	20.2
75 to 84	442	30.1*	28.4	31.9	142	21.9*	19.5	24.5	300	36.6**	34.2	39.0
85 or older	265	54.0*	51.3	56.7	76	44.1*	39.8	48.5	189	59.4**	56.1	62.5
Living arrangements												
Alone	425	33.3*	31.7	35.0	80	23.6*	20.9	26.4	345	36.9**	34.9	38.9
With others [†]	644	20.9	19.6	22.3	271	16.7	15.1	18.3	373	25.6 [†]	23.6	27.6
Main source of income												
Social assistance/Old Age Security/ Guaranteed Income Supplement	270	31.2*	29.1	33.4	72	23.9*	20.4	27.9	198	35.1**	32.4	37.8
Other [†]	719	22.5	21.3	23.7	259	16.6	15.2	18.1	460	28.1 [†]	26.4	29.9
Personal care limitation												
None [†]	829	20.3	19.3	21.3	274	14.6	13.4	15.8	555	25.1 [†]	23.6	26.5
Some	212	88.2*	85.0	90.8	68	84.3*	78.3	88.8	143	90.2*	86.2	93.2
Severe	27	93.0*	79.5	97.8	8	84.9*	53.8	96.5	19	96.9	89.2	99.2
Mobility limitation												
None [†]	935	22.3	21.3	23.3	321	16.6	15.4	18.0	614	27.0 [†]	25.6	28.5
Some	117	79.1*	73.6	83.8	26	68.9*	54.1	80.6	91	82.6*	76.5	87.3
Severe	18	96.3*	87.5	99.0	5	94.4*	78.0	98.8	13	97.2*	82.3	99.6
Health Utility Index												
No or mild disability [†]	270	11.5	10.5	12.6	89	8.0	7.0	9.1	181	14.7 [†]	13.2	16.4
Moderate disability	226	26.6*	24.1	29.1	79	21.1*	17.8	24.9	147	30.9**	27.6	34.3
Severe disability	516	49.7*	47.3	52.0	164	38.6*	34.7	42.6	352	57.3**	54.5	60.1
Province												
Newfoundland and Labrador	13	17.7*	15.3	20.4	4	12.5*	9.4	16.4	8	22.1**	19.0	25.6
Prince Edward Island	5	24.1	20.5	28.1	2	18.5	14.1	23.9	3	28.7 [†]	23.8	34.2
Nova Scotia	37	27.0	24.1	30.1	12	20.1	16.3	24.5	25	32.5 [†]	28.6	36.7
New Brunswick	31	28.5*	25.6	31.6	11	23.7*	20.0	27.8	19	32.5 [†]	28.4	36.8
Quebec	242	22.2*	20.1	24.5	80	16.6	14.0	19.6	163	26.6**	23.8	29.7
Ontario	448	26.7*	24.8	28.6	143	18.9	16.4	21.7	305	33.1**	30.5	35.7
Manitoba	43	28.6*	25.5	32.0	15	21.7	17.9	26.1	29	34.1 [†]	30.0	38.5
Saskatchewan	33	23.8	21.0	26.8	10	16.7	13.7	20.3	22	29.5 [†]	25.2	34.1
Alberta	80	22.5	19.5	25.7	27	16.2	12.7	20.5	53	27.8 [†]	23.9	32.2
British Columbia	138	22.5	20.3	25.0	48	16.6	13.8	19.9	91	27.7 [†]	24.3	31.5

[†] reference category; for province, reference category is all other provinces

* significantly different from reference category (p<0.05)

† significantly different from men (p<0.05)

Source: 2009 Canadian Community Health Survey—Healthy Aging.

Provincial differences

The prevalence of home care use (formal and/or informal) varied across the country. Reported use of home care was lower in Newfoundland and Labrador (18%) and Quebec (22%), and higher in New Brunswick (29%), Ontario (27%), and Manitoba (29%), when each province was compared with

the rest of Canada. Estimates for the remaining provinces were comparable to the national figure. These provincial differences remained when only formal home care was considered, except for Alberta, where the reported use of formal home care was less than the national estimate, and Quebec, where reported use was comparable to the national estimate (data not shown).

Provincial differences in the use of home care can be influenced by the age and health profiles of seniors residing in each province, and by variations in service availability, eligibility criteria, and the structure and delivery of care.¹⁶⁻¹⁹ The analyses in this study do not adjust for those factors.

Sources and types of care

More than half (53%) of seniors who reported receiving home care in the past year indicated that it had been provided exclusively by informal sources such as family, friends and neighbours (data not shown). Another 18% received only formal home care from paid employees and unpaid volunteers. The remaining 29% reported mixed sources of care, underscoring the complementary relationship between the informal and formal care networks.^{1,7}

The sources of care differed somewhat by the type of care provided, and for nearly all types, the informal network generally predominated (Figure 1). The exception was medical care, with equal shares reported to be coming from formal and informal providers, and a smaller share from mixed sources.

Understanding which services are provided most frequently by various types of caregivers is important, because hours of care tend to be higher when informal care is available.²⁰ Seniors who reported receiving care only from formal sources were less likely to have tangible support (66%) than were those who received help from informal (81%) or mixed sources (76%) (data not shown). Lack of tangible support may also be predictive of a senior's future professional home care needs.

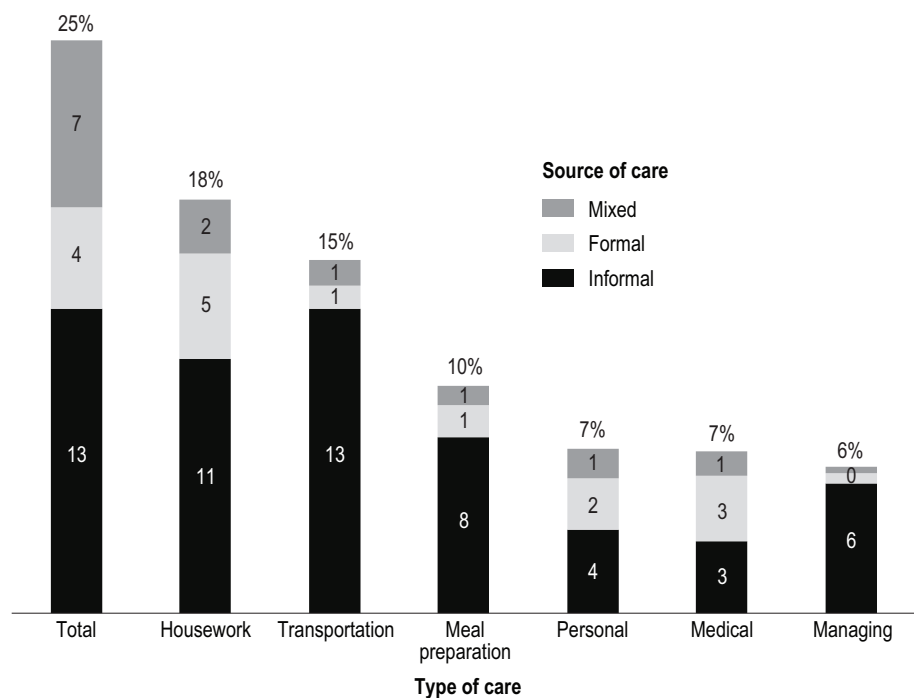
Among seniors who had received home care, housework (including home maintenance) was the most common type reported (18%), followed by transportation (15%) and meal preparation (10%) (Figure 1). This pattern was consistent across all provinces. Those who received medical or personal care, both of which are associated with greater dependency, were more likely to have received at least one other type of care (data not shown).

Unmet needs for professional home care

In 2009, close to 180,000 (4%) seniors reported that they had at least one unmet need for professional home

Figure 1

Percentage of seniors receiving home care, by type and source, household population aged 65 or older, Canada, 2009



Note: An "other" category, representing 1% of the total, is not shown. Because of rounding, detail may not add to total.

Source: 2009 Canadian Community Health Survey—Healthy Aging.

care services (Table 2). Across the provinces, the percentage of seniors reporting unmet home care needs was generally comparable. Close to two-thirds (63%) of seniors with unmet needs for formal care attributed them to personal circumstances, such as inability to pay; 24% cited features of the health care system, including lack of service availability; and the remaining 13% mentioned a combination of both (data not shown). Research shows that unmet needs for assistance are associated with negative consequences including inability to prepare food for oneself,²¹ injuries,²¹ depression and reduced morale,²² higher hospitalization rates,²³ and increased risks of falls,³ institutionalization, and premature death.²¹

Women were more likely than men to have unmet needs—5% versus 3%. The percentage reporting unmet needs

rose from about 3% at ages 65 to 74 to around 7% at age 85 or older, and was twice as high among those living alone as among those living with others. The prevalence of unmet needs was also associated with disability. For example, 10% severely disabled seniors reported an unmet need for professional home care, compared with 1% who had no disability. Among those who had severe personal care or mobility limitations, the prevalence of unmet needs was 20% and 29%, respectively; this compared with about 3% and 4% among seniors who did not have personal care or mobility limitations. Housework and personal care were the two most common tasks with which seniors needed, but did not receive, professional assistance. These associations between unmet need and sex, living arrangements and disability are consistent with other research.²¹⁻²⁴

Table 2
Number and percentage of seniors with unmet needs for professional home care, by selected characteristics, household population aged 65 or older, Canada, 2009

Characteristics	Total				Men				Women			
	Number	Percent	95% confidence interval		Number	Percent	95% confidence interval		Number	Percent	95% confidence interval	
			from	to			from	to			from	to
	'000	%			'000	%			'000	%		
Total	180	4.1	3.7	4.6	52	2.6	2.1	3.3	128	5.3[†]	4.7	6.1
Age group (years)												
65 to 74 [†]	77	3.2	2.6	4.0	22	1.9 ^E	1.3	2.8	55	4.4 [†]	3.4	5.6
75 to 84	69	4.7 [*]	4.0	5.6	19	3.0 ^E	2.1	4.2	50	6.1 ^{†*}	5.1	7.3
85 or older	33	6.7 [*]	5.5	8.2	10	6.0 ^E	3.8	9.3	22	7.1	5.8	8.7
Living arrangements												
Alone	80	6.2 [*]	5.5	7.1	19	5.6 [*]	4.3	7.4	60	6.5 [*]	5.6	7.5
With others [†]	100	3.2	2.7	3.9	32	2.0	1.5	2.7	68	4.6 [†]	3.7	5.8
Main source of income												
Social assistance/Old Age Security/ Guaranteed Income Supplement	59	6.8 [*]	5.8	8.1	14	4.6 ^E	3.0	7.1	45	8.0 ^{†*}	6.7	9.6
Other [†]	105	3.3	2.8	3.9	32	2.1	1.6	2.7	72	4.4 [†]	3.6	5.4
Personal care limitation												
None [†]	137	3.3	2.9	3.9	42	2.3	1.7	2.9	94	4.3 [†]	3.6	5.1
Some	37	15.5 [*]	12.6	18.9	8	9.6 ^E	6.4	14.2	29	18.6 ^{†*}	14.9	22.8
Severe	6	19.7 ^E	12.5	29.6	F	F	...	...	4	21.3 ^E	12.8	33.2
Mobility limitation												
None [†]	145	3.5	3.0	3.9	45	2.4	1.8	3.0	100	4.4 [†]	3.7	5.2
Some	29	19.8 [*]	15.5	24.9	4	10.4 ^E	5.9	17.8	25	23.0 ^{†*}	17.8	29.1
Severe	5	29.2 ^E	18.3	43.1	2	42.6 ^E	23.0	64.9	3	23.2 ^{†*}	11.8	40.5
Health Utility Index												
No or mild disability [†]	30	1.3 ^E	0.9	1.9	6	0.5 ^E	0.3	0.9	24	1.9 ^{†E}	1.2	3.1
Moderate disability	33	3.8 ^E	2.9	5.1	9	2.4 ^E	1.3	4.4	24	5.0 ^{†*}	3.7	6.7
Severe disability	108	10.4 [*]	9.2	11.8	35	8.2 [*]	6.3	10.4	74	12.0 ^{†*}	10.4	13.9
Type of unmet need[§]												
Medical	25	0.6	0.4	0.7	9	0.5 ^E	0.3	0.7	15	0.6	0.5	0.9
Personal	53	1.2	1.0	1.5	16	0.8 ^E	0.6	1.2	37	1.5 [†]	1.2	1.9
Housework	122	2.8	2.4	3.3	31	1.6	1.2	2.1	91	3.8	3.2	4.5
Transportation	36	0.8	0.6	1.0	12	0.6 ^E	0.4	1.1	24	1.0	0.8	1.3
Meal	35	0.8	0.6	1.1	13	0.7 ^E	0.4	1.1	22	0.9	0.7	1.2
Appointment	10	0.2 ^E	0.1	0.4	F	F	...	...	5	0.2 ^E	0.1	0.3
Province												
Newfoundland and Labrador	2	3.2 ^E	2.2	4.5	F	F	...	...	2	5.1 ^{†E}	3.5	7.4
Prince Edward Island	0.5	2.8 ^E	1.8	4.2	F	F	...	...	0.4	3.6 ^E	2.1	6.1
Nova Scotia	5	3.5 ^E	2.5	4.9	F	F	...	...	4	5.1 ^E	3.6	7.2
New Brunswick	4	3.4 ^E	2.3	4.9	F	F	...	...	3	4.8 ^E	3.1	7.4
Quebec	45	4.1	3.2	5.3	14	2.8 ^E	1.7	4.6	31	5.1	3.7	6.9
Ontario	71	4.2 ^E	3.4	5.2	18	2.4 ^E	1.6	3.6	53	5.7	4.4	7.4
Manitoba	7	4.5	3.3	6.2	2	2.6 ^E	1.5	4.4	5	6.1 ^E	4.1	9.0
Saskatchewan	4	3.0 ^E	2.1	4.2	F	F	...	...	3	4.1 ^E	2.8	6.2
Alberta	13	3.6 ^E	2.6	5.0	4	2.6 ^E	1.3	4.9	9	4.5 ^E	3.0	6.7
British Columbia	29	4.7	3.7	6.1	11	3.7 ^E	2.3	6.0	18	5.6	4.2	7.4

[†] reference category; reference category for province is all other provinces.

^{*} significantly different from reference category (p<0.05)

[†] significantly different from men (p<0.05)

[§] respondents could select more than one type

... not applicable

^E use with caution

F too unreliable to be published

Source: 2009 Canadian Community Health Survey—Healthy Aging.

Conclusion

As the number of seniors increases, the need for home care is expected to rise. Home care can help to maintain seniors' health, independence and quality of

life.^{1,3} Results from the CCHS–HA show that one in four Canadian seniors received home care, most commonly, housework and transportation. Informal care from family, friends and neighbours

predominates across most care types. About 180,000 (4%) seniors reported an unmet need for professional home care. ■

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Acute care hospital days and mental diagnoses

by Helen Johansen and Philippe Finès

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Abstract

Background

Data from the Discharge Abstract Database of the Canadian Institute for Health Information were used to examine acute care hospital days for patients with a mental condition coded as the most responsible diagnosis or a comorbid diagnosis. In 2009/2010, patients with a mental diagnosis represented 11.8% of people who had been hospitalized and 25.5% of acute care hospital days. Those for whom the mental condition was the most responsible diagnosis accounted for 9.0% of hospital days (1.2 million), and those with a comorbid mental diagnosis accounted for 16.5% of hospital days (2.3 million). Mental diagnoses were often associated with physical conditions. The average hospitalization with a mental diagnosis was two and a half times as long as the average for hospitalizations without a mental diagnosis. About one-quarter of hospital days with a mental diagnosis were designated as alternate level of care days.

Keywords

Alternate level of care, comorbidity, hospital records, length of hospital stay, mental disorders, mental health, mental patients

Authors

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Despite an increase in population-based studies of mental health at the national and provincial levels,¹⁻⁶ substantial gaps remain in understanding the impact of mental illness on the use of health care services. Reports tend to focus on mental conditions as a most responsible diagnosis and provide limited information about mental illness as a co-morbidity. However, psychiatric disorders can accompany physical conditions, and many physical conditions increase the risk of poor mental health.⁷⁻¹⁰ The combination of physical and mental conditions may result in higher rates of health care use, because mental illness often complicates help-seeking, diagnosis and treatment, and may influence prognosis.¹¹⁻¹⁴

Based on administrative data for acute care hospitals, this study examines hospitalizations with a most responsible or comorbid mental diagnosis (see *The data*). Rather than the number of hospitalizations, the analysis is based on the number of days and the average length of stay. The total number of days provides a proxy measure of resource use in the acute care hospital system, and the average length of stay is an indication of the intensity of hospital service use. This

study updates an earlier working paper,¹⁵ but unlike that report, does not include Quebec because of data limitations.

Less than 1% of population use a quarter of hospital days

In 2009/2010, approximately 182,000 people with a mental diagnosis were separated at least once from an acute care hospital (data not shown). They made up 0.7% of the population, but 11.8% of all patients separated from hospital

The data

The data are from the Canadian Institute of Health Information's Discharge Abstract Database and are compiled from discharge records for inpatients in acute care hospitals.¹⁶ This analysis excludes newborns, stillbirths, Quebec residents, patients not resident in Canada, and those without a usable patient identification number. Records with missing admission or separation dates and those missing gender were also excluded. A total of 2,069,690 records for patients who were separated from hospital during fiscal year 2009/2010 (April through March) were retained for this study.

A hospital record is generated for each hospital separation when the patient leaves the facility because of discharge, transfer, sign-out against medical advice, or death. The hospital records in this analysis pertain to inpatient care; they do not include out-patient visits.

A "most responsible" diagnosis is assigned to each hospital record. Reported diagnoses of mental conditions that were not designated "most responsible" were considered to be "comorbid." To identify mental diagnoses, the International Classification of Diseases tenth revision (ICD-10-CA) codes were used.^{1,17-19}

Length of stay is the number of days indicated in a hospital record; specifically, the number of days from the date of admission to the date of discharge. If admission and discharge occurred the same day, the length of stay was set to 0.5. Only days within fiscal year 2009/2010 were included (April 1, 2009 to March 31, 2010).

Descriptive statistics (percentages and averages) were calculated using SAS version 9.1.3.

that year. For one-third of these patients (61,900), a mental condition was the most responsible diagnosis, and for the remaining two-thirds (120,500), a mental condition was listed as a comorbidity. These patients accounted for 25.5% of all hospital days: 9.0% (about 1.3 million days) were attributable to a most responsible mental diagnosis, and 16.5% (2.3 million days) involved a comorbid mental diagnosis (Table 1).

Among male and female patients, similar percentages of acute care hospital days were attributable to mental

diagnoses. A most responsible mental diagnosis was recorded for 9.2% and 8.9% of the days used by male and female patients, respectively (data not shown). The corresponding figures for comorbid mental diagnoses were 17.3% and 15.9%.

Patterns vary by age

The percentage of acute care hospital days involving mental diagnoses varied by the patients' age and by whether the mental condition was the most responsible or a comorbid diagnosis.

The percentage of hospital days attributable to a most responsible mental diagnosis was highest among patients aged 10 to 19 (Table 1). Almost 30% of all days that 10- to 19-year-olds spent in hospital in 2009/2010 had a most responsible mental diagnosis. Among patients at progressively older ages, the percentage of days with a most responsible mental diagnosis generally declined, and by age 50 or older, was less than 10%.

Table 1
Acute care hospital days, by age group and presence of mental diagnosis, Canada excluding Quebec, 2009/2010

	Number of days					Percentage of days			Average length of stay (days)				
	Total days		Mental most responsible	Mental comorbid	No mental diagnosis	Mental most responsible	Mental comorbid	No mental diagnosis	Mental most responsible	Mental comorbid	No mental diagnosis	Ratio†	Ratio‡
	'000	%	'000			%							
Total	14,058	100.0	1,270	2,320	10,467	9.0	16.5	74.5	16.0	15.3	5.7	2.8	2.7
Age group													
0 to 9	337	2.4	7	14	316	2.0	4.1	93.8	13.5	8.3	3.4	3.9	2.4
10 to 19	387	2.8	114	27	245	29.5	7.1	63.4	11.9	5.9	3.2	3.7	1.8
20 to 29	776	5.5	127	51	598	16.4	6.6	77.0	11.9	6.1	2.7	4.3	2.2
30 to 39	917	6.5	117	79	722	12.7	8.6	78.7	10.5	7.9	3.0	3.5	2.6
40 to 49	1,017	7.2	142	144	731	14.0	14.2	71.9	10.7	9.6	4.4	2.4	2.2
50 to 59	1,569	11.2	140	221	1,208	8.9	14.1	77.0	12.8	11.9	5.5	2.3	2.2
60 to 69	2,120	15.1	120	298	1,702	5.7	14.0	80.3	18.3	15.9	6.4	2.9	2.5
70 to 79	2,851	20.3	172	499	2,180	6.0	17.5	76.5	27.0	19.5	7.8	3.5	2.5
80 to 89	3,187	22.7	259	755	2,172	8.1	23.7	68.2	31.7	20.1	9.6	3.3	2.1
90 or older	898	6.4	73	231	594	8.1	25.7	66.1	32.6	19.8	11.6	2.8	1.7

[†] average days with most responsible mental diagnosis to average days with no mental diagnosis

[‡] average days with mental comorbidity to average days with no mental diagnosis

Note: Because of rounding, detail may not add to total.

Source: 2009/2010 Discharge Abstract Database, Canadian Institute for Health Information.

By contrast, the percentage of hospital days with a comorbid mental diagnosis rose with age from fewer than 10% of days among patients younger than age 40 to about a quarter of days among those aged 80 or older.

Longer stays

Mental diagnoses, whether most responsible or comorbid, were associated with much longer hospital stays—overall, more than two and a half times as long—than stays not involving a mental diagnosis (Table 1). This pattern held among patients of all ages. For example, patients in their twenties who did not have a mental diagnosis averaged 2.7 days in hospital; their contemporaries with a most responsible mental diagnosis averaged 11.9 days, and those with a comorbid mental diagnosis, 6.1 days. For patients in their seventies, the averages were 7.8 days for stays without a mental diagnosis, 27.0 days for stays with a most responsible mental diagnosis, and 19.5 days for stays with a comorbid mental diagnosis.

Mental disorders

The three mental diagnoses accounting for the largest number of most responsible acute care hospital days were organic disorders (dementia, delirium) (461,000), mood disorders (313,000), and schizophrenic/psychotic disorders (266,000) (data not shown). The three comorbid mental diagnoses accounting for the largest numbers of days were organic disorders (1,404,000), mood disorders (600,000) and substance-related disorders (537,000).

As expected, the number of most responsible and comorbid days attributable to organic mental disorders were greatest for patients aged 70 or older (data not shown). Days attributable to substance-related disorders were prevalent over a wide range of ages, usually as a comorbidity. Days attributable to mood disorders appeared primarily as a most responsible diagnosis at young ages, but shifted to a comorbid diagnosis at older ages. Schizophrenic/Psychotic conditions were prevalent as a

most responsible diagnosis from ages 20 to 60.

Diseases associated with mental comorbidity

The percentage of acute care hospital days involving mental comorbidity differed by major disease type (Table 2). The figure ranged from 2.4% of days for hospitalizations related to pregnancy to 24.8% of days for hospitalizations for diseases of the nervous system (for instance, Parkinson's Disease). Other disease types with a relatively high percentage of days with a comorbid mental diagnosis were metabolic (22.9%), injury/poisoning (23.6%), and infectious/parasitic (23.1%).

Regardless of disease type, a mental comorbidity was associated with a substantial increase in the average length of stay. For instance, patients with a most responsible diagnosis of neoplasm

(cancer), but no mental comorbidity, averaged 7.6 days in hospital; for those with a mental comorbidity, the average length of stay was 21.0 days. Among patients hospitalized because of a circulatory disease, the corresponding averages were 7.1 days and 17.2 days.

Alternate level of care

The term alternate level of care (ALC) identifies hospital patients who have completed the acute care phase of their treatment, but who still occupy a bed because of ongoing post-acute care needs or the unavailability of supports in the community.^{20,21} These patients may stay in acute care hospitals for a long period. Previous analyses indicate that dementia is the most common diagnosis for longer stay ALC patients,²² and that a psychiatric diagnosis is common in ALC patients.²³

Table 2
Acute care hospital days, by major disease type and presence of mental diagnosis, Canada excluding Quebec, 2009/2010

Disease type (ICD-10-CA Chapters)	Hospital days		Average length of stay (days)		
	Total	With comorbid mental diagnosis	No mental diagnosis	Comorbid mental diagnosis	Ratio [†]
	'000	%	Number		
All chapters	14,058	2.3	6.7	13.5	2.0
1 Infection	438	23.1	7.3	18.0	2.5
2 Cancer	1,170	10.7	7.6	21.0	2.8
3 Blood	132	12.0	6.1	11.8	1.9
4 Metabolic	450	22.9	7.3	14.6	2.0
5 Mental	1,195	1.9	...	...	...
6 Nervous	410	24.8	10.1	19.4	1.9
7 Eye	14	8.6	2.3	9.5	4.2
8 Ear	15	9.2	2.7	7.5	2.8
9 Circulatory	2,086	16.8	7.1	17.2	2.4
10 Respiratory	1,219	20.6	6.3	13.7	2.2
11 Digestive	1,236	13.9	5.3	11.7	2.2
12 Skin	193	20.1	8.4	16.7	2.0
13 Skeletal	693	12.9	5.3	16.7	3.2
14 Genito-urinary	578	18.8	4.2	13.6	3.3
15 Childbirth	737	2.4	2.4	4.5	1.9
16 Perinatal	23	x	17.7	x	x
17 Congenital	46	10.1	4.7	19.4	4.1
18 Symptoms, signs (not elsewhere classified)	719	26.4	4.7	12.8	2.7
19 Injury/Poisoning	1,365	23.6	6.7	13.5	2.0
20 External cause	1,339	22.6	8.2	28.4	3.5

[†] average days with mental comorbidity to average days without mental comorbidity

... not applicable

x suppressed to meet confidentiality requirements of Statistics Act

Note: This analysis uses only records coded in ICD-10-CA.

Source: 2009/2010 Discharge Abstract Database, Canadian Institute for Health Information.

Table 3
Percentage of acute care hospital days designated alternate level of care, by age group and presence of mental diagnosis, Canada excluding Quebec, 2009/2010

	All hospital days	Percentage of days designated alternate level of care		
		Mental most responsible	Mental comorbid	No mental diagnosis
		%		
Total	13.0	23.2	26.6	8.7
Age group				
0 to 9	0.5	0.2	1.1	0.5
10 to 19	0.9	0.7	2.5	0.8
20 to 29	1.7	3.4	4.2	1.2
30 to 39	2.3	3.1	9.0	1.4
40 to 49	4.5	4.8	11.5	3.1
50 to 59	6.3	9.6	14.4	4.4
60 to 69	8.6	20.9	19.7	5.8
70 to 79	15.2	41.4	29.2	9.9
80 to 89	23.3	50.4	34.9	16.1
90 or older	31.1	53.6	39.4	25.0

Source: 2009/2010 Discharge Abstract Database, Canadian Institute for Health Information.

In fiscal year 2009/2010, ALC patients accounted for 13% of hospital days (more than 1.8 million). About one-quarter of hospital days attributable to mental diagnoses were designated ALC versus 9% of days not associated with a mental diagnosis (Table 3).

This study has several limitations. The results refer to acute care hospitalizations; because psychiatric hospitals were not included, hospitalizations for some of the most severe mental conditions are missing from the analysis. In fact, psychiatric hospitals account for around 15% of all mental-related hospitalizations.¹ As well,

emergency departments were not covered in this study. Finally, the validity of conclusions drawn from analyses of large administrative databases depends on the accuracy of case-defining diagnostic codes, which could not be determined.

Conclusion

In 2009/2010, people hospitalized with a mental diagnosis represented less than 1% of the population, but they used 25% of acute care hospital days. Two-thirds of these days involved a mental comorbidity. The average length of stay for patients with a comorbid mental diagnosis was more than two and a half times the average for patients who did not have a mental diagnosis, regardless of the patients' age and primary diagnosis. In addition, about one quarter of all mental health days were designated as ALC, indicating possible ongoing care needs or unavailability of support in the community. ■

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Erratum

Errors were discovered in the article, “Cause-specific mortality by education in Canada: A 16-year follow-up study,” Volume 23, Number 3. Corrections were made in October, 2012.

Data errors were found in:

Table 2 (Age-standardized mortality rates per 100,000 person-years at risk for selected causes of death, by educational attainment, male cohort members aged 25 or older at baseline, Canada 1991 to 2006);

Table 3 (Age-standardized mortality rates per 100,000 person-years at risk for selected causes of death, by educational attainment, female cohort members aged 25 or older at baseline, Canada 1991 to 2006).

The data in these tables for both the HTML and PDF versions were corrected and replaced.

The text was revised to reflect these corrections:*Fourth paragraph (page 28):*

For deaths potentially amenable to medical intervention, the gradient in mortality by education was less steep (RR=1.70 for men and 1.24 for women). The percent excess was 31% for men and 10% for women.