

Catalogue no. 82-003-X

Health Reports

Volume 22, Number 2



Statistics
Canada

Statistique
Canada

Canada

How to obtain more information

Specific inquiries about this product and related statistics or services should be directed to: Health Information and Research Division, Statistics Canada, Ottawa, Ontario, K1A 0T6 (telephone: 613-951-1765).

For information about this product or the wide range of services and data available from Statistics Canada, visit our website at www.statcan.gc.ca, e-mail us at infostats@statcan.gc.ca, or telephone us, Monday to Friday from 8:30 a.m. to 4:30 p.m., at the following numbers:

Statistics Canada's National Contact Centre

Toll-free telephone (Canada and United States):

Inquiries line	1-800-263-1136
National telecommunications device for the hearing impaired	1-800-363-7629
Fax line	1-877-287-4369

Local or international calls:

Inquiries line	1-613-951-8116
Fax line	1-613-951-0581

Depository Services Program

Inquiries line	1-800-635-7943
Fax line	1-800-565-7757

To access and order this product

This product, Catalogue no. 82-003-X, is available free in electronic format. To obtain a single issue, visit our website at www.statcan.gc.ca and select "Publications."

This product, Catalogue no. 82-003-X, is also available as a standard printed publication at a price of CAN\$24.00 per issue and CAN\$68.00 for a one-year subscription.

The following additional shipping charges apply for delivery outside Canada:

	Single issue	Annual subscription
United States	CAN\$6.00	CAN\$24.00
Other countries	CAN\$10.00	CAN\$40.00

All prices exclude sales taxes.

The printed version of this publication can be ordered as follows:

- Telephone (Canada and United States) 1-800-267-6677
- Fax (Canada and United States) 1-877-287-4369
- E-mail infostats@statcan.gc.ca
- Mail
Statistics Canada
Finance
R.H. Coats Bldg., 6th Floor
150 Tunney's Pasture Driveway
Ottawa, Ontario K1A 0T6
- In person from authorized agents and bookstores.

When notifying us of a change in your address, please provide both old and new addresses.

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "About us" > "Providing services to Canadians."

HealthReports

Catalogue no. 82-003-XPE • Volume 22 Number 2

A Canadian peer-reviewed journal of
population health and health services research

Published by authority of the Minister responsible for Statistics Canada

© Minister of Industry, 2011

All rights reserved. The content of this electronic publication may be reproduced, in whole or in part, and by any means, without further permission from Statistics Canada, subject to the following conditions: that it be done solely for the purposes of private study, research, criticism, review or newspaper summary, and/or for non-commercial purposes; and that Statistics Canada be fully acknowledged as follows: Source (or "Adapted from", if appropriate): Statistics Canada, year of publication, name of product, catalogue number, volume and issue numbers, reference period and page(s). Otherwise, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form, by any means-electronic, mechanical or photocopy-or for any purposes without prior written permission of Licensing Services, Client Services Division, Statistics Canada, Ottawa, Ontario, Canada K1A 0T6.

June 2011

Catalogue no. 82-003-XPE, Vol. 22, No. 2
ISSN 0840-6529

Catalogue no. 82-003-XIE, Vol. 22, No. 2
ISSN 1209-1367

Frequency: Quarterly

Ottawa

Note of Appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued cooperation and goodwill.

Editor-in-Chief
Christine Wright

Senior Editor
Mary Sue Devereaux

Managing Editor
Janice Felman

Assistant Editor
Anne Marie Baxter

Production Manager
Robert Pellarin

Creative Services
Rasha Bradic

Administration
Amber Doy-Yat

Associate Editors

David Buckridge
McGill University

Elizabeth Lin
The Clarke Institute of Psychiatry

Doug Manuel
Ottawa Health Research Institute
and Statistics Canada

Nazeem Muhajarine
University of Saskatchewan

Georgia Roberts
Statistics Canada

Nancy Ross
McGill University and Statistics Canada

Geoff Rowe
Statistics Canada

Michelle Simard
Statistics Canada

Author information: We seek submissions from researchers based in government or academia. Submissions can come in the form of a traditional research article, a shorter descriptive piece that we call “Health Matters,” or a contribution that addresses technical issues related to the analysis of complex health surveys or administrative databases—“Methodological Insights.” For detailed author guidelines, please visit the journal’s website at: www.statcan.gc.ca/healthreports.

Electronic version: *Health Reports* is available free in PDF or HTML format. The current issue may be obtained at www.statcan.gc.ca/healthreports. For previous issues, select “Other issues in the series” from the left sidebar of the *Health Reports* website.

Aussi disponible en français : *Rapports sur la santé*, n° 82-003-X au catalogue

Symbols

The following standard symbols are used in Statistics Canada publications:

- . 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

The paper used in this publication meets the minimum requirements of American National Standard for Information Sciences – Permanence of Paper for Printed Library Materials, ANSI Z39.48 – 1984.

About Health Reports

H*Health Reports* publishes original research on diverse topics related to the health of populations and the delivery of health care. The journal archives, for the research and policy communities and for the general public, discoveries from analyses of national/provincial surveys and administrative databases, as well as results of international comparative health research. *Health Reports* is also a forum for sharing methodological information by those using health surveys or administrative databases. *Health Reports* is produced by the Health Analysis Division at Statistics Canada. Articles appear monthly in electronic format and quarterly in print, and are indexed in Index Medicus and MEDLINE.

For more information about *Health Reports*, contact Janice Felman, Health Analysis Division, Statistics Canada, 24th Floor, R.H. Coats Building, Ottawa, Ontario, Canada K1A 0T6. Telephone: (613) 951-6446; fax: (613) 951-3959; email: HealthReports@statcan.gc.ca

Editorial Board

David L. Streiner, Scientific Editor
University of Toronto

Bill Avison
University of Western Ontario

Adam Baxter-Jones
University of Saskatchewan

Lise Dubois
University of Ottawa

James Dunn
University of Toronto and Centre for
Research on Inner City Health

Bob Evans
University of British Columbia

David Feeny
Kaiser Permanente

Rick Glazier
Institute for Clinical Evaluative Sciences and
University of Toronto

Judy Guernsey
Dalhousie University

Glenn Irwin
Health Canada

Howard Morrison
Public Health Agency of Canada

Cameron Mustard
Institute for Work and Health, University of
Toronto

Tom Noseworthy
University of Calgary

Patricia O'Campo
University of Toronto and Centre for
Research on Inner City Health

Jennifer O'Loughlin
University of Montreal

Indra Pulcins
Canadian Institute for Health Information

Nancy Ross
McGill University and Statistics Canada

Paul Veugelers
University of Alberta

Michael Wolfson
Statistics Canada

In this issue

Research articles



□ **Breast cancer incidence and neighbourhood income ... 7**

by Marilyn J. Borugian, John J. Spinelli, Zenaida Abanto, Chen Lydia Xu and Russell Wilkins

Residence in the lowest as opposed to the highest neighbourhood income quintile was associated with a 15% lower risk of being diagnosed with breast cancer.

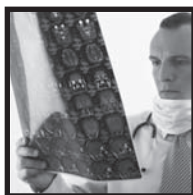


□ **Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves) 15**

by Noreen Willows, Paul Veugelers, Kim Raine and Stefan Kuhle

Aboriginal adults in food-insecure households were more likely than those in food-secure households to have poor general health, high stress, less life satisfaction, and a very weak sense of community belonging.

Health matters



□ **Conditional survival analysis across cancer sites.... 21**

by Larry F. Ellison, Heather Bryant, Gina Lockwood and Lorraine Shack

For almost all the individual cancers studied, the relative probability of living an additional five years improved when measured at increasingly longer periods after diagnosis, the effect being strongest in the first one to two years.



□ **Cognitive performance of Canadian seniors 27**

by Heather Gilmour

Seniors with low scores on various cognitive tasks were more likely than those with higher scores to experience poor outcomes on several measures of health and well-being.

Methodological insights

- **Psychometric properties, factorial structure, and measurement invariance of the English and French versions of the Medical Outcomes Study social support scale 33**

by Annie Robitaille, Heather Orpana and Cameron N. McIntosh

The Medical Outcomes Study social support scale appears to function uniformly among English- and French-speaking respondents.



- **Primary mental health care visits in self-reported data versus provincial administrative records 41**

by JoAnne L. Palin, Elliot M. Goldner, Mieke Koehoorn and Clyde Hertzman

Self-reported data and administrative data provide different estimates of the number of mental health visits per person to general practitioners.





ELECTRONIC PUBLICATIONS
AVAILABLE AT

www.statcan.gc.ca

Breast cancer incidence and neighbourhood income

by Marilyn J. Borugian, John J. Spinelli, Zenaida Abanto, Chen Lydia Xu and Russell Wilkins

Abstract

Background

In developed countries, women of higher socio-economic status often have higher breast cancer incidence rates, compared with women of lower socio-economic status.

Data and methods

Data were extracted from the Canadian Cancer Registry for the 229,955 cases of adult female invasive breast cancer diagnosed from 1992 through 2004. Postal code at diagnosis was used to determine neighbourhood income quintile. Breast cancer incidence was examined by year, region, age and neighbourhood income quintile. Census data for 1991 on children ever born and British Columbia data for 2006 on first-time attendance at mammography screening were analyzed by neighbourhood income quintile.

Results

Residence in the lowest as opposed to the highest neighbourhood income quintile was associated with a 15% lower risk of being diagnosed with breast cancer. Higher income levels were associated with lower parity in 1991 and a higher prevalence of first-time screening mammography in British Columbia in 2006.

Interpretation

Canadian data support an association between the diagnosis of invasive breast cancer and neighbourhood income quintile. Parity and mammography screening may account for some differences in incidence.

Keywords

Mammography screening, parity, Poisson regression, record linkage, small-area analysis, social class, socioeconomic factors

Authors

Marilyn J. Borugian (1-604-675-8058; mborugian@bccrc.ca), John J. Spinelli and Zenaida Abanto are with the British Columbia Cancer Agency in Vancouver, British Columbia, V5Z 1L3. Chen Lydia Xu is at the University of Aberdeen in Scotland. Russell Wilkins is with the Health Analysis Division at Statistics Canada, Ottawa, Ontario

Incidence and mortality rates for most chronic diseases including several types of cancer are higher among people of lower socio-economic status.^{1,2} By contrast, for female breast cancer in developed countries, the relationship may be inverted, with women of higher socio-economic status having higher rates,³⁻¹¹ even when risk factors that differ by socio-economic status such as parity, age at first birth and hormone use¹² are taken into account. Only one earlier study examined the risk of breast cancer in relation to socio-economic status in Canada,¹³ and it focused on the effects of passive smoking.

The purpose of the present study was to examine the association between neighbourhood income and the diagnosis of female breast cancer. Population data from the Canadian Cancer Registry were used to calculate national age-specific and age-standardized incidence rates of breast cancer from 1992 through 2004 by neighbourhood income quintile and region. At the outset, it is recognized that area-based analyses such as this cannot disentangle associations with income itself from neighbourhood context, nor can they establish causal relationships.

Data and methods

Case selection

All incident cases of invasive breast cancer diagnosed from January 1, 1992 through December 31, 2004 among Canadian women aged 19 or older were eligible for inclusion in this study. Cases were identified from the Canadian Cancer Registry, accessed via the Statistics Canada Research Data Centre at the University of British Columbia.

Of the 229,955 incident cases in the registry during the period, 3,750 (1.6%)

were excluded because of missing, invalid or non-residential postal codes, and 37 because the women were younger than 19 at diagnosis. This left 226,169 (98.4%) cases.

No personal identifiers other than the 6-digit postal code in the cancer registries were used. The study was approved by the joint British Columbia Cancer Agency/University of British Columbia Research Ethics Board.

Data sources and variables

The data obtained from the Canadian Cancer Registry for each breast cancer case were: age at diagnosis, year of diagnosis, and postal code of usual place of residence at the time of diagnosis. Only the first three digits of the postal code were available for cases diagnosed in Quebec. For the denominators, population data by census year (1991, 1996, 2001, and 2006) and by 5-year age group were obtained from Statistics Canada for enumeration areas (1991 and 1996) and dissemination areas (2001 and 2006), the smallest geographic units for which population data are released. Data for non-census years were interpolated from values for the closest census years.

To partially compensate for the lack of individual data on reproductive risk factors, 1991 census data on number of children ever born per 1,000 women aged 15 or older (parity) were used; these data were compiled by neighbourhood income quintile and region. Information for 1991 was used because this question was not asked on later censuses.

The possible effect differential use of screening mammography was examined by neighbourhood income quintile with already-extracted 2006 British Columbia data on first-time screening mammography attendance, compiled by neighbourhood income quintile as determined by postal code at the time of screening.

Neighbourhood income quintiles

Neighbourhood income quintiles were defined for enumeration and dissemination areas according to methods developed at Statistics Canada,

and assigned based on the postal code of the subject's usual place of residence at the time of breast cancer diagnosis. Quintile values were determined for each census during the study period. The value derived from the census closest to the diagnosis date was assigned to each subject's record.⁸

Based on the postal code, the corresponding 1996 census enumeration areas and 2001 and 2006 dissemination areas were determined using Statistics Canada's postal code conversion software (*PCCF+ Version 4J*). Additional files were used to determine the corresponding 1991 census enumeration areas, based on the nearest centroids (central points described by longitude and latitude) of those areas with respect to the 1996 enumeration area centroids. Neighbourhood income data were obtained from the census closest to the diagnosis date.

Neighbourhood income quintiles were based on average income per single-person equivalent in the enumeration area or dissemination area. This measure uses the person-weights implicit in the Statistics Canada low-income cut-offs to derive "single-person equivalent" multipliers for each household size. This is a way of adjusting for household size, since more sophisticated variables were not available for enumeration areas before 2001. Population quintiles by neighbourhood income were constructed within each area (census metropolitan area, census agglomeration or residual areas in each province), then pooled across areas. Because housing costs vary substantially across Canada, area-based quintiles better reflect income adequacy relative to need.

Statistical analysis

Female breast cancer incidence rates were calculated for each 10-year age group, year of diagnosis, region and neighbourhood income quintile, using Orius 98 Manager software.¹⁴ The 10 provinces and 3 territories were grouped into 5 regions: British Columbia; Prairies and Territories (Alberta, Saskatchewan, Manitoba, Yukon, Northwest Territories,

and Nunavut; the combined population of the territories was less than 2% of the population of the Prairie provinces); Ontario; Quebec; and Atlantic (Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador).

Age-standardized breast cancer incidence rates (ASIR) per 100,000 female person-years at risk were computed by the direct method using the 1991 population of Canada as the standard. Rate ratios (RR, a measure of relative risk) with 95% confidence intervals based on the Poisson distribution were computed from the ASIR for each neighbourhood income quintile relative to the highest income quintile, with year of diagnosis as a co-variate and stratified by 10-year age group. Tests for heterogeneity and trend in the RRs were calculated using the likelihood ratio test from the standard technique of Poisson regression.¹⁵ Differences in neighbourhood income quintile RRs across age and year were tested using interaction terms in the Poisson regression model.

Data on the number of children ever born per 1,000 women aged 15 or older were compiled by neighbourhood income quintile for 1991.

Data for 2006 from the British Columbia Screening Mammography Program were examined by neighbourhood income quintile as determined by postal code at time of attendance. The percentage of women aged 30 to 89 undergoing screening mammography for the first time was calculated.

Results

Age group and neighbourhood income quintile

For women in all age groups, the risk of being diagnosed with breast cancer was greatest in the highest neighbourhood income quintile (Table 1). Compared with women in neighbourhoods in the top quintile, the RRs for those in the lowest, second-lowest, middle, and second-highest quintiles were lower: 0.85, 0.89, 0.92 and 0.95, respectively.

Table 1
Incident cases of female breast cancer, age-standardized incidence rates, and rate ratios, by age group and neighborhood income quintile, Canada, 1992 to 2004

Age group (years)/ Neighbourhood income quintile	Number of cases	Age- standardized incidence rate (per 100,000)	Rate ratio [†]		
			%	95% confidence interval from	to
Total 19 or older					
1 (lowest)	44,138	114.21	0.85	0.84	0.86
2	45,671	119.69	0.89	0.88	0.90
3	44,693	117.70	0.92	0.91	0.93
4	44,544	117.47	0.95	0.94	0.96
5 (highest)	47,943	128.00	1.00	...	...
19 to 39					
1 (lowest)	2,247	10.25	0.75*	0.72	0.78
2	2,396	11.39	0.83*	0.80	0.87
3	2,631	12.47	0.91*	0.88	0.95
4	2,759	13.04	0.96	0.93	1.00
5 (highest)	2,709	13.58	1.00	...	...
40 to 49					
1 (lowest)	6,631	129.91	0.93*	0.91	0.95
2	7,486	135.35	0.97*	0.95	0.99
3	7,830	132.42	0.95*	0.93	0.97
4	8,431	133.62	0.96*	0.94	0.98
5 (highest)	9,474	141.19	1.00	...	...
50 to 59					
1 (lowest)	9,032	238.98	0.91*	0.90	0.93
2	9,777	239.92	0.93*	0.91	0.94
3	10,193	242.03	0.94*	0.92	0.96
4	11,010	252.57	0.99	0.97	1.01
5 (highest)	12,082	255.50	1.00	...	...
60 to 69					
1 (lowest)	9,944	305.13	0.85*	0.84	0.87
2	10,524	317.57	0.90*	0.88	0.92
3	10,168	323.12	0.93*	0.91	0.94
4	9,970	333.11	0.96*	0.94	0.97
5 (highest)	10,439	347.72	1.00	...	...
70 or older					
1 (lowest)	16,284	354.60	0.80*	0.79	0.82
2	15,488	368.32	0.85*	0.84	0.86
3	13,871	385.12	0.89*	0.88	0.91
4	12,384	397.29	0.92*	0.90	0.94
5 (highest)	13,239	431.94	1.00	...	...

[†] reference category is highest neighbourhood income quintile (5)

* significantly different from reference category

... not applicable

Source: Canadian Cancer Registry; 1991, 1996, 2001 and 2006 Census of Canada.

This pattern was most pronounced among women aged 19 to 39 or 70 or older, among whom the reductions in risk were 25% and 20%, respectively, for those in the lowest as opposed to the highest income quintile. The corresponding risk reductions were attenuated (ranging from 7% to 15%) but still statistically significant in the other age groups.

In each region, differences in breast cancer ASIRs among the first four neighbourhood income quintiles were relatively small (and often not statistically significant), but the difference was much larger (and always significant) between the fourth and fifth (Figure 1).

Parity

In 1991, in all regions except British Columbia, the number of children ever born per 1,000 women aged 15 or older was inversely related to neighbourhood income quintile (Figure 2). Regional differences were striking: women in each neighbourhood income quintile in Atlantic Canada had, on average, about 50% more children than did their counterparts in British Columbia.

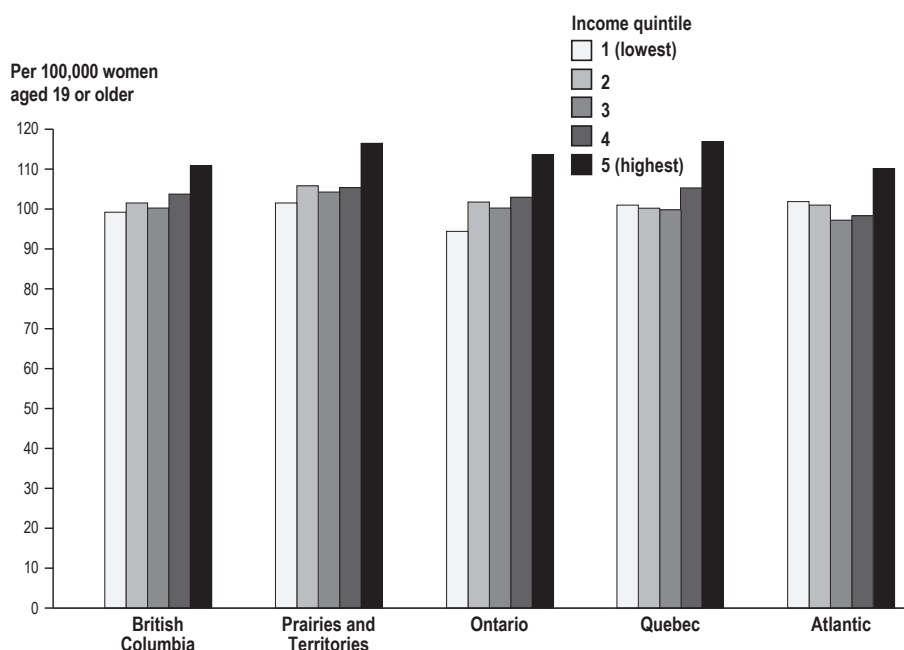
Trends and birth cohorts

Overall, breast cancer ASIRs in all neighbourhood income quintiles had declined slightly by 2004, following a short-term rise in the late 1990s that coincided with the uptake of screening mammography offered by provincial programs. However, throughout the period, the association between higher neighbourhood income and higher breast cancer incidence persisted. The greatest difference in ASIRs between adjacent income quintiles was between the fourth and fifth, although the gap widened from 1995 to 1998, and then narrowed from 2002 to 2004.

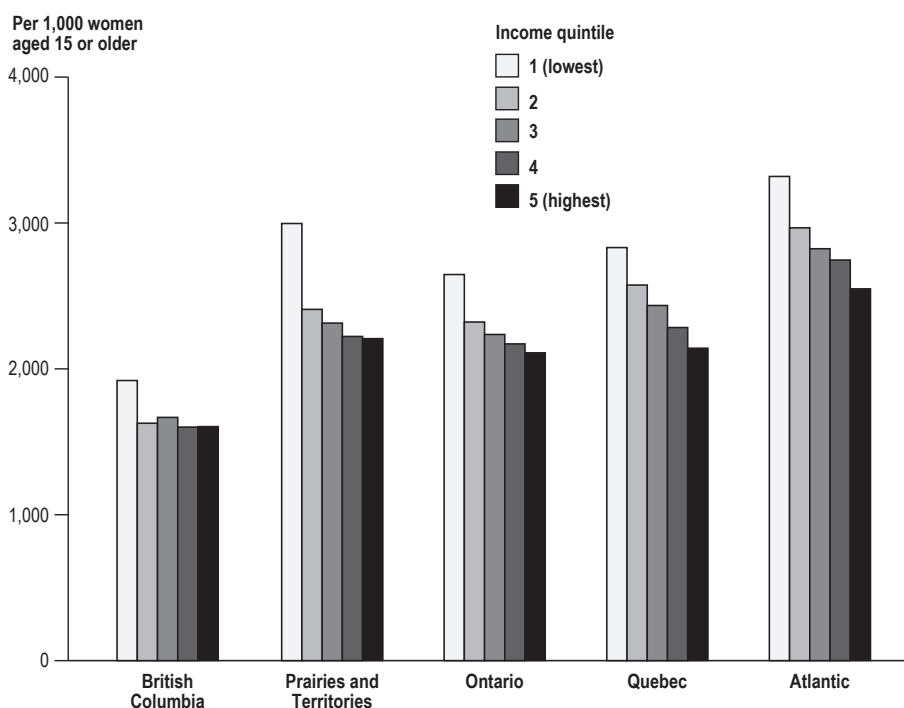
To investigate possible birth cohort effects, breast cancer ASIRs for women aged 50 to 59, 60 to 69, and 70 or older were examined by neighbourhood income and year of diagnosis (Figure 3). The two-way interaction of neighbourhood income quintile RR across each age group and year ($p < 0.001$ in each case) was also tested. Over the 13-year period, in all neighbourhood income quintiles, breast cancer incidence rates were stable or rose slightly among women in their 50s and 60s, but declined among women aged 70 or older. For women in their 60s and 70 or older, the gap in incidence rates across the income quintiles widened in the first few years of the period and persisted through 2004.

Screening mammography

For British Columbia women in each age group (except 70 to 79), those in higher-income neighbourhoods tended to be more likely to have presented for a first mammogram, compared with those in lower-income neighbourhoods (Figure 4).

Figure 1**Age-standardized incidence rates for female breast cancer, by neighbourhood income quintile and region, Canada, 1992-2004**

Source: Canadian Cancer Registry; 1991, 1996, 2001 and 2006 Census of Canada.

Figure 2**Children ever born, by neighbourhood income quintile and region, Canada, 1991**

Source: 1991 Census.

Discussion

This analysis of breast cancer incidence rates by neighbourhood income quintile revealed a 15% lower risk of diagnosis among women in the lowest quintile, compared with those in the highest. Similar patterns for breast cancer in relation to individual socio-economic status, as measured by education, were reported for a Norwegian prospective cohort.¹⁶ An earlier study of breast cancer *mortality* in urban Canada¹ found a 12% lower risk in the lowest compared with the highest neighbourhood income quintile.

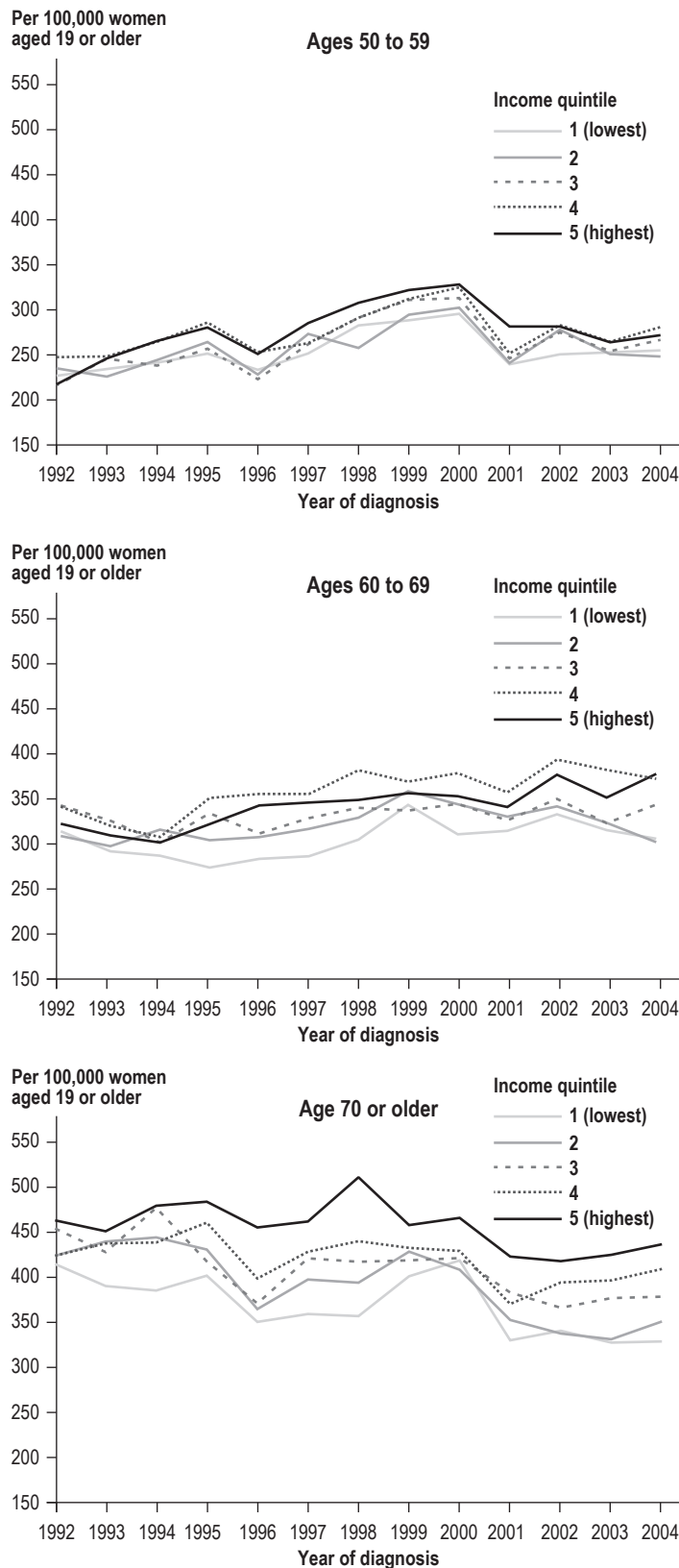
The association between breast cancer risk and neighbourhood income may be partly explained by the distribution of risk factors such as parity or age at first birth that also vary with socio-economic status, as has been reported in some^{17,18} but not all¹² studies.

Parity may influence breast cancer risk through the reduction of estrogen exposure during the months when no menstrual cycles are experienced.¹⁹⁻²³ And indeed, women in higher-income neighbourhoods tended to have fewer children than did those in lower-income neighbourhoods. However, the major difference in parity was between the first (lowest) and second (next lowest) income quintiles, while the major difference in breast cancer incidence was between the fourth and fifth (highest) quintiles. Moreover, the association between parity and breast cancer incidence did not apply across regions. For example, among the regions, parity was lowest for British Columbia women, but British Columbia's breast cancer incidence rates were also among the lowest.

The availability of data by age group from 1992 to 2004 made it possible to consider possible birth cohort effects. The results showed a decline in incidence among women aged 70 or older, but a rise among those aged 50 to 59.

In a 1987 paper,²⁴ White et al. examined the changes in breast cancer risk that would be expected if age at first birth was the only factor at work. That study may help to explain the results of

Figure 3
Age-standardized breast cancer incidence rates, by neighbourhood income quintile, year of diagnosis and age group, Canada, 1992 to 2004



Source: Canadian Cancer Registry; 1991, 1996, 2001 and 2006 Census of Canada.

What is already known on this subject?

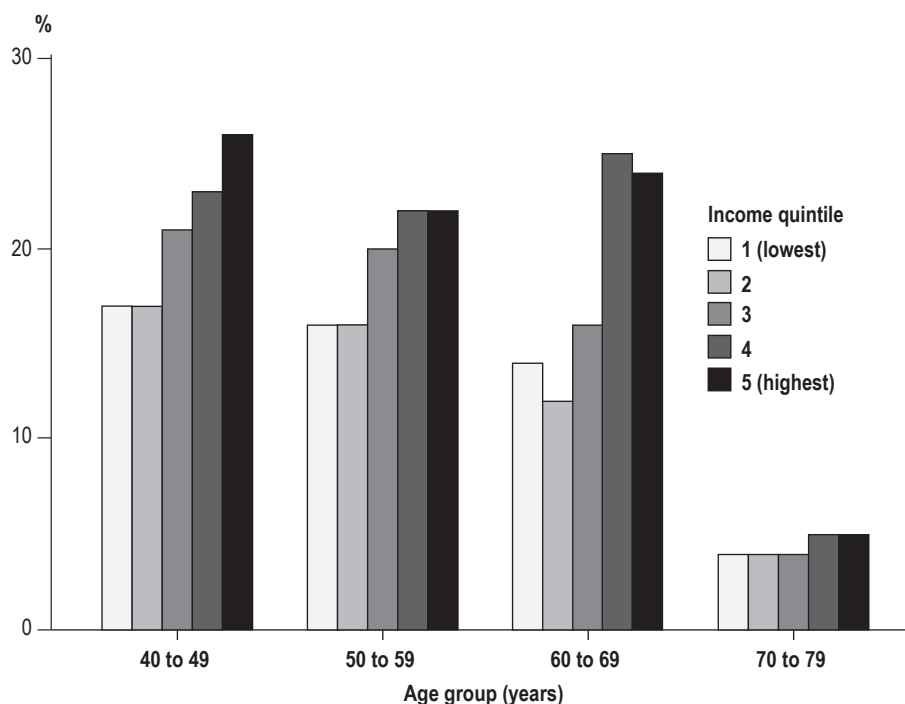
- Data from other countries indicate an elevated risk of breast cancer among women of higher socio-economic status.
- Factors such as number of children even born (parity) and participation in screening mammography, which also vary by socio-economic status, may be responsible for the association.

What does this study add?

- Across Canada over a recent 13-year period, breast cancer incidence rates were highest in the most affluent neighbourhoods, and considerably lower in all other neighbourhoods.
- Lower parity and a higher prevalence of screening mammography may be related to the higher breast cancer incidence rates among women in the highest neighbourhood income quintile, but these factors did not fully explain the differences across income categories.

the present analysis. Women who were aged 70 or older in 1992 had been in the family formation stage in the 1940s, when births were delayed, notably as a result of World War II; this potentially conferred a higher breast cancer risk on them. By contrast, women who were in their 70s in 2004 had entered their child-bearing years during the postwar baby-boom and so may have been at lower risk of breast cancer due to earlier ages at first birth. The risk profile of 50- to 59-year-olds also changed over the study period, as the women who had started families in the early 1960s were succeeded by those who started families in the 1970s when the trend was toward later ages at first birth. Thus, women in their 50s at the end of the study period may have been at greater risk of breast cancer than was the case for the previous generation.

Figure 4
Percent of eligible population aged 40 to 79 attending first-time screening mammography, by neighbourhood income quintile and age group, British Columbia, 2006



Source: British Columbia Screening Mammography Program; 2006 Census of Canada.

Consistent with earlier research,²⁵ the present analysis shows a strong positive association between participation in screening mammography and neighbourhood income quintile among women aged 40 to 69.

A positive association between socio-economic status and breast cancer has been reported in many developed countries,^{3-4, 7} but over time, rates among women of lower socio-economic status have started to “catch up”.²⁶ For example, area-based socio-economic disparities in breast cancer incidence in the United States levelled off or narrowed after 2000,²⁷ similar to the difference reported in the present study between the fourth (second highest) and fifth (highest) income quintiles.

But even taking individual-level indicators of socio-economic status and known risk factors into account, Robert et al.¹² showed that area-based measures of socio-economic status continued to

be associated with breast cancer risk. This suggests that area-based measures are not just proxies for individual-level socio-economic status, but may represent additional factors. Future analysis of data from prospective cohorts would allow comparison of individual and neighbourhood factors, as well as lifestyle, family history, occupational and residential history, and biologic sample data collected before the onset of disease.

Limitations

The design of this study limited the investigation of factors that might help explain why living in a higher-income neighbourhood would be associated with a higher risk of being diagnosed with breast cancer. The use of small-area data meant that it was not possible to directly adjust for individual-level risk factors. Moreover, only one postal code (residence at diagnosis) was available, so

the income quintile of neighbourhoods where women with breast cancer had lived at potentially relevant earlier periods could not be considered. As well, national cancer registration data contain no staging information.

Only the first three digits of the postal code were available for cases diagnosed in Quebec, thereby yielding less precise estimates of neighbourhood income quintile. Such non-differential misclassification would tend to attenuate effect estimates, thus diminishing the association between diagnosis and neighbourhood income, especially for Quebec.

Data on the two factors that might contribute to the results—parity and mammography—were also limited. Census parity data were available only for 1991. Screening mammography data pertained to British Columbia, and to first-time attendance, which may differ from return attendance with respect to important factors such as age. However, differential access to medical care or screening²⁸ were unlikely to have been major factors because of publicly funded universal health care in Canada.

The small percentage of cases that were excluded was unlikely to have biased the results.

Conclusion

Breast cancer incidence is one of the few adverse health outcomes consistently associated with higher socio-economic status. The association may be partly related to differences in parity and screening mammography, but other factors remain to be identified. Additional research on neighbourhood-level differences would be beneficial in informing public health strategies for breast cancer prevention. ■

Acknowledgments

The authors gratefully acknowledge guidance from the Health Statistics Division of Statistics Canada and excellent support from the staff of the British Columbia Inter-university Research Data Center, namely, Cheryl Fu and Lee Grenon. We also thank

Kim Boyuk, Nancy Darcovich, Donna Dosman, Laurie Gibbons and Darren Lauzon of Statistics Canada for their guidance and support during this study. For their valuable help with access to parity and screening data, respectively,

we thank Mary Luebbe of the Data Liberation Initiative at the University of British Columbia, and Larry St. Germain at the Screening Mammography Program of British Columbia.

References

1. Wilkins R, Berthelot J, Ng E. Trends in mortality by neighbourhood income in urban Canada from 1971 to 1996. *Health Reports* 2002; 13(Suppl): 1-27.
2. Parkin D, Muir C, Whelan SL, et al. Cancer incidence in five continents. Volume VII. *IARC Scientific Publications* 2002; 155: 128-53.
3. Barbone F, Filiberti R, Franceschi S, et al. Socioeconomic status, migration and the risk of breast cancer in Italy. *International Journal of Epidemiology* 1996; 25(3): 479-87.
4. Dano H, Andersen O, Ewertz M, et al. Socioeconomic status and breast cancer in Denmark. *International Journal of Epidemiology* 2003; 32(2): 218-24.
5. Reynolds P, Hurley S, Goldberg DE, et al. Regional variations in breast cancer among California teachers. *Epidemiology* 2004; 15(6): 746-54.
6. Reynolds P, Hurley SE, Quach AT, et al. Regional variations in breast cancer incidence among California women, 1988-1997. *Cancer Causes and Control* 2005; 16(2): 139-50.
7. Yost K, Perkins C, Cohen R, et al. Socioeconomic status and breast cancer incidence in California for different race/ethnic groups. *Cancer Causes and Control* 2001; 12(8): 703-11.
8. Borugian MJ, Spinelli JJ, Mezei G, et al. Childhood leukemia and socioeconomic status in Canada. *Epidemiology* 2005; 16(4): 526-31.
9. Brown SB, Hole DJ, Cooke TG. Breast cancer incidence trends in deprived and affluent Scottish women. *Breast Cancer Research and Treatment* 2007; 103(2): 233-8.
10. Vidarsdottir H, Gunnarsdottir HK, Olafsdottir EJ, et al. Cancer risk by education in Iceland; a census-based cohort study. *Acta Oncologica* 2008; 47(3): 385-90.
11. Mezei G, Borugian MJ, Spinelli JJ, et al. Socioeconomic status and childhood solid tumor and lymphoma incidence in Canada. *American Journal of Epidemiology* 2006; 164(2): 170-5.
12. Robert SA, Strombom I, Trentham-Dietz A, et al. Socioeconomic risk factors for breast cancer: distinguishing individual- and community-level effects. *Epidemiology* 2004; 15(4): 442-50.
13. Johnson KC, Hu J, Mao Y. Passive and active smoking and breast cancer risk in Canada, 1994-97. *Cancer Causes and Control* 2000; 11(3): 211-21.
14. On L, Semenciw RM, Mao Y. Orius software: calculation of rates and epidemiologic indicators, and preparation of graphical output. *Chronic Diseases in Canada* 2000; 21(3): 134-6.
15. Breslow NE, Day NE. Statistical methods in cancer research. Volume II—The design and analysis of cohort studies. *IARC Scientific Publications* 1987; (82): 1-406.
16. Braaten T, Weiderpass E, Kumle M, Lund E. Explaining the socioeconomic variation in cancer risk in the Norwegian Women and Cancer Study. *Cancer Epidemiology, Biomarkers and Prevention* 2005; 14(11 Pt 1): 2591-7.
17. Prehn AW, West DW. Evaluating local differences in breast cancer incidence rates: a census-based methodology (United States). *Cancer Causes and Control* 1998; 9(5): 511-7.
18. Robbins AS, Brescianini S, Kelsey JL. Regional differences in known risk factors and the higher incidence of breast cancer in San Francisco. *Journal of the National Cancer Institute* 1997; 89(13): 960-5.
19. Adami HO, Hansen J, Jung B, Rimsten AJ. Age at first birth, parity and risk of breast cancer in a Swedish population. *British Journal of Cancer* 1980; 42(5): 651-8.
20. Fraumeni JF, Jr., Lloyd JW, Smith EM, Wagoner JK. Cancer mortality among nuns: role of marital status in etiology of neoplastic disease in women. *Journal of the National Cancer Institute* 1969; 42(3): 455-68.
21. Hsieh C, Pavia M, Lambe M, et al. Dual effect of parity on breast cancer risk. *European Journal of Cancer* 1994; 30A(7): 969-73.
22. Kvale G, Heuch I, Eide GE. A prospective study of reproductive factors and breast cancer. I. Parity. *American Journal of Epidemiology* 1987; 126(5): 831-41.
23. Morris GJ. Breastfeeding, parity, and reduction of breast cancer risk. *Breast Journal* 2009; 15(5): 562-3.
24. White E. Projected changes in breast cancer incidence due to the trend toward delayed childbearing. *American Journal of Public Health* 1987; 77(4): 495-7.
25. Pruitt SL, Shim MJ, Mullen PD, et al. Association of area socioeconomic status and breast, cervical, and colorectal cancer screening: a systematic review. *Cancer Epidemiology, Biomarkers and Prevention* 2009; 18(10): 2579-99.
26. Krieger N. Is breast cancer a disease of affluence, poverty, or both? The case of African American women. *American Journal of Public Health* 2002; 92(4): 611-3.
27. Harper S, Lynch J, Meersman SC, et al. Trends in area-socioeconomic and race-ethnic disparities in breast cancer incidence, stage at diagnosis, screening, mortality, and survival among women ages 50 years and over (1987-2005). *Cancer Epidemiology, Biomarkers and Prevention* 2009; 18(1): 121-31.
28. Shields M, Wilkins K. An update on mammography use in Canada. *Health Reports* 2009; 20(3): 7-19.



ELECTRONIC PUBLICATIONS
AVAILABLE AT

www.statcan.gc.ca

Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves)

by Noreen Willows, Paul Veugelers, Kim Raine and Stefan Kuhle

Abstract

Background

Aboriginal people are more vulnerable to food insecurity and morbidity than is the Canadian population overall. However, little information is available about the association between food insecurity and health in Aboriginal households.

Data and methods

Data from the 2004 Canadian Community Health Survey—Nutrition were used to examine the relationships between household food security and self-reported health, well-being and health behaviours in a sample of 837 Aboriginal adults living off reserve. Household food security status was based on Health Canada's interpretation of the United States Household Food Security Survey Module. Multivariable logistic regression was used to identify significant relationships, while adjusting for potential confounders.

Results

An estimated 29% of Aboriginal people aged 18 or older lived in food-insecure households. They were more likely to report poor general and mental health, life dissatisfaction, a very weak sense of community belonging, high stress and cigarette smoking, compared with their counterparts in food-secure households. When age, gender and household education were taken into account, respondents from food-insecure households had significantly higher odds of poor general health, high stress, life dissatisfaction, and a very weak community belonging.

Interpretation

Reductions in household food insecurity may improve the health and well-being of Aboriginals living off-reserve.

Keywords

Diet, eating, food intake, health behaviour, low income population, nutrition surveys, poverty

Authors

Noreen Willows (1-780-492-3989; noreen.willows@ualberta.ca), Paul Veugelers, Kim Raine and Stefan Kuhle are with the University of Alberta, Edmonton, Alberta, T6G 2T4.

Food insecurity exists when the availability of nutritionally adequate and safe foods or the ability to acquire such food in socially acceptable ways is limited or uncertain.¹ It can range from the fear of not being able to provide or obtain food to hunger due to food shortages. The deprivation of basic need represented by food insecurity is a possible precursor to suboptimal dietary intakes and compromised health and well-being.^{2,3} Food insecurity is thus an important public health issue, particularly for economically marginalized groups including Aboriginal peoples.⁴⁻⁷

In Canada, “Aboriginal peoples” are the descendants of the original inhabitants of North America, and include Status and non-Status Indians (First Nations), Métis and Inuit.⁸ Research shows that the health of these groups is less favourable than that of the non-Aboriginal population.⁹ Moreover, health inequalities persist when socio-economic factors, obesity and health behaviours such as smoking and alcohol consumption are taken into account.⁹

The Canadian Community Health Survey (CCHS) provides information on health status, health care use and health determinants. Although the survey excludes residents of Indian Reserves and some remote regions,¹⁰ the CCHS can be used to examine the health of the majority of Aboriginal people.

According to the 2001 Census, more than 70% of the Aboriginal population lived off a reserve, most of them (68%) in urban areas.¹¹ The 2004 CCHS intentionally oversampled Aboriginal people aged 19 to 50 to allow for analysis of this subpopulation.

The 2004 CCHS was the first cycle of the survey to measure household food security using the United States Household Food Security Survey Module (HFSSM).^{12,13} The HFSSM is an internationally validated 18-question measure of the food security status of households in the previous 12 months.¹⁴ Household food insecurity (HFI) identified using the HFSSM is not the same as general income inadequacy; rather, it is a condition of deprivation due

Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves) • Research article

to resource constraint in one specific area of need.¹⁴

Based on responses to the HFSSM, one-third of Aboriginal households participating in the 2004 CCHS experienced multiple conditions characteristic of HFI; the figure for non-Aboriginal households was 9%.⁴ Aboriginal households had a higher prevalence of socio-demographic risk factors for HFI, and the relationship between HFI and these factors was stronger among Aboriginal respondents.⁴

The aim of the present exploratory study was to determine if HFI was a specific correlate of health in the Aboriginal population. Data from the 2004 CCHS were used to examine the relationship between HFI and self-reported health, well-being and health behaviours among adult Aboriginal respondents.

Data and methods

Survey design

The 2004 CCHS—Nutrition was a cross-sectional survey of residents of private dwellings in the 10 provinces. A complex multistage sampling strategy was used to select households and respondents. From January 2004 through January 2005, one member from each of 35,107 households was interviewed. The survey covered approximately 98% of the population of the provinces. To ensure that the survey was representative, a non-response adjustment was applied to the survey weights. Detailed descriptions of the CCHS design, sample and interview procedures are available elsewhere.^{12,13,15}

Variable selection

From 13 fixed ethnic responses, respondents were asked to select those that applied. Respondents were included in the present study if they self-identified as Aboriginal, even if they also indicated another ethnic group. This approach is consistent with that used in the Census, whereby someone reporting at least one Aboriginal ancestor is categorized as Aboriginal.¹⁶ Of the 1,528 CCHS respondents who identified as Aboriginal,

59% were North American Indian, 37% Métis and 3% Inuit,¹² a distribution proportionally similar to that in the 2006 Census.¹⁷ Only data from Aboriginal respondents aged 18 or older were used in this analysis.

Because of the relatively small sample size, categories for almost all variables were aggregated. Information about the original survey variables is available elsewhere.¹⁵ Household food security status was based on an interpretation of the responses to the HFSSM developed by Health Canada's Office of Nutrition Policy and Promotion.¹³ Specifically, the questions addressed household food access issues in the context of financial constraint. Moderate and severe HFI were combined into a single category.

The socio-demographic variables used in the analyses were age, gender, household education and household income adequacy. Household education was the highest level attained by any household member. Household income adequacy was based on the number of people in the household and total household income from all sources in the 12 months before the interview.

Five CCHS questions were used to assess respondents' health and well-being: self-reported general and mental health, life satisfaction, stress, and sense of community belonging. In each case, respondents selected from four or five options. Responses to the questions about self-perceived general and mental health were dichotomized as "good" (excellent/very good/good) or "poor" (fair/poor). Stress was dichotomized as "high" (quite a bit/extreme stress) or "low" (not at all stressful/not very stressful/a bit stressful). Life satisfaction was dichotomized as "high" (very satisfied, satisfied) or "low" (neither satisfied nor dissatisfied/dissatisfied or very dissatisfied). Sense of community belonging was dichotomized as "present" (very strong/somewhat strong/weak) or "very weak" (very weak).

Respondents were asked if a health professional had diagnosed them with any of the following chronic conditions: high blood pressure, diabetes, heart disease, cancer, a bowel disorder such as

Crohn's Disease or colitis, osteoporosis (respondents aged 50 or older), or any other long-term physical or mental condition. Individuals were considered to have a chronic condition if they responded "yes" to the presence of one or more.⁹

Two health behaviours—cigarette smoking and fruit/vegetable consumption—were considered. Smoking was dichotomized as current non-smoker or current smoker. Fruit/Vegetable consumption was considered "low" if respondents reported fewer than five times a day, and "adequate" if they reported five or more times a day. Weight status, including obesity, was not retained as an outcome variable because directly measured height and weight were available for only 57.5% of adult respondents.¹⁸

Statistical analysis

Associations between HFI and the health outcomes/behaviours were examined in a series of univariate and multivariate logistic regression models. The multivariate models were adjusted for age and gender (Model 1); for age, gender and household education (Model 2); and for age, gender, household education and household income adequacy (Model 3). Standard errors were estimated with a bootstrapping procedure.^{19,20} Prevalence estimates were calculated using sampling weights provided by Statistics Canada to account for design effect and non-response bias. Sampling variability guidelines recommended by Statistics Canada for interpreting the coefficient of variation (CV) were used. Data with a moderate CV (16.5% to 33.3%) must be interpreted with caution.¹⁵ Stata Version 9 (Stata Corp, College Station, TX, USA) was used to perform the statistical analyses.

The study was conducted under the Research Data Centre Program,²¹ which provided access in a secure university setting to the 2004 CCHS—Nutrition Master File.¹³ Institutional ethics approval was received from the Human Research Ethics Board of the Faculty of Agriculture, Forestry and Home Economics, University of Alberta.

Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves) • Research article

Results

The sample size comprised 837 Aboriginal respondents aged 18 or older living off a reserve, 57% of whom were women (data not shown). More than half (52%) of respondents were aged 18 to 40; a third (32%) were aged 41 to 55; and the remaining 15% were aged 55 or older. More than a third (36%) lived in households where the highest level of educational attainment was secondary graduation or less. Almost half lived in households in the lowest (23%) or lower-middle (25%) income adequacy categories; 48% were from households in the upper-middle (30%) or highest (18%) income categories. For small percentages

of respondents, data were missing for education (3%) and household income adequacy (5%).

Almost three in ten (29%) Aboriginal adults lived in food-insecure households. Compared with their counterparts in food-secure households, they were more likely to report poor general health (36% versus 21%) and poor mental health (21% versus 10%), life dissatisfaction (28% versus 13%), a very weak sense of community belonging (20% versus 11%), high stress (43% versus 21%), and cigarette smoking (64% versus 46%) (Table 1). When age and gender were taken into account, these relationships remained significant, and in addition, Aboriginal adults in food-insecure households had greater odds of low fruit/vegetable consumption than did those in food-secure households (Table 2, Model 1). When household education was also considered (Model 2), the odds for poor mental health, smoking, and low fruit/vegetable consumption no longer differed significantly between the two groups. And when income adequacy was included (Model 3), stress was the only health outcome that remained significantly higher for Aboriginal adults in food-insecure households.

Table 1
Prevalence of measures of health and well-being and health behaviours, by household food security status, off-reserve Aboriginal population aged 18 or older, Canada, 2004

	Household food security status		
	Total	Insecure	Secure
	%		
Self-perceived general health			
Good	75	64	79
Poor	25	36	21
Self-perceived mental health			
Good	87	79	90
Poor	13	21 ^E	10 ^E
Self-perceived stress			
Low	72	57	79
High	28	43	21 ^E
Life satisfaction			
High	83	72	87
Low	17	28 ^E	13 ^E
Sense of community belonging			
Present	87	80	89
Very weak	13	20 ^E	11 ^E
Chronic condition			
No	55	53	57
Yes	45	47	44
Smoking			
Non-smoker	49	36	54
Current smoker	51	64	46
Fruit/Vegetable intake			
At least 5 times a day	14	9 ^E	17
Less than 5 times a day	86	91	83

^E use with caution

Source: 2004 Canadian Community Health Survey—Nutrition.

What is already known on this subject?

- Aboriginal people experience mortality and morbidity rates that exceed rates for non-Aboriginal Canadians.
- Household food insecurity is an important public health issue in Canada, particularly for economically marginalized groups including First Nations, Métis and Inuit.
- Household food insecurity is a possible precursor to suboptimal dietary intakes and compromised health and well-being.

What does this study add?

- Aboriginal adults in food-insecure households were more likely than those in food-secure households to have poor general health, high stress, less life satisfaction, and a very weak sense of community belonging.
- These relationships persisted even when age, gender and household educational attainment were taken into account.

Discussion

The 2004 CCHS—Nutrition data reveal associations between HFI and several health outcomes among Aboriginal adults living off a reserve. Even when age, gender and household education were taken into account, adults in food-insecure households were more likely than those in food-secure households to have poor self-perceived general health, high stress, low life satisfaction, and a very weak sense of community belonging. However, except for stress, the relationships were no longer significant when the data were further adjusted for household income. The inclusion of income likely over-adjusted the data, because the HFSSM questions pertain either to a lack of money or an inability to afford food as the reason for the situations and behaviours

that characterize food insecurity.^{13,14} Therefore, the results of the age-/gender-/education-adjusted model may better reflect the associations between HFI and the health outcomes.

The poorer health and well-being of Aboriginal adults in food-insecure households are consistent with other research. For example, a study of CCHS respondents with diabetes found that HFI was associated with life dissatisfaction, poor general and mental health, and increased stress.²²

Anxiety is another dimension of HFI.¹³ In Canada, HFI has been associated with acute and chronic stress, a sense of alienation, and exclusion from society.^{23,24} Thus, the associations between HFI and stress, life dissatisfaction and a very

Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves) • Research article

Table 2

Unadjusted and adjusted odds ratios relating household food security status to measures of health and well-being and lifestyle behaviours, off-reserve Aboriginal population aged 18 or older, Canada, 2004

	Unadjusted odds ratio	95% confidence interval		Model 1 (adjusted for age, gender)			Model 2 (adjusted for age, gender, household education)			Model 3 (adjusted for age, gender, household education, household income adequacy)		
		from	to	Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval		Adjusted odds ratio	95% confidence interval	
Poor self-perceived general health												
Food insecure	2.09*	1.17	3.74	2.42*	1.34	4.36	2.37*	1.29	4.37	1.53	0.75	3.11
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Poor self-perceived mental health												
Food insecure	2.55*	1.06	6.14	2.54*	1.05	6.12	2.36	0.96	5.81	1.62	0.48	5.50
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
High self-perceived stress												
Food insecure	2.81*	1.45	5.43	2.77*	1.46	5.26	2.86*	1.48	5.52	3.13*	1.44	6.78
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Low life satisfaction												
Food insecure	2.64*	1.24	5.62	3.03*	1.43	6.43	2.89*	1.40	5.95	2.15	0.89	5.18
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Very weak sense of community belonging												
Food insecure	2.16*	1.05	4.45	2.10*	1.02	4.33	2.16*	1.07	4.36	1.70	0.76	3.81
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Presence of chronic condition												
Food insecure	1.17	0.66	2.08	1.47	0.82	2.64	1.61	0.88	2.93	1.65	0.81	3.38
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Current smoker												
Food insecure	2.08*	1.22	3.54	1.93*	1.12	3.31	1.59	0.94	2.69	1.20	0.66	2.17
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...
Low fruit/vegetable intake												
Food insecure	2.00	0.98	4.09	2.12*	1.04	4.36	1.99	0.97	4.08	1.86	0.76	4.55
Food secure†	1.00	...	...	1.00	...	...	1.00	...	...	1.00	...	...

† reference category

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

... not applicable

Source: 2004 Canadian Community Health Survey—Nutrition.

weak sense of community belonging in the present study were anticipated.

Among Canadians in general, a very strong sense of community belonging has been associated with excellent or very good general and mental health.²⁵ Among Aboriginal Canadians in particular, the connection between the individual and the larger society continues to be a strong determinant of health.²⁶ In this study, HFI was associated with a very weak sense of community belonging and poor self-reported health; however, it is possible that an interrelationship may exist among all three.

Limitations

Specific problems related to the design and variable selection of the CCHS 2004—Nutrition make the interpretation of results problematic. The survey was cross-sectional, so causal relationships between variables cannot be inferred. And because the survey relied on self-reports, the results are subject to recall and report bias.

Owing to the small number of Aboriginal respondents, the present study was limited by the need to aggregate data. For example, health outcomes for respondents from the most food-insecure

households could not be examined separately. As well, data for individuals with sole and mixed Aboriginal ancestry had to be combined, although their life experiences and cultural orientation may differ.²⁷ Similarly, data for respondents who identified as North American Indian, Métis or Inuit had to be pooled. Individuals reporting North American Indian origins comprised the largest percentage of Aboriginal respondents, so the findings are more reflective of the circumstances of First Nations than of the other groups.

Cultural or ethnic identity may influence individuals' perception of their well-being.²⁸ The concept of health for

Associations between household food insecurity and health outcomes in the Aboriginal population (excluding reserves) • Research article

many Aboriginal peoples is a balance of the physical, mental, emotional, spiritual and social aspects of life.²⁹ Questions that would assess the degree to which such a balance is achieved were not part of the CCHS. Consequently, the measures of health may not correspond with traditional Aboriginal perceptions of health that are based on holistic and ecological foundations.³⁰

The small sample size precluded analysis of health outcomes of HFI among Aboriginal children. This is an important area of research for future studies.

Conclusion

The complex reality of the lives of the Aboriginal population living off a reserve is of major importance, but these groups tend to be under-represented in health research in Canada.³¹ Using an internationally validated tool, the present study contributes to a greater understanding of HFI among this population. The findings suggest that the pervasiveness of HFI in the context of financial constraint may contribute to the relatively poor health and well-being of Aboriginal people. ■

Funding

Noreen D. Willows, Kim Raine and Paul Veugelers acknowledge salary support from the Alberta Heritage Foundation for Medical Research and CIHR and CRC chair programs. Funding was from the Canadian Institutes of Health Research - Institute of Nutrition, Metabolism and Diabetes, Statistics Canada, and Health Canada.

References

1. Anderson SA. Core indicators of nutritional status for difficult-to-sample populations. *Journal of Nutrition* 1990; 120 (Suppl. 11): 1559-1600.
2. Vozoris N, Tarasuk V. Household food insufficiency is associated with poorer health. *Journal of Nutrition* 2003; 133: 120-6.
3. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. *Journal of Nutrition* 2008; 138: 604-12.
4. Willows ND, Veugelers P, Raine K, Kuhle S. Prevalence and sociodemographic risk factors related to household food security in Aboriginal peoples in Canada. *Public Health Nutrition* 2009; 12: 1150-6.
5. Willows ND. Determinants of healthy eating in Aboriginal peoples in Canada: The current state of knowledge and research gaps. *Canadian Journal of Public Health* 2005; 96 (Suppl. 3): S32-6.
6. Power EM. Conceptualizing food security for Aboriginal People in Canada. *Canadian Journal of Public Health* 2008; 97: 95-7.
7. Egeland GM, Pacey A, Cao Z, Sobol I. Food insecurity among Inuit preschoolers: Nunavut Inuit Child Health Survey, 2007-2008. *Canadian Medical Association Journal* 2010; 182: 243-8.
8. Indian and Northern Affairs Canada. *Words First: An Evolving Terminology Relating to Aboriginal Peoples in Canada*. Ottawa: Indian and Northern Affairs Canada, 2002. Available at: http://www.collectionscanada.gc.ca/webarchives/20071124233110/http://www.ainc-inac.gc.ca/pr/pub/wf/wofi_e.pdf. Accessed September 22, 2009.
9. Tjepkema M. The health of the off-reserve Aboriginal population. *Health Reports* (Suppl.) 2002; 13: 73-88.
10. Canadian Community Health Survey. Available at: <http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3226&lang=en&db=imdb&adm=8&dis=2>. Accessed June 22, 2010.
11. O'Donnell V, Tait H. *Aboriginal Peoples Survey 2001 - Initial Findings: Well-being of the Non-reserve Aboriginal Population*. Ottawa: Statistics Canada, 2003. Available at: <http://www.statcan.gc.ca/pub/89-589-x/89-589-x2003001-eng.pdf>. Accessed June 22, 2010.
12. Health Canada. *Canadian Community Health Survey, Cycle 2.2, Nutrition (2004). A Guide to Accessing and Interpreting the Data* (Catalogue H164-20/2006E-PDF) Ottawa: Health Canada, 2006.
13. Health Canada. *Canadian Community Health Survey Cycle 2.2, Nutrition (2004). Income-Related Household Food Security in Canada* (Catalogue H164-42/2007E-PDF) Ottawa: Health Canada, 2007.
14. Bickel G, Nord M, Price C, et al. *Guide to Measuring Household Food Security, Revised 2000*. Alexandria: Food and Nutrition Service, United States Department of Agriculture, 2000. Available at: www.fns.usda.gov/fsec/files/fsguide.pdf. Accessed September 22, 2009.
15. Statistics Canada. *Canadian Community Health Survey 2004. User Guide for the Public Use Microdata File*. Ottawa: Statistics Canada, 2005. Available at: http://www.statcan.gc.ca/imdb-bmdi/document/5049_D8_T9_V1-eng.pdf. Accessed September 22, 2009.
16. Statistics Canada. *How Statistics Canada Identifies Aboriginal Peoples*. Ottawa: Statistics Canada, 2007. Available at: <http://www.statcan.gc.ca/pub/12-592-x/12-592-x2007001-eng.pdf>. Accessed September 22, 2009.
17. Statistics Canada. *Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations, 2006 Census*. The Daily, Tuesday, January 15, 2008. Statistics Canada, 2008. Available at: <http://www.statcan.gc.ca/daily-quotidien/080115/dq080115a-eng.htm>. Accessed June 22, 2010.
18. Tjepkema M. Adult obesity. *Health Reports* 2006; 17(3): 9-25.
19. Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 283-310.
20. Piérard E, Buckley N, Chowhan J. Bootstrapping made easy: A STATA ADO file. *The Research Data Centres Information and Technical Bulletin* 2004; 1: 20-36.
21. Statistics Canada. *The Research Data Centres Program*. Statistics Canada, 2009. Available at: <http://www.statcan.gc.ca/rdc-cdr/index-eng.htm>. Accessed September 22, 2009.
22. Gucciardi E, Vogt JA, DeMelo M, Stewart DE. Exploration of the relationship between household food insecurity and diabetes in Canada. *Diabetes Care* 2009; 32: 2218-24.
23. Hamelin A-M, Habicht J-P, Beaudry M. Food Insecurity: Consequences for the household and broader social implications. *Journal of Nutrition* 1999; 129: 525-8.
24. Hamelin A-M, Beaudry M, Habicht J-P. Characterization of household food insecurity in Québec: food and feelings. *Social Science and Medicine* 2002; 54: 119-32.
25. Shields M. Community belonging and self-perceived health. *Health Reports* 2008; 19(2): 1-11.
26. Richmond CAM, Ross NA, Egeland GM. Social support and thriving health: a new approach to understanding the health of indigenous Canadians. *American Journal of Public Health* 2007; 97: 1827-33.
27. Maxim PS, Keane C, White J. *Urban Residential Patterns of Aboriginal People in Canada*. In: D. Newhouse and E. Peters, eds. *Not strangers in these parts: Urban Aboriginal Peoples*. Ottawa: Policy Research Initiative, 2003: 79-91.
28. Garrouette EM, Sarkisian N, Arguelles L, et al. Cultural identities and perceptions of health among health care providers and older American Indians. *Journal of General Internal Medicine* 2006; 21: 111-6.
29. National Aboriginal Health Organization (NAHO). *How we see it! Broader Determinants of Health within Aboriginal Contexts*. Ottawa: National Aboriginal Health Organization, 2007. Available at: <http://www.naho.ca/english/publications/vaccho.pdf>. Accessed September 22, 2009.
30. First Nations Centre. *First Nations and Inuit Regional Health Surveys, 1997: A Synthesis of the National and Regional Reports*. Ottawa: National Aboriginal Health Organization, 2004.
31. Young TK. Review of research on aboriginal populations in Canada: relevance to their health needs. *British Medical Journal* 2003; 327: 419-22.

Conditional survival analyses across cancer sites

by Larry F. Ellison, Heather Bryant, Gina Lockwood and Lorraine Shack

Abstract

Survival estimates measured from the time of a cancer diagnosis become less informative after one or two years' survival. Using records from the Canadian Cancer Registry linked to the Canadian Vital Statistics Death Database, five-year conditional relative survival ratio (RSR) estimates were derived for a large number of cancers. For each cancer with an initial five-year RSR of at least 80% (except breast cancer), a conditional five-year RSR of 95% or more was achieved after five years' survival. Among cancers with initial five-year RSRs of 50% to 79%, a five-year conditional RSR of 95% or more was observed for cancers of the cervix uteri and colon after five years. There was no apparent improvement in survival prospects during the first five years after diagnosis for chronic lymphocytic leukemia (CLL). Despite initial prognoses of less than 50%, a conditional five-year RSR of at least 90% five years after diagnosis was achieved for stomach cancer and leukemia (excluding CLL).

Keywords

neoplasms, population surveillance, prognosis, registries, survival analysis

Authors

Larry F. Ellison (1-613-951-5244; larry.ellison@statcan.gc.ca) is with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6. Heather Bryant and Gina Lockwood are with the Canadian Partnership Against Cancer, Toronto, Ontario. Lorraine Shack is with Alberta Health Services and Community Health Science, University of Calgary, Calgary, Alberta.

Survival statistics are an indicator of the effectiveness of cancer detection and treatment.¹ These statistics are used to compare cancer control over time² and across jurisdictions.^{3,4} They are also of interest to clinicians providing direct care and to patients, who usually want an estimate of their prognosis.⁵

Survival estimates are typically presented as the probability—or the ratio of observed and expected probabilities in the case of relative survival—of surviving a given length of time (for example, five years) after diagnosis. However, these estimates are less informative for people who have survived one or more years, as the risk of death due to cancer is often greatest in the first few years. After this initial period, the prognosis can improve substantially, so the earlier estimates no longer apply.⁶ The outlook for such people can be estimated more appropriately using *conditional* survival.

For the first time in Canada, predicted conditional relative survival estimates are presented for a large number of cancers. Cancers with the greatest relative improvement in prognosis since diagnosis are highlighted. Cancers showing less improvement are also identified.

Prognosis improves over time

For almost all the individual cancers studied, the relative probability of living an additional five years improved when measured at increasingly longer periods after diagnosis, the effect being strongest in the first one to two years (Table 1). A notable exception was chronic lymphocytic leukemia (CLL), for which five-year relative survival was just under 80% at diagnosis and did not appear to improve over the subsequent five years.

After five years' survival, the conditional five-year relative survival ratio (RSR) had risen to at least 95% for the cancers with an initial five-year RSR of at least 80%. The exception was breast cancer (five-year RSR of 93% after five years). Thyroid, prostate and testicular cancers had five-year prognoses of 95% or more at diagnosis; for skin melanoma and cancer of the corpus uteri, this level was achieved after three years, and for Hodgkin lymphoma, it took five years.

Table 1

Predicted five-year relative survival ratios (RSR), by type of cancer and conditional on having survived up to five years, Canada excluding Quebec, 2004 to 2006

Cancer type	RSR conditional on surviving (years)					
	0	1	2	3	4	5
	%					
Thyroid	98	100	100	100	99	99
Prostate	96	97	98	99	99	99
Testis	95	98	99	99	100	100
Skin melanoma	90	92	94	96	97	98
Breast	88	89	90	91	92	93
Corpus uteri	85	90	94	96	98	98
Hodgkin lymphoma	85	92	93	94	94	95
Chronic lymphocytic leukemia (CLL)	77	80	79	78	79	78
Cervix uteri	73	82	87	92	94	96
Bladder (including in situ)	73	83	88	90	93	94
Kidney and renal pelvis	67	83	88	91	92	94
Soft tissue	65	79	86	90	92	93
Larynx	64	72	78	81	80	83
Rectum	64	73	79	84	90	93
Colon	63	77	85	90	94	97
Non-Hodgkin lymphoma	63	78	82	83	84	85
Oral (buccal cavity and pharynx)	63	74	82	86	88	88
Ovary	42	53	61	69	76	82
Multiple myeloma	37	45	47	51	55	60
Leukemia (excluding CLL)	34	65	77	78	88	90
Stomach	24	49	68	80	87	92
Brain	23	47	65	71	75	78
Liver	18	42	55	67	74 [†]	82 [†]
Lung and bronchus	16	37	54	65	71	75
Esophagus	13	34	56	69	77	83 [†]
Pancreas	6	28	54	68	79	88 [†]

[†] standard error of 3.0% or more; no estimates have standard errors of 3.3% or more

Source: Canadian Cancer Registry, Statistics Canada and provincial/territorial cancer registries.

A five-year conditional RSR of 90% or higher was achieved for breast cancer after two years, and by one year for all other cancers in this group.

Among cancers with five-year RSRs of 50% to 79% at diagnosis, a five-year conditional RSR of 95% or higher was observed for cancers of the cervix uteri and colon after five years. A five-year conditional RSR of 90% or higher was achieved for cancers of the bladder, kidney and renal pelvis, and soft tissue after three years, and for rectal cancer, after four years. It was not achieved for the other cancers with initial five-year RSRs of 50% to 79%, although improvements from the mid-sixty percents at diagnosis to the mid-eighty percents among those surviving the first five years were noted for oral and laryngeal cancers, and for non-Hodgkin lymphoma. The apparent

lack of improvement in prognosis over time for people diagnosed with CLL was unique among the cancers associated with at least a little excess mortality at diagnosis. This is consistent with findings reported in a recent study using Surveillance, Epidemiology and End Results data from the United States.⁷

A much better expectation of continued survival than at diagnosis was achieved for all cancers for which the initial five-year relative prognosis was less than 50% (Figure 1). Nonetheless, the five-year conditional RSR remained below 90% five years after diagnosis for all but two cancers in this group. Stomach cancer and leukemia (excluding CLL) reached a 90% five-year conditional RSR after five years' survival—despite original prognoses of 24% and 34%, respectively. The lowest five-year relative survival

estimates at diagnosis were for cancers of the esophagus (13%) and pancreas (6%); however, by the fifth year of survival, both had five-year conditional RSRs in the mid- to upper-eighty percent range. The corresponding improvement for multiple myeloma (from 37% to 60%) was more modest.

Ranking of five-year RSRs

Cancers of the pancreas and colon showed the most striking improvements in the ranking of five-year RSRs from diagnosis to five years later (Table 2). Among the cancers studied here, pancreatic cancer ranked 26th at diagnosis, but given five years' survival, it ranked 16th. Colon cancer rose from 15th to 6th position. Cancers of the stomach and esophagus, and leukemia (excluding CLL) improved seven, six and five positions, respectively.

A substantial drop in ranking—from 8th to 23rd position—was observed for CLL, due largely to the lack of a predicted increase in relative survival among those surviving the first five years after diagnosis. The rankings of multiple myeloma, breast and larynx each fell six to seven positions, indicating that survival had not improved to the same degree as for many other cancers.

Patterns similar for males and females

Cancer-specific patterns in relative survival conditional on surviving one to five years after diagnosis were generally similar by sex (data not shown). For example, at diagnosis, the five-year RSRs for rectal cancer were 63% for males and 65% for females; at five years' survival, the figures were 92% and 94%, respectively.

In some instances, an apparent sex-specific survival advantage at diagnosis disappeared during the first five years of follow-up. Five-year RSRs at diagnosis were at least four percentage points higher for females than males for skin melanoma, lung and bronchial cancer, Hodgkin lymphoma and brain cancer, but differed by no more than one percentage point at or before the fifth anniversary of diagnosis (data not

The data

Cancer incidence data are from the July 2010 version of the Canadian Cancer Registry (CCR), a dynamic, person-oriented, population-based database maintained by Statistics Canada. The CCR contains information on cases diagnosed from 1992 onward, compiled from reports from every provincial/territorial cancer registry.

A file containing records of invasive cancer cases and in situ bladder cancer cases (the latter are reported for each province/territory except Ontario) was created using the multiple primary coding rules of the International Agency for Research on Cancer.⁸ Cases were classified based on the *International Classification of Diseases for Oncology, Third Edition*⁹ and grouped using Surveillance, Epidemiology, and End Results Program grouping definitions, with mesothelioma and Kaposi's sarcoma as separate groups.¹⁰

Mortality through December 31, 2006 was determined by record linkage to the Canadian Vital Statistics Death Database (excluding deaths registered in the province of Quebec), and from information reported by provincial/territorial cancer registries. For deaths reported by a provincial registry but not confirmed by record linkage, the date of death was assumed to be that submitted by the reporting registry.

Analyses were based on all primary cancers—an approach that is becoming standard practice.¹¹⁻¹³ Data from the province of Quebec were excluded from the analysis primarily because of issues associated with correctly ascertaining the vital status of cases. Records were also excluded if: age at diagnosis was younger than 15 or older than 99; diagnosis was established through autopsy only or death certificate only; or the year of birth or death was unknown.

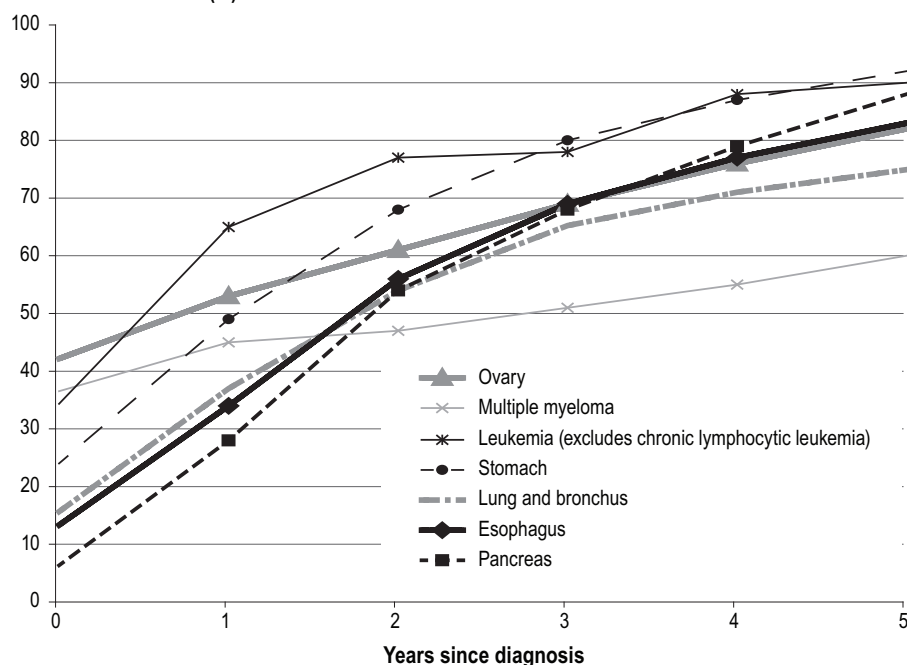
In the context of cancer, conditional survival is the probability of living an additional number of years (y) given that the person has already survived a fixed number of years (x) since diagnosis. The measure can be obtained by dividing the cumulative survival at x + y years by the cumulative survival at x years. Conditional five-year relative survival expresses the likelihood of surviving five years into the future at various points since diagnosis, relative to the expected survival of similar people in the general population.¹⁴

Relative survival was estimated as the ratio of the observed survival for people diagnosed with cancer to the survival expected for the general population with the same sex, age, province/territory at time of diagnosis and time period. When a relative survival ratio (RSR) reaches 100%, survival for those diagnosed with cancer is similar to that of an otherwise comparable group in the general population. RSRs were derived using the period method,^{15,16} which provides more timely estimates of cancer survival.¹⁷⁻²⁰ When survival is generally improving, a period estimate tends to be a conservative prediction of the survival that is eventually observed.¹⁷⁻²⁰

Survival analyses were based on a publicly available algorithm²¹ to which minor adaptations were made. Expected survival proportions were derived from sex- and period-specific complete provincial life tables using the Ederer II approach.²² Further detail on the survival methodology is provided elsewhere.²³ For descriptive purposes, cancers were initially grouped according to the five-year survival prognosis at diagnosis: good (80% or more), fair (50% to 79%), and poor (less than 50%).

Figure 1
Five-year predicted conditional relative survival ratios, selected cancers, Canada excluding Quebec, 2004 to 2006

Conditional five-year
relative survival ratio (%)



Source: Canadian Cancer Registry, Statistics Canada and provincial/territorial cancer registries.

shown). Similarly, an apparent survival advantage for men diagnosed with bladder cancer disappeared relatively soon after diagnosis (data not shown).

Conclusion

The conditional survival estimates presented here are population-based, and therefore, reflect the average survival time of large groups of people rather than an individual's prognosis. Even so, the figures are a useful update of the initial prognosis for a number of cancers, and are generally a cause for optimism. For most cancers, the outlook for people who have survived one or more years after diagnosis is better than that at diagnosis, sometimes substantially so. For some cancers for which survival was already very promising, such as thyroid cancer, little additional improvement could be expected.

Conditional survival data provide more accurate prognostic information about how the risk of death changes over time. These results could assist people who have survived one or more years after a cancer diagnosis in

Table 2
Relative rank of cancer type based on predicted five-year relative survival ratio (RSR) at diagnosis and conditional on having survived five years, Canada excluding Quebec, 2004 to 2006

Cancer type	Five-year RSR rank		Change in rank
	At diagnosis	Conditional on surviving five years	
Testis	3	1	2
Thyroid	1	2	-1
Prostate	2	2	0
Skin melanoma	4	4	0
Corpus uteri	6	4	2
Colon	15	6	9
Cervix uteri	9	7	2
Hodgkin lymphoma	6	8	-2
Bladder (including in situ)	9	9	0
Kidney and renal pelvis	11	9	2
Rectum	13	11	2
Soft tissue	12	11	1
Breast	5	11	-6
Stomach	21	14	7
Leukemia (excluding CLL)	20	15	5
Oral (buccal cavity and pharynx)	15	16	-1
Pancreas	26	16	10
Non-Hodgkin lymphoma	15	18	-3
Esophagus	25	19	6
Larynx	13	19	-6
Ovary	18	21	-3
Liver	23	21	2
Brain	22	23	-1
Chronic lymphocytic leukemia (CLL)	8	23	-15
Lung and bronchus	24	25	-1
Multiple myeloma	19	26	-7

Source: Canadian Cancer Registry, Statistics Canada and provincial/territorial cancer registries.

adjusting their view of the future, and help cancer care providers in planning follow-up. Calculations of conditional survival for individual cancers by subsite or histological subtype and by age group would further inform clinical understanding. ■

Acknowledgements

The Canadian Cancer Registry is maintained by Statistics Canada. It is comprised of data supplied by the provincial and territorial cancer registries whose cooperation is gratefully acknowledged. The authors thank Kathryn Wilkins of Statistics Canada for her review of the manuscript.

References

- Dickman PW, Adami H-O. Interpreting trends in cancer patient survival. *Journal of Internal Medicine* 2006; 260: 103-17.
- Verdecchia A, Guzzinati S, Francisci S, et al. Survival trends in European cancer patients diagnosed from 1988 to 1999. *European Journal of Cancer* 2009; 45: 1042-66.
- Coleman M, Quaresma M, Berrino F, et al. Cancer survival in five continents: a worldwide population-based study (CONCORD). *The Lancet Oncology* 2008; 9: 730-56.
- Sant M, Allemani C, Santaquilani M, et al. EURO-CARE-4. Survival of cancer patients diagnosed in 1995-1999. Results and commentary. *European Journal of Cancer* 2009; 45: 931-91.
- Kaplowitz SA, Campo S, Chiu WT. Cancer patients' desires for communication of prognosis information. *Health Communication* 2002; 14: 221-41.
- Wang SJ, et al. Conditional survival in gastric cancer: a SEER database analysis. *Gastric Cancer* 2007; 10(3): 153-8.
- Brenner H, Gondos A, Pulte D. Trends in long-term survival of patients with chronic lymphocytic leukemia from the 1980s to the early 21st century. *Blood* 2008; 111: 4916-21.
- Parkin DM, Chen VW, Ferlay J, et al. *Comparability and Quality Control in Cancer Registration*. (IARC Technical Publication No. 19) Lyon: International Agency for Research on Cancer, 1994.
- Fritz A, Percy C, Jack A, et al., eds. *International Classification of Diseases for Oncology, Third Edition*. Geneva: World Health Organization, 2000.
- Altekruse SF, Kosary CL, Krapcho M, et al. eds. *SEER Cancer Statistics Review, 1975-2007*. Bethesda, Maryland: National Cancer Institute. Based on November 2009 SEER data submission, posted to the SEER web site, 2010. Available at: http://seer.cancer.gov/csr/1975_2007/.
- Brenner H, Hakulinen T. Patients with previous cancer should not be excluded in international comparative cancer survival studies. *International Journal of Cancer* 2007; 121: 2274-8.
- Rosso S, De Angelis R, Ciccolallo L, et al. Multiple tumours in survival estimates. *European Journal of Cancer* 2009; 45: 1080-94.
- Ellison LF. Measuring the effect of including multiple cancers in survival analyses using data from the Canadian Cancer Registry. *Cancer Epidemiology* 2010; 34: 550-5.
- Henson DE, Ries LA. On the estimation of survival. *Seminars in Surgical Oncology* 1994; 10(1): 2-6.
- Brenner H, Gefeller O. An alternative approach to monitoring cancer patient survival. *Cancer* 1996; 78: 2004-10.
- Brenner H, Gefeller O. Deriving more up-to-date estimates of long term patient survival. *Journal of Clinical Epidemiology* 1997; 50: 211-6.
- Brenner H, Söderman B, Hakulinen T. Use of period analysis for providing more up-to-date estimates of long term survival rates: empirical evaluation among 370,000 cancer patients in Finland. *International Journal of Epidemiology* 2002; 31: 456-62.
- Brenner H, Gefeller O, Hakulinen T. Period analysis for 'up-to-date' cancer survival data: theory, empirical evaluation, computational realisation and applications. *European Journal of Cancer* 2004; 40: 326-35.
- Talback M, Stenbeck M, Rosén, M. Up-to-date long term survival of cancer patients: an evaluation of period analysis on Swedish Cancer Registry data. *European Journal of Cancer* 2004; 40: 1361-72.
- Ellison LF. An empirical evaluation of period survival analysis using data from the Canadian Cancer Registry. *Annals of Epidemiology* 2006; 16: 191-6.
- Dickman PW. *Population-based Cancer Survival Analysis*. Available at: http://www.pauldickman.com/rsmodel/sas_colon/. Accessed January, 2010.
- Ederer F, Heise H. The effect of eliminating deaths from cancer on general population survival rates, methodological note 11, End Results Evaluation section, National Cancer Institute, August, 1959.
- Statistics Canada. *Cancer Survival Statistics* (Statistics Canada, Catalogue 82-226-XIE-2011001) Ottawa: Minister of Industry, 2011. Available at: <http://www.statcan.gc.ca/pub/82-226-x/82-226-x2011001-eng.htm>.



ELECTRONIC PUBLICATIONS
AVAILABLE AT

www.statcan.gc.ca

Cognitive performance of Canadian seniors

by Heather Gilmour

Abstract

With data from the 2009 Canadian Community Health Survey—Healthy Aging Cognition Module, five cognitive functioning categories based on normative values that adjust for age, sex and education were created. The two lowest categories were combined to identify seniors (65 or older) without Alzheimer's disease or dementia living in private households, who had low scores on four cognitive tasks: first recall, second recall, semantic fluency, and processing speed. Low income, not living with a spouse or partner, and diabetes were associated with low scores on each task. Heart disease, impairment in instrumental and daily activities, receiving home care, social participation, loneliness, and self-perceived general and mental health were also associated with low cognitive performance, although the associations differed by cognitive task.

Keywords

Accidental falls, activities of daily living, aging, cognition disorders, cross-sectional studies, health surveys, home care services, loneliness, memory disorders, mental recall, social alienation

Author

Heather Gilmour (613-951-2114, Heather.Gilmour@statcan.gc.ca) is with the Health Analysis at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Cognition is “the mental process of knowing, including aspects such as awareness, perception, reasoning, and judgement.”¹ Some decrease in cognition is expected at older ages, but the decline is not uniform across all cognitive tasks or for all individuals.² Impaired cognition can have health consequences, such as first stroke,³ falls,⁴ and institutionalization.⁵ It may reduce an individual's ability to communicate pain to health care providers,⁶ carry out instrumental activities of daily living,⁷ and cope with chronic disease symptoms, perform self-care and adhere to medication instructions.⁸⁻¹⁰

Different aspects of cognition may have different influences on health. Some research has suggested that memory impairment is especially important in the early detection of dementia or in the progression to Alzheimer's disease,^{11,12} while other studies have found that verbal tasks¹³ and the number of impaired cognitive domains^{14,15} are important. Dysfunction in domains other than memory may be an early sign of vascular or other non-Alzheimer dementias.¹⁶ Executive function and memory may influence activities of daily living,⁷ and impaired processing speed and executive function have been associated with an increased risk of falls.^{4,17}

Using data from the 2009 Canadian Community Health Survey (CCHS)—Healthy Aging Cognition Module, this study examines correlates of low performance on four cognitive tasks among Canadians aged 65 or older who were living in private dwellings and who did not have Alzheimer's disease or dementia (see *The data*). Low performance on these four cognitive tasks is analyzed in relation to socio-demographic characteristics and measures of health status and well-being.

The Cognition Module

Respondents to the Cognition Module of the 2009 CCHS—Healthy Aging were asked to perform four tasks.

Two tasks—immediate and delayed recall of a list of words—measured short-term verbal memory, verbal learning and post-interference recall.^{22,23} Respondents were required to memorize a list of 15 common, unrelated words (for example,

drum, curtain), recall them immediately, and again, after about five minutes. The delayed recall was performed after the other cognitive tasks.

The two other tasks—semantic fluency and the Mental Alternation Test—measured executive function. To assess semantic fluency,^{24,25} respondents were asked to recall as many names as possible from a specified category (animals) in one minute.²⁶ For the Mental

Alternation Test,²⁷⁻²⁹ respondents recited the alphabet, and then counted from 1 to 26. They then had 30 seconds in which to alternate between number and letters in the format 1-A-2-B-3-C, etc.

Five cognitive functioning categories based on normative values that adjust for age, sex and education were previously created and validated for the household population aged 45 or older.¹⁹ In this

The data

The data are from the Cognition Module of the 2009 Canadian Community Health Survey (CCHS)—Healthy Aging. The sampling frame consisted of people aged 45 or older living in private dwellings in the ten provinces. Residents of the three territories, Indian reserves, Crown lands, institutions and some remote regions, and full-time members of the Canadian Forces were excluded. Data collection took place from December 2008 through November 2009 using Computer-Assisted Personal Interviewing.

The Cognition Module was administered in English or French only to non-proxy respondents. This differed from the main component of the CCHS, for which proxy responses were accepted if the mental or physical health of selected participants prevented them from completing the interview (2.2% of the sample). Respondents excluded from the Cognition Module because they required a proxy reporter were more likely to have Alzheimer's disease or dementia or to have suffered a stroke than were those who did not need a proxy reporter.¹⁹ Exclusion of such respondents means that the cognitive functioning categories were created from a higher-functioning sample.²⁰ As well, because residents of long-term health care institutions (7% of seniors)¹⁸ were excluded from the CCHS, the sample becomes less representative of the entire senior population at successively older ages.

Other reasons why respondents were excluded from the Cognition Module included interviews by telephone, completion of the survey in a language other than English or French (non-proxy), and refusal to perform the trials.

The overall response rate to the Cognition Module was 62.3% (N = 25,864), compared with 74.4% for the entire sample. Separate sampling weights were created specifically for use with the cognitive outcome variables.

This study is based on 13,176 people aged 65 or older who did not report a diagnosis of Alzheimer's disease or dementia and who completed the Cognition Module, representing a weighted population of 4.3 million. In this sample, 81.8% responded to the immediate recall, 68.1% to the delayed recall, 91.3% to semantic fluency (animal-naming), and 88.0% to the Mental Alteration Test. Missing responses were excluded from prevalence estimates for each task. Standard errors in modelling were computed using a bootstrapping technique.²¹

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

The *living arrangements* of respondents were classified as: living alone, living with a spouse/partner, or other.

The presence of *chronic conditions* was established by asking respondents if a health professional had diagnosed them as having conditions that had lasted, or were expected to last, at least six months. Respondents were read a list of conditions. Chronic conditions were self-reported and were not verified by an external source.

Based on *body mass index (BMI)* calculated from self-reported height and weight, respondents were classified as: obese (BMI 30 kg/m² or more), overweight (BMI 25 to less than 30 kg/m²), normal weight (BMI 18.5 to less than 25 kg/m²), or underweight (BMI less than 18.5 kg/m²).

Respondents were identified as having had a *single fall* or *recurrent falls* (two or more) based on the questions, "In the past 12 months, did you have any falls?" and "How many times have you fallen in the past 12 months?"

Questions about respondents' ability to perform *instrumental and basic activities* were based on the OARS Multidimensional Assessment Questionnaire.³⁰ For this analysis, answers were grouped to identify respondents with mild impairment versus moderate/severe/total impairment.

Respondents who received *home care* in the past 12 months were categorized as those who received formal care only, informal care only, or both.

Frequent social participation was defined as at least weekly participation in at least one of eight community-related activities that included other people.

Respondents were asked how often they lacked companionship, felt left out, or felt isolated. For this analysis, those who answered "some of the time" or "often" versus "hardly ever" on each of the three questions were classified as *lonely*.

Self-perceived health was based on the question, "In general, would you say your health is: ..." Those who responded good, very good or excellent (versus fair or poor) were defined as having "positive" self-perceived health. A similar question was used for *self-perceived mental health*.

analysis, for each cognitive task, scores in the two lowest categories (about 30% of respondents) were used to identify respondents with *low cognitive performance*.

Low income/Living alone

The socio-economic characteristics of people aged 65 or older with low cognitive performance differed from those of people whose scores were

higher. Seniors with low scores on each task were more likely than were seniors with higher scores to be in the lowest income group (Table 1). They were less likely to be living with a partner and

Table 1

Selected socio-demographic, health and well-being characteristics, by score[†] on cognitive functioning tasks, household population aged 65 or older without Alzheimer's disease or dementia, Canada excluding territories, 2009

Characteristic	Score on cognitive functioning tasks							
	First recall		Second recall		Semantic fluency		Processing speed	
	Low	Moderate/ High [‡]	Low	Moderate/ High [‡]	Low	Moderate/ High [‡]	Low	Moderate/ High [‡]
Socio-demographic								
Household income								
Lowest	38.2**	29.8	37.3**	28.1	35.3**	30.1	37.6**	28.3
Low-middle	23.4**	28.6	26.2	27.7	27.5	27.1	28.7	26.4
Middle	18.7	19.0	16.3**	20.3	17.9	20.0	17.4*	20.6
High-middle	11.7	13.1	11.1*	14.0	12.7	13.1	9.9**	14.4
Highest	8.0	9.5	9.2	9.9	6.6**	9.8	6.5**	10.3
Living arrangements								
Alone	33.1*	29.6	32.8*	29.4	31.5	30.9	33.2*	30.2
With partner	54.5**	61.4	56.4**	62.3	57.4	60.1	56.0**	60.8
Other	12.4**	9.0	10.9*	8.4	11.1*	9.0	10.8*	9.0
Health								
Chronic condition								
Diabetes	20.1**	15.5	19.3**	15.3	19.4**	15.6	19.4**	15.5
Heart disease	23.0	21.9	22.3	21.4	22.9	22.6	24.6*	21.8
High blood pressure	53.6	51.3	52.3	52.0	53.3	52.6	53.8	52.5
Mood/Anxiety disorder	8.4	7.3	8.9	7.3	7.1	7.2	6.7	7.3
Body mass Index								
Underweight	2.2 [‡]	2.5	1.7	2.0	3.6**	1.8	3.2*	1.9
Normal weight	42.2	39.5	40.5	40.7	41.2	40.5	40.5	41.0
Overweight	35.5**	39.5	37.7	38.7	36.4	38.6	36.1	38.8
Obese	20.1	18.5	20.0	18.6	18.8	19.0	20.3	18.3
Well-being								
Fall in past year								
Single	12.3	13.1	13.7	13.2	13.3	12.7	12.7	12.9
Recurrent	8.1*	6.1	5.9	6.6	7.5	6.7	7.7	6.7
Impairment in basic and instrumental activities								
Mild	16.6*	14.2	16.9**	13.3	16.5*	14.2	16.5**	13.8
Moderate/Severe	6.3**	3.1	5.3**	2.8	7.4**	3.9	6.9**	3.9
Receiving home care								
Formal	4.1	4.1	4.3	3.8	5.9*	4.1	5.2	4.4
Informal	12.4	11.1	12.7	10.6	11.4	12.2	12.1	11.8
Both	7.2*	5.7	8.0**	5.1	8.3**	5.7	7.6*	6.0
Frequent social participation	74.1**	78.4	77.2	78.7	75.9	77.7	74.1**	78.8
Lonely	13.9**	10.4	12.5	10.4	13.3**	10.4	13.5**	10.2
Positive self-perceived health	73.1**	81.0	75.7**	81.8	74.9**	80.2	73.2**	81.7
Positive self-perceived mental health	92.1**	96.0	94.0**	96.1	93.1**	95.8	93.0**	96.1

[†] adjusted for age, sex and education

[‡] reference category

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

** significantly different from estimate for reference category ($p < 0.01$)

[‡] use with caution

Source: 2009 Canadian Community Health Survey—Health Aging Cognition Module.

more likely to live alone or to have other living arrangements, compared with seniors with moderate/high cognitive performance scores.

Chronic conditions

Vascular conditions^{31,32} and psychiatric disorders^{33,34} have been associated with low cognitive function. In this study, seniors with low scores on each of the four tasks were more likely than those with higher scores to have been diagnosed with diabetes, a relationship that persisted even after accounting for socio-demographic and other health variables (data not shown). As well, seniors with low scores on the processing speed task were more likely than those with higher scores to have heart disease. However, no association between low performance on any cognitive task and high blood pressure or mood/anxiety disorders was apparent.

Body mass index

A high BMI or being underweight has been associated with cognitive impairment later in life.³⁵ Although only current height and weight were reported to the 2009 CCHS, seniors with low immediate recall scores were less likely than those with higher scores to be overweight. As well, seniors with low scores on the semantic fluency and processing speed tasks were more likely than those with higher scores to be underweight.

Falls, impairment and home care

A low score on the first recall task was associated with having had recurrent falls in the past year, but none of the cognitive tasks was associated with having had a single fall. These findings are contrary to previous research that found both single and recurrent falls to be related to processing speed and executive function.¹⁷

For each cognitive task, seniors with low scores were significantly more likely than those with high scores to report impairment in performing instrumental

and basic activities. However, the relationship between mild or moderate/severe impairment and the first recall task, and between mild impairment and the processing speed task did not persist when socio-demographic factors and chronic conditions were taken into account (data not shown).

Low scores on each cognitive task were associated with receiving a combination of formal and informal home care; only the semantic fluency task was associated with receiving formal home care alone. Of course, home care needs may reflect physical as well as cognitive conditions. In multivariate analyses that controlled for socio-demographic factors, chronic conditions and aspects of physical function (pain, mobility, vision or hearing problems), the association between low cognitive performance and receiving both types of home care persisted for the second recall and semantic fluency tasks, and between receiving formal home care alone and semantic fluency (data not shown).

Social interaction

Social interaction is protective against cognitive decline, and infrequent social participation may be an early sign of declining cognitive function.³⁶ Although the temporal order cannot be established, results from the CCHS—Healthy Aging show that seniors with low scores on the first recall or processing speed task were less likely than those with higher scores to report frequent participation in community-related events, and they were more likely to be lonely, even when other factors were taken into account (data not shown). An apparent association between loneliness and semantic fluency did not persist in multivariate models.

Self-perceived health

Regardless of how they scored on the cognitive tasks, large majorities of seniors perceived their general (at least three-quarters) or mental (over 90%) health as positive. However, for each

task, seniors with low scores were less likely than those with higher scores to rate their health positively. This result persisted when socio-demographic factors, chronic conditions and functional impairment were taken into account (data not shown), with the exception of the second recall and perceived general health.

Conclusion

Seniors with low scores on the various cognitive tasks were more likely than those with higher scores to experience poor outcomes on several measures of health and well-being. The cognitive health of non-institutionalized seniors and the factors associated with it are important for health care planning and policy development. Findings from the CCHS—Healthy Aging Cognition Module contribute to an understanding of the socio-demographic and health characteristics and the needs of seniors free of Alzheimer's disease or dementia who continue to live in private households, but whose performance on four tasks commonly used to assess cognition is low. ■

Acknowledgement

The content of the Canadian Community Health Survey—Healthy Aging was developed by the Health Statistics Division at Statistics Canada in consultation with Health Canada, the Public Health Agency of Canada, and experts conducting the Canadian Longitudinal Study on Aging (CLSA), an initiative of the Canadian Institute of Health Research. Consultations included stakeholders from Human Resources and Social Development Canada and provincial and territorial health ministries. The addition of 5,000 respondents aged 45 to 54 to the survey was funded by the CLSA. Statistics Canada thanks all participants for their input and advice during the development of the survey.

References

1. *The American Heritage Dictionary of the English Language*. Fourth edition. Boston, Massachusetts: Houghton Mifflin Company, 2000.
2. Glisky EL. *Changes in Cognitive Function in Human Aging. Brain Aging: Models, Methods, and Mechanisms*. Boca Raton, Florida: CRC Press, 2007.
3. DeFries T, Avendaño M, Glymour MM. Level and change in cognitive test scores predict risk of first stroke. *Journal of the American Geriatric Society* 2009; 57(3): 499-505. doi:10.1111/j.1532-5415.2008.02132.x
4. Welmerink DB, Longstreth Jr WT, Lyles MF, Fitzpatrick AL. Cognition and the risk of hospitalization for serious falls in the elderly: Results from the Cardiovascular Health Study. *Journal of Gerontology A Biological Sciences and Medical Sciences* 2010; 65A(11): 1242-9. doi:10.1093/gerona/gql115.
5. Luppá M, Luck T, Weyerer S, et al. Prediction of institutionalization in the elderly. A systematic review. *Age and Ageing* 2010; 39: 31-8. doi:10.1039/ageing/afp202.
6. Tsai PF, Means KM. Osteoarthritic knee or hip pain. Possible indicators in elderly adults with cognitive impairment. *Journal of Gerontological Nursing* 2005; 31(8): 39-45.
7. Tomaszewski Farias S, Cahn-Weiner DA, Harvey DJ, et al. Longitudinal changes in memory and executive functioning are associated with longitudinal change in instrumental activities of daily living in older adults. *The Clinical Neuropsychologist* 2009; 23: 446-61. doi:10.1080/13854040802360558.
8. Sinclair AJ, Girling AJ, Bayer AJ. Cognitive dysfunction in older subjects with diabetes mellitus: impact on diabetes self-management and use of care services. *Diabetes Research and Clinical Practice* 2000; 50: 202-12.
9. Huang AJ, Brown JS, Thom DH, et al. Urinary incontinence in older community-dwelling women: the role of cognitive and physical function decline. *Obstetrics and Gynecology* 2007; 109(4): 909-16.
10. Gard PR. Non-adherence to antihypertensive medication and impaired cognition: which comes first? *International Journal of Pharmacy Practice* 2010; 18(5): 252-9. doi:10.1111/j.2042-7174.2010.00045.x.
11. Tuokko H, Vernon-Wilkinson R, Weir J, et al. Cued recall and early identification of dementia. *Journal of Clinical and Experimental Neuropsychology* 1991; 13(6): 871-9.
12. Bäckman L. Memory and cognition in preclinical dementia: What we know and what we do not know. *Canadian Journal of Psychiatry* 2008; 53(6): 354-60.
13. Taler V, Phillips NA. Language and performance in Alzheimer's disease and mild cognitive impairment: A comparative review. *Journal of Clinical and Experimental Neuropsychology* 2008; 30(5): 501-56. doi:10.1080/13803390701550128.
14. Gualtieri CT, Johnson LG. Neurocognitive testing supports a broader concept of mild cognitive impairment. *American Journal of Alzheimer's Disease and Other Dementias* 2005; 20(6): 359-66. doi:10.1177/153331750502000607.
15. Tabert MH, Manly JJ, Lui X, et al. Neuropsychological prediction of conversion to Alzheimer Disease in patients with mild cognitive impairment. *Archives of General Psychiatry* 2006; 63(8): 916-24.
16. Padovani A, Di Piero V, Bragoni M, et al. Patterns of neuropsychological impairment in mild dementia: A comparison between Alzheimer's disease and multi-infarct dementia. *Acta Neurologica Scandinavica* 1995; 92(6): 433-42.
17. Holtzer R, Friedman R, Lipton RB, et al. The relationship between specific cognitive functions and falls in aging. *Neuropsychology* 2007; 21(5): 540-8. doi:10.1037/0894-4105.21.5.540.
18. Statistics Canada. Selected collective dwelling and population characteristics (25) and type of collective dwelling (17) for the population in collective dwellings of Canada, provinces and territories, 2006 Census - 100% data. 2006 *Census of Canada. Topic-based Tabulations*.
19. Findlay L, Bernier J, Tuokko H, et al. Validation of cognitive functioning categories from the Canadian Community Health Survey—Healthy Aging. *Health Reports* 2010; 21(2): 85-100.
20. Herzog AR, Wallace RB. Measures of cognitive functioning in the AHEAD study. *Journals of Gerontology Series B, Psychological Sciences and Social Sciences* 1997; 52(special issue): 37-48.
21. Rust K, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.
22. Rosenberg SJ, Ryan JS, Prifitera A. Rey Auditory-Verbal Learning Test performance of patients with and without memory impairment. *Journal of Clinical Psychology* 1984; 40(3): 785-7.
23. Rey A. *L'examen clinique en psychologie*. Paris: Presses Universitaires de France, 1964.
24. Troyer AK, Moscovitch M, Winocur G. Clustering and switching as two components of verbal fluency: Evidence from younger and older healthy adults. *Neuropsychology* 1997; 11(1): 138-46.
25. Raoux N, Amieva H, Le Goff M, et al. Clustering and switching processes in semantic verbal fluency in the course of Alzheimer's disease subjects: Results from the PAQUID longitudinal study. *Cortex* 2008; 44: 1188-96. doi:10.1016/j.cortex.2007.08.019.
26. Tombaugh T, Kozak J, Rees L. Normative data stratified by age and education for two measures of verbal fluency: FAS and animal naming. *Archives of Clinical Neuropsychology* 1999; 14(2): 167-77.
27. Jones BV, Teng EL, Folstein MF. A new bedside test of cognition for patients with HIV infection. *Annals of Internal Medicine* 1993; 119(10): 1001-4.
28. Teng EL. The Mental Alteration Test (MAT). *The Clinical Neuropsychologist* 1995; 9: 287. doi:10.1080/13854049508400492.
29. Salib E, McCarthy J. Mental alteration test (MAT): A rapid and valid screening tool for dementia in primary care. *International Journal of Geriatric Psychiatry* 2002; 17: 1157-61. doi:10.1002/gps.738.
30. Fillenbaum GG, Smyer MA. The development, validity, and reliability of the Oars Multidimensional Functional Assessment Questionnaire. *Journal of Gerontology* 1981; 36: 428-34.
31. Beissels GJ, Staekenborg S, Brunner E, et al. Risk of dementia in diabetes mellitus: A systematic review. *Lancet Neurology* 2006; 5: 64-74.
32. Cherubini A, Lowenthal DT, Paran E, et al. Hypertension and cognitive function in the elderly. *Disease-a-Month* 2010; 56: 106-47. doi:10.1016/j.disamonth.2009.12.007.
33. Colenda CC, Legault C, Rapp SR, et al. Psychiatric disorders and cognitive dysfunction among older, postmenopausal women: Results from the women's health initiative memory study. *American Journal of Geriatric Psychiatry* 2010; 18: 177-86.
34. Rosenberg PB, Mielke MM, Xue Q, et al. Depressive symptoms predict incident cognitive impairment in cognitively healthy older women. *American Journal of Geriatric Psychiatry* 2010; 18: 204-11.
35. Gustafson D. A life course of adiposity and dementia. *European Journal of Pharmacology* 2008; 585(1): 163-75. doi:10.1016/j.ejphar.2008.01.052.
36. Barnes LL, Mendes de Leon CF, Wilson RS, et al. Social resources and cognitive decline in a population of older African Americans and whites. *Neurology* 2004; 63: 2322-6.



ELECTRONIC PUBLICATIONS
AVAILABLE AT

www.statcan.gc.ca

Psychometric properties, factorial structure, and measurement invariance of the English and French versions of the Medical Outcomes Study social support scale

by Annie Robitaille, Heather Orpana and Cameron N. McIntosh

Abstract

Background

The Medical Outcomes Study (MOS) social support scale is a 19-item survey that measures four dimensions of functional support. The current study reports on the psychometric properties, factorial structure, and measurement invariance of the scale for a sample of English- and French-speaking Canadians aged 55 or older.

Data and methods

The internal consistency and composite reliability for a congeneric measurement model of the dimensions of functional social support were examined. A confirmatory factor analysis and test of invariance across language (English = 2,642; French = 489) were also performed.

Results

Across both English- and French-speaking respondents, results indicated good internal consistency (Cronbach's alpha ranged from .90 to .97) and composite reliability (ranging from .93 to .97) for all dimensions of functional social support. The confirmatory factor analysis revealed acceptable fit indices for the 4-factor structure similar to the original one. The scale appears to function uniformly across both language groups.

Interpretation

The MOS social support scale appears to be a psychometrically sound instrument for use in research on social support with samples of English- and French-speaking older adults.

Keywords

aging, data analysis, data collection, empirical research, factor analysis, geriatrics, language, questionnaires, social environment, statistical models

Authors

Annie Robitaille (1-613-907-1065; annie.g.robitaille@gmail.com) is with the Centre on Aging, University of Victoria, Victoria, British Columbia. Heather Orpana is with the School of Psychology, University of Ottawa, Ottawa, Ontario. Cameron N. McIntosh is with Public Safety Canada, Ottawa, Ontario, Canada.

Social support plays an important role in successful aging,¹ physical health,^{2,3} mortality,⁴⁻¹⁶ and mental health.^{3,17-23} Very broadly, it can be defined as the help furnished by an individual's social network, such as the provision of information, financial aid or emotional support.²⁴ To understand the association between specific types of social support and mental and physical health, it is recommended that researchers use measures that include as many dimensions as possible and focus on types of support that have been related to positive health outcomes.²⁵⁻²⁷

The Medical Outcomes Study (MOS) social support scale²⁸ developed by Sherbourne and Stewart consists of 19 items pertaining to the functional aspects of social support, and one item related to structural social support. The original study was conducted on a sample of 2,987 patients aged 18 to 98 who had chronic health conditions. Based on a confirmatory factor analysis (CFA) on the 19 items designed to measure functional support, the authors reported that a four-factor model was a good fit to the data. The four functional dimensions of social support are: tangible support (material aid and assistance); affectionate support (love and affection); positive social interaction (engaging in entertaining

activities with others); and emotional/informational support (feedback, guidance and information). Standardized factor loadings were high for items in each dimension.

The factorial validity of the MOS social support scale was later examined by Gjesfjeld et al. on a sample of 330 mothers whose children were receiving mental health treatment. The authors conducted a CFA on an 18-item scale and on 12- and 4-item abbreviated versions.²⁹ They found a better-fitting model for the 12- and 4-item versions. These results suggest that some uncertainty remains about the fit of the original version of the scale and that a better-fitting model may be attained if certain items are removed.

Thus, despite the use of the MOS social support scale in numerous studies, more research is needed to test its factor structure and psychometric properties on different populations.²⁹

For example, given that the MOS social support scale is brief, easy to understand, and was designed to minimize respondent burden, it is especially suited for older respondents. However, the psychometric soundness and factor structure of the support scale have not been examined with a national sample of older adults.

As well, information about measurement invariance (MI) between English-and French-speaking respondents on the scale is lacking. This is especially important in Canada, where comparisons between these groups are common. According to Statistics Canada and the Canadian Institute for Health Information, rates of emotional and informational support are relatively low in Quebec,³⁰ but more analysis is needed to determine if these are true differences or artifacts of translation. Before studies of social support can report findings from English-and French-speaking respondents, MI must be established to ensure that the constructs have the same meaning for each group.

Statistics Canada's National Population Health Survey (NPHS), which incorporates the MOS social support scale, is administered in English and French. Two earlier studies that translated the scale from English to French and examined its psychometric properties found good internal consistency, reliability and convergent validity.^{31,32} However, the translation used by the NPHS was designed independently from these other versions, so it is unlikely that the psychometric results would be the same.

The primary purpose of this study is to examine the internal consistency of the English and French versions of the MOS social support scale for a sample of older adults. The second objective is to conduct a CFA to assess the factor structure of the English and French versions of the scale. A third purpose is to determine if the items comprising the scale operate in

the same way for English- and French-speaking respondents.

Methods

Sample and data

The data are from the household component of the longitudinal National Population Health Survey (NPHS),³³ which has collected data from the same individuals every two years since 1994/1995. The household component covers the population of the ten provinces, excluding full-time members of the Canadian Forces, residents of Indian Reserves and Crown Lands, residents of some remote areas in Ontario and Quebec, and all residents (military and civilian) of Canadian Forces bases.³⁴ The Health Institutions component of the NPHS, which was administered to residents of health care institutions, was ended after cycle five and was not included in this study.

For all provinces except Quebec, a stratified two-stage sample design, where dwellings were selected within clusters, was used. The design was based on the Labour Force Survey (LFS). The Quebec sample was selected based on a two-stage sample design from households participating in the "Enquête sociale et de la santé."³⁴ The longitudinal sample size was 17,276. In cycle 3 (1998/1999), the response rate for the 17,276 respondents in the longitudinal data file was 88.3%.³³ Computer-assisted telephone and personal interviewing was used to collect the data; the majority of interviews were by telephone.³³

The present study includes only respondents aged 55 or older at the start of the survey in 1994/1995 and is based on cycle 3 data (1998/1999).

Measures

Social support

The 19-item MOS social support survey measures four dimensions of functional social support.²⁸ (The survey also contains a structural support item not included in this study.) Emotional/Informational support comprises eight items estimating the extent to which

interpersonal relationships provide guidance, positive affect, and empathetic understanding. Tangible support comprises four items pertaining to material aid and behavioural assistance. Affectionate support comprises three items that measure expressions of love and affection. Positive social interaction comprises four items that relate to the availability of someone with whom to have fun. Questions are answered on a five-point scale ranging from "none of the time" to "all of the time," with higher values indicating more support.

Language

NPHS respondents were interviewed in English or French. This variable was used to identify English- and French-speaking respondents for the present study. The vast majority who chose to be interviewed in French lived in the province of Quebec.

Analyses

The descriptive analyses for this study were generated using SAS software (Version 8).³⁵ Because of its capacity to perform CFA of ordered categorical scales, *Mplus* (version 4.1) was chosen to conduct all other analyses.^{36,37}

The internal consistency of the MOS social support scales was measured with Cronbach's alpha using polychoric correlations, provided that the data were ordered categorically.³⁸ The use of Cronbach's alpha as an indication of internal consistency has been criticized,³⁸⁻⁴¹ especially when data are not continuous. Therefore, the composite reliability for congeneric measures model (CRCMM) was also examined.⁴⁰

Fitting ordered categorical variables to a model for continuous variables can distort the factor structure and fit of the model and affect comparisons between groups.⁴²⁻⁴⁴ Consequently, the CFA and test of invariance were conducted with procedures for ordered categorical data. A polychoric correlation matrix was analyzed using a weighted least squares estimator with a mean- and variance-adjusted chi-square (WLSMV).^{37,43} If the sample size is large enough, this

method performs well for categorical variables, even when modest violations of normality are reported.^{43,44} A two-step approach to testing MI was used.³⁷ First, a baseline model where thresholds and factor loadings were free across both groups with reasonable fit to the data was established. Second, the consistency of the social support scale for English- and French-speaking respondents was tested by constraining all factor loadings and thresholds as being equal across both groups.

Survey sampling weights were used to avoid parameter estimate bias.^{33,45} To get a normalized weight, the weighted value was further divided by the average weight.

Because stratified and cluster sampling were used to collect the data, the bootstrap technique was used for the preliminary analyses to adjust for violation of the assumption of independence between observations.

In structural equation modeling (SEM), the use of complex survey design data may underestimate standard errors, and, in turn, affect chi-square values. The linearization (Taylor Series approximation) method with both the cluster and stratum identifiers was used. This method provides robust estimates of parameters and standard errors.⁴⁶

Use of approximate fit indices (AFIs) in SEM for models that fail the chi-square test rather than reporting the significance of chi-square has been criticized.⁴⁷ However, given the large sample size in this study, it is likely that the chi-square test statistic will be significant, suggesting that the discrepancy between the observed and hypothesized model will be greater than would be expected by chance alone. Therefore, both the significance of the chi-square test and the AFIs are reported. The AFIs are not meant to provide support or lack thereof of a perfectly fitting model, but rather, information about whether the model is acceptable based on the approximate fit.⁴⁸

Similar to tests of overall model fit, chi-square difference tests used in MI are sensitive to sample size.⁴⁹ Recent work suggests that AFIs in MI research

are less sensitive to sample size than are chi-square statistics.⁴⁹⁻⁵¹ Vandenberg and Lance recommend using change in comparative fit index (CFI) with a cutoff value of .02 to detect lack of invariance.⁵² The use of root mean square error of approximation (RMSEA) values is not recommended.⁴⁹

Unlike other estimation methods where degrees of freedom, and consequently, the chi-square statistic are based on the specification of the model, the degrees of freedom of the WLSMV method are adjusted depending on both sample size and model specification.^{37,43,53} Therefore, only the *p* values, not the degrees of freedom or chi-square values, are interpretable. For this reason, degrees of freedom and chi-square values are not reported.

The following criteria were used to evaluate model fit: the *p*-values of chi-square; the Comparative Fit Index (CFI); the Tucker–Lewis index (TLI), and RMSEA. According to Hu and Bentler, CFI and TLI values greater than .95 indicate an acceptable fit.⁵⁴ RMSEA

values less than .05 represent a good fit, and values up to .08, a reasonable fit.^{54,55} Parameter estimates and standard error estimates are also examined.

Results

Preliminary analysis

A total of 4,444 NPHS cycle 3 (1998/1999) respondents were aged 55 or older in 1994/1995. The present analyses exclude 8 respondents with missing data on the language of interview variable. A further 525 cases were deleted because they had died, and 111 because they had moved to an institution.

Of the remaining respondents, 669 had at least one missing value on the MOS social support scale and were deleted. Respondents with missing values were similar to those without missing values in gender and language distribution, but they were older and had lower levels of education and income. Because the majority of them (530) were missing data on all MOS social support items, imputations would have been difficult.

Table 1
Selected characteristics of study sample, by language of interview, household population aged 55 or older, Canada excluding territories, 1998/1999

	Language of interview			
	English (n = 2,642)		French (n = 489)	
	Number	Percent [†]	Number	Percent [†]
Sex				
Men	1,020	43.6	198	40.3
Women	1,622	56.5	291	59.7
Marital status*				
Married/Common-law/Living with partner	1,383	65.1	258	58.1
Single	160	4.4	37	6.5
Widowed/Separated/Divorced	1,099	30.5	194	35.4
Income*				
Lowest	131	3.7	23	4.4
Lower-middle	477	12.9	125	23.5
Middle income	945	35.4	198	41.8
Upper-middle	677	33.5	88	24.0
Highest	236	14.6	19	6.3
Education*				
Less than secondary graduation	1,195	39.6	301	59.4
Secondary graduation	328	13.0	55	11.8
Some postsecondary	539	21.7	56	11.9
Postsecondary graduation	578	25.8	77	16.9

[†] weighted estimates

* significant differences between English- and French-speaking respondents

Source: 1998/1999 National Population Health Survey, household component.

Table 2

Means, standard deviations (S.D.), coefficient alpha estimates, and composite reliability estimates (CRCMM) for Medical Outcomes Study social support factors, by language of interview, household population aged 55 or older, Canada excluding territories, 1998/1999

Scale	Language of interview							
	English (n = 2,642)				French (n = 489)			
	Mean	S.D.	alpha	CRCMM	Mean	S.D.	alpha	CRCMM
Tangible support	13.54	3.47	0.93	0.93	12.69	4.89	0.93	0.93
Affectionate support	10.30	2.58	0.94	0.94	9.55	3.52	0.90	0.93
Positive social interaction	13.14	3.52	0.95	0.95	12.62	4.41	0.93	0.94
Emotional/Informational support	26.37	6.79	0.97	0.97	24.93	9.12	0.96	0.96

Note: Normalized survey sampling weights and Taylor linearization method were used.

Source: 1998/1999 National Population Health Survey, household component.

An option would have been to add covariates to the CFA model and make “missingness” conditional on these, but this approach does not work well with cases that are missing all values on the indicator variables.

The analyses were conducted on the remaining 3,131 adults, who ranged in age from 58 to 99 ($M = 69.72$, $SD = 7.91$) (Table 1). English-speaking respondents had significantly higher levels of education and income than did those who were French-speaking. The latter were less likely than the former to be in a relationship. No differences emerged in gender and age.

Reliability

Cronbach's alphas all exceeded .90 (Table 2). The composite reliability was based on the standardized loadings and standardized measurement error variances of the fully constrained model. These estimates were used given that the model appears to function similarly for both groups. All values exceeded .93.

Confirmatory factor analysis

A CFA with four factors was performed separately on the English- and French-speaking respondents (Table 3). For both groups, the model represented an adequate fit to the data. However, the RMSEA values for the English-speaking respondents were somewhat high. Investigation of the MI indices suggested cross-loading of item 5 (“someone to take you to the doctor if you needed it”) on the affectionate (modification index = 41.30, standardized expected parameter

change = .31), positive social interaction (modification index = 41.16, standardized expected parameter change = .29), and emotional/informational (modification index = 51.76, standardized expected parameter change = .33) factors. It appears that item 5 measures not only tangible support, but also affectionate social support, positive social interaction, and emotional/instrumental social support.

For French-speaking respondents, all modification indices were low. After a number of factors were considered, the specification of the model was not changed. The RMSEA was only slightly high and is acceptable⁵⁶; the CFI and TLI values suggested an acceptable fit, and theoretically, it is difficult to explain why these items would be cross-loading on the other factors.

The items of the MOS social support scale all loaded significantly on their respective latent variable

(Table 4, Figure 1). (Tables reporting the correlation matrix, including the means and standard deviations for each item from the model, are available from the authors.)

Test of invariance

The unconstrained multigroup model, in which the thresholds and the factor loadings are relaxed, represents an acceptable fit to the data. The second model, in which factor loadings and thresholds are constrained to be equal across both groups, also represents an acceptably fitting model (Table 3). Constraining the factor loadings and thresholds to be equal across both groups resulted in a significant chi-square difference test ($\Delta\chi^2[\Delta df = 21] = 50.84$, $p = .0003$). However, ΔCFI for testing the invariance of factor loadings and thresholds was .008, suggesting that the weight of the factor loading and the thresholds were invariant across both

Table 3

Goodness-of-fit statistics for Medical Outcomes Study social support scale, household population aged 55 or older, Canada excluding territories, 1998/1999

Model	Probability values	Comparative fit index (CFI)	Tucker-Lewis index (TLI)	Root mean square error of approximation (RMSEA)
English-speaking	<0.0001	.96	.99	.076
French-speaking	<0.0001	.96	.99	.047
French and English combined	<0.0001	.95	.99	.084
Test for equality across language				
Factor loading and thresholds unconstrained	<0.0001	.97	.99	.086
Factor loading and thresholds constrained	<0.0001	.98	.10	.075

Note: Normalized survey sampling weights and Taylor linearization method were used.

Source: 1998/1999 National Population Health Survey, household component.

models. Partial measurement invariance was examined by constraining each item one at a time as equal across both groups. No differences were found.

Discussion

The primary purpose of the study was to examine the psychometric properties of the English and French versions of the MOS social support scale for a sample of older adults. Overall, the findings are similar to earlier studies reporting good psychometric properties for the MOS social support scale.^{28,29} The high Cronbach's alphas and CRCMM values for all subscales suggest good internal consistency.

A second objective was to test the hypothesis of a four-factor structure of the 19-item MOS social support scale. The results suggest that the four-factor model of functional social support is acceptable. While this is consistent with earlier studies,²⁸ some items appeared to

be cross-loading on more than one factor, which suggests that a better-fitting model could be obtained if some items were deleted. This aligns with Gjesfjeld and colleagues' finding.²⁹

A third objective was to examine the invariance of the model between English- and French-speaking older adults. Based on change in CFI, the instrument functions relatively uniformly across both groups. Furthermore, when each item was examined independently, no differences between individual items emerged. Nonetheless, because the chi-square difference test was significant, lack of measurement invariance cannot be ruled out.

The English and French versions of the MOS social support scale used in the NPHS appear to be good measures of older adults' perception of the availability of social support, which is a predictor of healthy aging.⁵⁷⁻⁶¹ However, the scale does not measure all dimensions of social support. For example, it does not include

What is already known on this subject?

- The Medical Outcomes Study (MOS) social support scale is a 19-item scale that measures four dimensions of functional social support.
- Because it is brief, easy to understand, and was developed to minimize respondent burden, it is especially suited for older respondents.
- Information about whether the social support scale functions equally for English- and French-speaking respondents is lacking.

What does this study add?

- The MOS social support scale is an appropriate measure to use with a sample of English- and French-speaking Canadians aged 55 or older.
- This study provides further evidence that the scale measures four dimensions of functional support.
- The MOS social support scale appears to function uniformly among English- and French-speaking respondents.

Table 4
Standardized and unstandardized estimates from final models, household population aged 55 or older, Canada excluding territories, 1998/1999

Parameters	Language of interview			
	English (n = 2,642)		French (n = 489)	
	Standardized estimate	Unstandardized estimate (standard error)	Standardized estimate	Unstandardized estimate (standard error)
Item 2 on tangible support	0.80 [†]	1.00	0.83 [†]	1.00
Item 3 on emotional/informational support	0.85 [†]	1.00	0.82 [†]	1.00
Item 4 on emotional/informational support	0.83	.97 (.012)	0.80	.98 (.030)
Item 5 on tangible support	0.85	1.06 (.024)	0.89	1.08 (.034)
Item 6 on affectionate support	0.90 [†]	1.00	0.86 [†]	1.00
Item 7 on positive social interaction	0.89 [†]	1.00	0.87 [†]	1.00
Item 8 on emotional/informational support	0.88	1.03 (.012)	0.87	1.06 (.029)
Item 9 on emotional/informational support	0.91	1.07 (.012)	0.90	1.10 (.025)
Item 10 on affectionate support	0.90	1.00 (.014)	0.90	1.04 (.034)
Item 11 on positive social interaction	0.90	1.01 (.009)	0.88	1.00 (.021)
Item 12 on tangible support	0.92	1.14 (.020)	0.91	1.10 (.029)
Item 13 on emotional/informational support	0.87	1.02 (.012)	0.89	1.08 (.027)
Item 14 on positive social interaction	0.93	1.05 (.009)	0.83	0.95 (.020)
Item 15 on tangible support	0.95	1.18 (.021)	0.90	1.09 (.032)
Item 16 on emotional/informational support	0.94	1.11 (.013)	0.91	1.11 (.027)
Item 17 on emotional/informational support	0.94	1.10 (.012)	0.92	1.11 (.027)
Item 18 on positive social interaction	0.95	1.06 (.008)	0.91	1.04 (.022)
Item 19 on emotional/informational support	0.94	1.10 (.013)	0.88	1.07 (.033)
Item 20 on affectionate support	0.94	1.04 (.013)	0.85	.99 (.034)

[†] fixed parameter

Note: Normalized survey sampling weights and Taylor linearization method were used.

Source: 1998/1999 National Population Health Survey, household component.

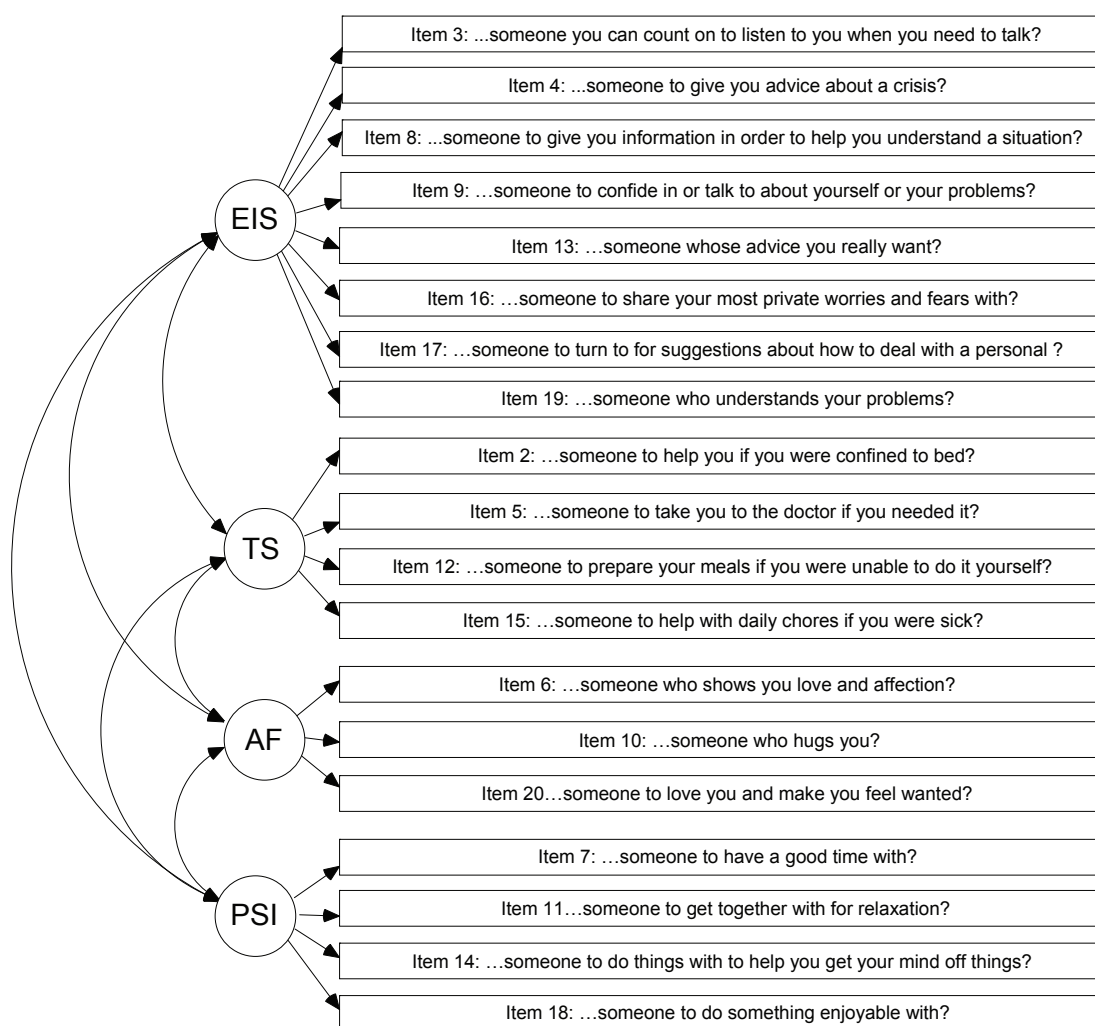
reassurance of worth,^{27,62-65} nor does it indicate the source of support (relatives, friends, children). The addition of such items is an important area for future research.

The current findings apply only to people aged 55 or older with similar demographic characteristics. Moreover, although differences between those with and without missing values were significant, the former were excluded from the study because there was no valid way to impute their data. Results might have been slightly different had these people been included in the analyses.

As well, the assessment of MI between English- and French-speaking older

Figure 1

Model of the factorial structure of Medical Outcomes Study social support scale for sample of English- and French-speaking respondents aged 55 or older, Canada excluding territories, 1998/1999



EIS = emotional/informational support

TS = tangible support

AF = affectionate support

PSI = positive social interaction

Note: Item 1 is not in figure because it measures structural support and was not included in study.

Source: 1998/1999 National Population Health Survey, household component.

adults is valuable to researchers exploring social support in these populations. In the past, the two groups had been combined or compared although MI between them had not been evaluated. The English- and French-speaking Canadians in the current study do not appear to differ in their interpretation of the meaning of

the MOS social support scale items. This suggests that cultural differences between the two groups likely played an important role in differences in levels of social support found by previous studies using the MOS social support scale. ■

Acknowledgements

The authors are grateful to Rochelle Garner for all the help she provided with the paper. This study was supported by the Statistics Canada Tom Symons Research Stipend Program to the first author.

References

- Depp CA, Jeste DV. Definitions and predictors of successful aging: A comprehensive review of larger quantitative studies. *American Journal of Geriatric Psychiatry* 2006; 14(1): 6-20.
- Bosworth HB, Schaie WK. The relationship of social environment, social networks, and health outcomes in The Seattle Longitudinal Study: Two analytical approaches. *Journal of Gerontology Series B: Psychological Sciences and Social Sciences* 1997; 52B(5): 197-205.
- Shields M, Martel L. Healthy living among seniors. *Health Reports* (Statistics Canada, Catalogue 82-003) 2005; 16 (Suppl): 7-20.
- Blazer DG. Social support and mortality in an elderly community population. *American Journal of Epidemiology* 1982; 115(5): 684-94.
- House JS, Robbins C, Metzner HL. The association of social relationships and activities with mortality: prospective evidence from the Tecumseh Community Health Study. *American Journal of Epidemiology* 1982; 116(1): 123-40.
- Orth-Gomér K, Johnson JV. Social network interaction and mortality: A six-year follow-up study of a random sample of the Swedish population. *Journal of Chronic Diseases* 1987; 40(10): 949-57.
- Seeman TE, Kaplan GA, et al. Social network ties and mortality among the elderly in the Alameda county study. *American Journal of Epidemiology* 1987; 126(4): 714-23.
- Hanson BS, Isacson SO, Janzon L, Lindell SE. Social network and social support influence mortality in elderly men: prospective population study of "men born in 1914", Malmö, Sweden. *American Journal of Epidemiology* 1989; 130(1): 100-11.
- Hirdes JP, Forbes WF. The importance of social relationships, socioeconomic status and health practices with respect to mortality among healthy Ontario males. *Journal of Clinical Epidemiology* 1992; 45(2): 175-82.
- Steinbach U. Social networks, institutionalization, and mortality among elderly people in the United States. *Journal of Gerontology* 1992; 47(4): S183-90.
- Kaplan GA, Wilson TW, Cohen RD, et al. Social functioning and overall mortality: prospective evidence from the Kuopio Ischemic Heart Disease Risk Factor Study. *Epidemiology* 1994; 5(5): 495-500.
- Kawachi I, Colditz GA, Ascherio A, et al. A prospective study of social networks in relation to total mortality and cardiovascular disease in men in the USA. *Journal of Epidemiology and Community Health* 1996; 50(3): 245-51.
- Seeman TE. Social ties and health: the benefits of social integration. *Annals of Epidemiology* 1996; 6(5): 442-51.
- Dalgard OS, Lund Håheim L. Psychosocial risk factors and mortality: a prospective study with special focus on social support, social participation, and locus of control in Norway. *Journal of Epidemiology and Community Health* 1998; 52(8): 476-81.
- Ceria CD, Masaki KH, Rodriguez BL, et al. The relationship of psychosocial factors to total mortality among older Japanese-American men: The Honolulu Heart Program. *Journal of the American Geriatrics Society* 2001; 49(6): 725-31.
- Lennartsson C, Silverstein M. Does engagement with life enhance survival of elderly people in Sweden? The role of social and leisure activities. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* 2001; 56(6): S335-S342.
- Krause N. Anticipated support, received support, and economic stress among older adults. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* 1997; 52(6): 284-93.
- Oxman TE, Berkman LF, Kasl S, Freeman DH, Barrett J. Social support and depressive symptoms in the elderly. *American Journal of Epidemiology* 1992; 135(4): 356-68.
- Ramos M, Wilmoth J. Social relationships and depressive symptoms among older adults in Southern Brazil. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* 2003; 58: S253-61.
- Lépine JP, Bouchez S. Epidemiology of depression in the elderly. *International Clinical Psychopharmacology* 1998; 13(5 suppl): S7-12.
- Krause N, Liang J, Yatomi N. Satisfaction with social support and depressive symptoms: A panel analysis. *Psychology and Aging* 1989; 4(1): 88-97.
- Russell DW, Cutrona CE. Social support, stress, and depressive symptoms among the elderly: Test of a process model. *Psychology and Aging* 1991; 6(2): 190-201.
- Blazer DG, Hybels CF. Origins of depression in later life. *Psychological Medicine* 2005; 35: 1241-52.
- Cohen S. Social relationships and health. *American Psychologist* 2004; 59(8): 676-84.
- Cohen S, Gottlieb BH, Underwood LG. Social relationships and health: Challenges for measurement and intervention. *Advances in Mind-Body Medicine* 2001; 17(2): 129-42.
- Cohen S, Gottlieb BH, Underwood LG. Social relationships and health. In: Cohen S, Underwood LG, Gottlieb BH (eds). *Measuring and Intervening in Social Support*. New York: Oxford University Press, 2000: 3-25.
- Caron J, Guay S. Soutien social et santé mentale: concept, mesure, recherche récentes et implications pour l'intervention. *Santé Mentale au Québec* 2005; 30(2): 15-38.
- Sherbourne CD, Stewart AL. The MOS social support survey. *Social Science and Medicine* 1991; 32(6): 705-14.
- Gjesfjeld CD, Greeno CG, Kim KH. A confirmatory factor analysis of an abbreviated social support instrument: The MOS-SSS. *Research on Social Work Practice* 2008; 18(3): 231-7.
- Badoux A. Social support in healthy and psychologically distressed French populations. *Psychology, Health, and Medicine* 2000; 5(2): 143-54.
- Anderson D, Bilodeau B, Deshaies G, Gilbert M, Jobin J. French-Canadian validation of the MOS Social Support Survey. *Canadian Journal of Cardiology* 2005; 21(10): 867-73.
- Statistics Canada and Canadian Institute for Health Information. Proportion of the population 12 years and over without a high level of social support, Quebec and some Canadian provinces, 2005. *Health Indicators* 2006 (1): 82-221.
- Statistics Canada. *National Population Health Survey, Household Component, Cycles 1 to 7 (1994/1995 to 2006/2007), Longitudinal Documentation*. Ottawa: Statistics Canada, 2008.
- Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* 1995; 7(1): 29-39.
- SAS [computer program]. Version 8. Cary, North Carolina: SAS Institute Inc, 2000.
- Mplus [computer program]. Version 4.1. Los Angeles, California: Muthén & Muthén, 2006.
- Muthén LK, Muthén BO. *Mplus User's Guide*. 5th ed. Los Angeles, California: Muthén & Muthén, 2007.
- Zumbo BD, Gadermann AM, Zeisser C. Ordinal versions of coefficients alpha and theta for likert rating scales. *Journal of Modern Applied Statistical Methods* 2007; 6(1): 21-9.
- Huysamen GK. Coefficient alpha: unnecessarily ambiguous; unduly ubiquitous. *Journal of Industrial Psychology* 2006; 32(4): 34-40.
- Raykov T. Estimation of composite reliability for congeneric measures. *Applied Psychological Measurement* 1997; 21(2): 173-84.

41. Bentler PM. Alpha, dimension-free, and model-based internal consistency reliability. *Psychometrika* 2009; 74(1): 137-43.
42. Lubke GH, Muthén BO. Applying Multigroup Confirmatory Factor Models for Continuous Outcomes to Likert Scale Data Complicates Meaningful Group Comparisons. *Structural Equation Modeling* 2004; 11(4): 514-34.
43. Flora DB, Curran PJ. An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods* 2004; 9(4): 466-91.
44. Lei P-W. Evaluating estimation methods for ordinal data in structural equation modeling. *Quality and Quantity* 2007; 43(3): 495-507.
45. Asparouhov T. Sampling weights in latent variable modeling. *Structural Equation Modeling* 2005; 12(3): 411-34.
46. Stapleton LM. An assessment of practical solutions for structural equation modeling with complex sample data. *Structural Equation Modeling* 2006; 13(1): 28-58.
47. Vernon T, Eysenck SBG. Special issue on structural equation modeling [Special Issue]. *Personality and Individual Differences* 2007; 42(5).
48. Millsap RE. Structural equation modeling made difficult. *Personality and Individual Differences* 2007; 42: 875-81.
49. Meade AW, Johnson EC, Braddy PW. Power and sensitivity of alternative fit indices in tests of measurement invariance. *Journal of Applied Psychology* 2008; 93(3): 568-92.
50. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling* 2007; 14(3): 464-504.
51. Cheung GW, Rensvold RB. Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling* 2002; 9(2): 233-55.
52. Vandenberg RJ, Lance CE. A review and synthesis of the measurements invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods* 2000; 3: 4-70.
53. Mplus discussion board. 2009. Available at: <http://www.statmodel.com/>.
54. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling* 1999; 6(1): 1-55.
55. Byrne BM, Campbell TL. Cross-cultural comparisons and the presumption of equivalent measurement and theoretical structure: A look beneath the surface. *Journal of Cross-Cultural Psychology* 1999; 30(5): 555-74.
56. Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, editors. *Testing structural equation models*. Newbury Park, California: Sage, 1993: 136-62.
57. Camirand H, Nanhou V. La détresse psychologique chez les Québécois en 2005: Série Enquête sur la santé dans les collectivités canadiennes. *Institut de la statistique du Québec, Zoom Santé*, 2008 Sept; 1-4.
58. Couture M, Larivière N, Lefrançois R. Psychological distress in older adults with low functional independence: A multidimensional perspective. *Archives of Gerontology and Geriatrics* 2005; 41(1): 101-11.
59. Préville M, Hébert R, Bravo G, Boyer R. Predisposing and facilitating factors of severe psychological distress among frail elderly adults. *Canadian Journal on Aging* 2001; 21(2): 195-204.
60. Krause N, Liang J, Keith V. Personality, social support, and psychological distress in later life. *Psychology and Aging* 1990; 5(3): 315-26.
61. Blazer DG. Depression in late life: Review and commentary. *Focus* 2009; 7(1): 118-36.
62. Caron J, Lecomte Y, Stip E, Renaud S. Predictors of quality of life in schizophrenia. *Community Mental Health Journal* 2005; 41(4): 399-417.
63. Caron J, Latimer E, Tousignant M. Predictors of psychological distress in low income populations of Montreal. *Canadian Journal of Public Health* 2007; 98: 35-44.
64. Caron J, Mercier C, Martin A, Stip E. Le rôle du soutien social, du fardeau familial et de la satisfaction des services dans la détresse psychologique et la qualité de vie des familles de personnes atteintes de schizophrénie. *Santé Mentale au Québec* 2005; 30(2): 165-82.
65. Caron J, Liu A. *Measuring Psychological Well-being on a population health survey on mental health*. Report resented to Statistics Canada, March 2008.

Primary mental health care visits in self-reported data versus provincial administrative records

by JoAnne L. Palin, Elliot M. Goldner, Mieke Koehoorn and Clyde Hertzman

Abstract

Background

Survey data and provincial administrative health data are the major sources of population estimates of mental health care visits to General Practitioners (GPs). Previous research has suggested that self-reported estimates of the number of mental health-related visits per person to health professionals may exceed estimates obtained from physician reimbursement records.

Data and methods

Self-reported data from the 2002 Canadian Community Health Survey (CCHS): Mental Health and Well-being and administrative records from the Medical Services Plan of British Columbia were linked. The analytic sample consisted of 145 CCHS respondents who had at least one mental health visit to a GP in the past 12 months according to both data sources. High Reporters (self-reported visits exceeded number in administrative data), Low Reporters (self-reported visits were less than number in administrative data), and Exact Matches were analyzed in two ways. The first analysis used diagnostic codes to identify mental health-related visits in the administrative data. For the second analysis, all GP visits in the administrative data were counted as “possibly” mental health-related. Differences were described based on the median number of visits.

Results

When diagnostic codes were used to identify mental health-related visits in the administrative data, High Reporters (49%) substantially exceeded Low Reporters (24%). The remaining 27% were Exact Matches. Based on a broader definition of a mental health visit, 51% were Exact Matches. High reporting was common among people with mental disorders.

Interpretation

Self-reported data and administrative data provide different estimates of the number of mental health visits per person to GPs. The discrepancy can be large.

Keywords

databases, data collection, data interpretation, health surveys, medical record linkage, mental disorders, mental health services

Authors

JoAnne L. Palin (1-250-816-5050; joanne.ubc@gmail.com), Mieke Koehoorn, and Clyde Hertzman are with the School of Population and Public Health, University of British Columbia, Vancouver, British Columbia V6T 1Z3. Elliot M. Goldner is with the Centre for Applied Research in Mental Health and Addiction, Simon Fraser University, Vancouver, British Columbia.

General practitioners (GPs) are the main source of mental health care for most Canadians. Information about the number of times individuals talk with GPs about mental health concerns is used for a variety of purposes,^{1,2} such as assessing adherence to treatment follow-up guidelines. The major sources of population-level data on primary mental health care visits are surveys, particularly the 2002 Canadian Community Health Survey: Mental Health and Well-being (CCHS 1.2),^{3,4} and provincial administrative health records, which the Public Health Agency of Canada now uses for national surveillance of “treated” mental health issues. Yet evidence from two previous studies^{5,6} indicates that survey data provide higher within-individual estimates of the number of mental health visits than do provincial administrative data.

One study⁵ found that the mean difference in the number of mental health visits to “health professionals” in 1994/1995 National Population Health Survey data was 28% higher than the number of mental health visits to “physicians” in Ontario Health Insurance Program data. However, that study did not directly compare the number of mental health visits to GPs in each data

source. In addition, it focused on visits involving mental health “services” (such as psychotherapy) in the administrative data and did not count general office visits for mental health reasons.

Another method for identifying mental health visits in administrative data is based on the diagnostic codes recorded as the reasons for the visits.^{7,8} Using the *diagnostic code* method (which is

also used for national surveillance), Palin et al.⁶ compared mental health visits in administrative data from the British Columbia Medical Services Plan with estimates from the 2002 CCHS in a linked sample. Because the CCHS asked about visits to GPs and to other types of health professionals separately, a direct comparison of *GP visits* in each data source was possible. Among the respondents who had a mental health visit with a GP according to both data sources, the mean and median numbers of visits were higher in the self-reported data. The study focused on the “main GP” seen for mental health issues in the past 12 months because the CCHS question referred to the GP with whom the respondent talked “the most often.”

It is possible that the diagnostic code method did not capture every visit during which the patient’s mental health was discussed. In British Columbia, GPs submit a single diagnostic code with each billing claim. However, primary care patients can present with a myriad of physical, emotional, social and personal issues,⁹ and physical symptoms may arise from mental health issues or vice versa. If a GP recorded a diagnostic code for a physical condition or for “general symptoms” as the reason for the visit in a billing record, that visit would not be counted as a *mental health* visit in the administrative data, but could be counted in the self-reported survey data if mental health issues had been discussed. In such cases, it may seem as if a survey respondent “over-reported” the number of mental health visits when compared with administrative data.

Thus, the present study used a two-stage approach to count mental health visits in administrative data. In the first stage, the number of mental health GP visits that CCHS respondents reported having had with the GP seen most often in the previous 12 months was compared with the number of visits to the main GP that were accompanied by a *mental* diagnostic code in the British Columbia Medical Services Plan data.

In the second stage, the self-reported CCHS data were compared with the

total number of visits to the main GP, regardless of diagnosis, in the administrative data. If the number of self-reported *mental health* visits to the main GP exceeded the *total* number of visits to the main GP in the administrative data, the difference between the data sources was not solely attributable to diagnostic coding. These comparisons were made for the sample overall and by mental disorder.

Data and methods

Data sources

The self-reported data are from a subsample of the cross-sectional 2002 Canadian Community Health Survey (CCHS) (cycle 1.2). The survey covered people aged 15 or older living in private dwellings in the 10 provinces; it excluded residents of the territories, institutions, Indian reserves and certain remote areas, as well as members of the regular Armed Forces and civilian residents of military bases. To obtain adequate sample sizes for young people and seniors, people aged 15 to 24 and 65 or older were over-sampled.

The response rate to the CCHS in British Columbia was 77.7%. For the respondents in the linked study sample, 86.2% of interviews were face-to-face; the others were conducted by telephone. Detailed information about the survey design, methodology and questionnaire has been published elsewhere.^{3,4} Proxy interviews were not conducted.

Administrative data are from the British Columbia Medical Services Plan database, which contains records of payments to physicians for medical services provided under fee-for-service arrangements.¹⁰

Data linkage and sample size

The 2002 CCHS sample for British Columbia totalled 3,902 respondents. The British Columbia Ministry of Health Services linked the CCHS data to the Medical Services Plan data for those CCHS respondents who had given permission to do so, and who had provided their Personal Health Number

(PHN). The PHN is a unique identifier for individuals eligible to receive provincial health care services. The Centre for Health Services and Policy Research (now Population Data BC), which maintains the data for research purposes, provided the administrative data extracts. To ensure confidentiality, PHNs and physician billing numbers were replaced with anonymous study identifiers, and other potentially identifying information was removed. The linkage was verified by comparing sex and month and year of birth in both data sources; 2,660 individuals met all the criteria.

The study reference period for each respondent was the 12 months before his/her survey interview date, so the data sources were compared for identical 12-month periods for each respondent individually. For example, the study reference period might be March 3, 2001 to March 2, 2002 for one respondent, and March 15, 2001 to March 14, 2002 for another.

The linked study sample consisted of 2,378 individuals who were continuously registered in the Medical Services Plan throughout the fiscal years pertaining to the study reference period. The sample was reduced by 12 CCHS respondents who did not report the number of visits or who had in-patient care. This yielded 2,366 individuals, representing 60.6% of the original CCHS sample for British Columbia. The analytic subsample consisted of the 145 respondents who had primary mental health care according to *both* data sources (Table 1).

Definition of GP visit

For this study, the number of self-reported mental health visits was obtained from the CCHS question: “Think of the family doctor or the general practitioner you talked to the *most often* during the past 12 months. How many times did you see, or talk on the telephone, to this family doctor or general practitioner (about your problems with your emotions, mental health or use of alcohol or drugs)?” In this analysis, that doctor is considered the “main GP.”

Table 1
Percentage distribution of selected demographic and mental health characteristics in Canadian Community Health Survey (CCHS) Public Use Microdata File, linked study sample and analytic subsample, household population aged 15 or older, British Columbia, 2002

	Full CCHS sample [†]		Linked study sample [‡]		Analytic subsample [§]	
	Number	%	Number	%	Number	%
Total	3,902	100.0	2,372	100.0	145	100.0
Sex						
Male	1,831	46.9	1,052	44.2	53	36.6
Female	2,071	53.1	1,326	55.8	92	63.4
Age group						
15 to 24	546	14.0	269	11.3	9	6.2
25 to 34	603	15.5	290	12.2	29	20.0
35 to 64	1,913	49.0	1,196	50.3	93	64.1
65 to 74	427	10.9	320	13.5	5	3.4
75 or older	413	10.6	303	12.7	9	6.2
Household income						
Less than \$15,000	430	11.0	261	11.0	32	22.1
\$15,000 to \$29,999	660	16.9	419	17.6	21	14.5
\$30,000 to \$49,999	853	21.9	566	23.8	32	22.1
\$50,000 to \$79,999	866	22.2	540	22.7	34	23.4
\$80,000 or more	728	18.7	468	19.7	21	14.5
Missing	365	9.4	124	5.2	5	3.4
Marital status^{††}						
Married/Common-law	1,977	50.7	1,269	53.4	64	44.1
Widowed/Divorced/Separated	886	22.8	589	24.8	43	29.6
Single	1,030	26.3	517	21.7	38	26.2
Education^{††}						
Less than secondary	855	21.9	534	22.6	24	16.9
Secondary graduation	710	18.2	419	17.8	24	16.9
Postsecondary graduation	1,848	47.4	1,143	48.5	70	49.3
Other	443	11.4	263	11.1	24	16.9
Mental disorder/Substance dependence (past 12 months)						
Yes	513	13.1	271	11.4	82	56.6
No	3,214	82.4	2,013	84.7	55	37.9
Missing	175	4.5	94	4.0	8	5.5

[†] 2002 Canadian Community Health Survey: Mental Health and Well-being (cycle 1.2) Public Use Microdata File for British Columbia

[‡] linked data from 2002 CCHS and British Columbia Medical Services Plan

[§] linked subsample of 2002 CCHS respondents who talked with a GP about their mental health in past 12 months according to both data sources

^{††} missing cases not displayed (less than 2% of total)

Sources: 2002 Canadian Community Health Survey: Mental Health and Well-being; British Columbia Medical Services Plan.

In the administrative data, a “visit” was defined as one or more Medical Services Plan claims for GP services for the same patient on the same date. Diagnostic codes in the British Columbia Medical Services Plan data include ICD-9 codes, some ICD-9-CM (Clinical Modification) codes, and additional codes specific to the Medical Services Plan diagnostic coding system.⁷ The codes used to identify mental health visits were the Medical Services Plan diagnostic code

50B for “anxiety/depression,” and ICD codes 290 to 314, and 316. Anonymized physician identification numbers were used to determine which GP was seen most often by each respondent and to count the number of visits to that GP.

Definition of mental disorder

Mental disorders (major depressive episode, manic episode, agoraphobia, panic disorder, social phobia) in the past 12 months were assessed in the 2002

CCHS with the World Mental Health version of the Composite International Diagnostic Interview that was adapted for the survey (CCHS 1.2/WMH-CIDI).^{4,11} Substance dependence (alcohol or illicit drugs) in the past 12 months was also assessed in the 2002 CCHS.⁴ Because of the small sample size, the three anxiety disorders were combined, and manic episodes were not included in the analysis.

Analytical techniques

The number of *mental health* visits to the main GP in the Medical Services Plan data was subtracted from the number of self-reported visits in the CCHS data for each CCHS respondent in the analytic subsample who had at least one visit according to *both* data sources. These CCHS respondents were grouped into three categories: High Reporters (self-reported mental health visits exceeded number in administrative data over same 12 months), Low Reporters (self-reported number was less than number in administrative data), and Exact Matches (self-reported visits equalled visits in administrative data). Neither data source is considered to be the gold standard, so the labels of the three categories refer only to the direction of difference.

The chi-squared test of equal proportions was used to compare the percentages of High Reporters and Low Reporters with the percentage of Exact Matches. Median and maximum differences between data sources were calculated to describe the magnitude of high and low reporting.

The percentages of High Reporters, Low Reporters and Exact Matches were also calculated for a second scenario: the difference between the total number of visits to the main GP for *any* reason in the Medical Services Plan data and the number of self-reported mental health visits to the main GP in the CCHS data.

Statistics Canada produces survey weights that correspond to the number of people in the population represented by a respondent. For the vast majority of analyses, survey data should be weighted. However, the aim of this study was to

examine the *actual* level of case-by-case agreement between the two data sources before and after changing the definition of a primary mental health care visit in the administrative data. Therefore, population survey weights were not applied.¹² Analyses were conducted using SPSS for Windows (Rel. 12.0.1. 2001. Chicago: SPSS Inc.).

Results

Scenario 1 (includes only *mental health* visits to main GP in administrative data)

Close to half (49%) of the survey respondents in the linked subsample were High Reporters; that is, in their CCHS interview, they reported more mental health visits to their main GP than were recorded in the Medical Services Plan data (Figure 1, Scenario 1). About a quarter (24%) were Low Reporters, and just over a quarter (27%) were Exact Matches. Most individuals

in the subsample who had a mental disorder were High Reporters, with the percentage ranging up to 75%. By contrast, among the individuals in the subsample who did not meet the criteria for having had a mental disorder in the previous 12 months, the percentage of High Reporters (35%) did not exceed that of Exact Matches (38%), yet agreement remained low.

For High Reporters, the median difference between the self-reported estimates and the administrative data was 3 visits, ranging from 2 visits for those with substance dependence to 4.5 visits for those with anxiety disorders (Table 2); the maximum difference was 42 visits. For Low Reporters, the median difference was 2 visits; the maximum difference, 36 visits.

Scenario 2 (includes *all* visits to main GP in administrative data)

When the definition of a mental health visit in the administrative data was broadened to include *all* visits to the

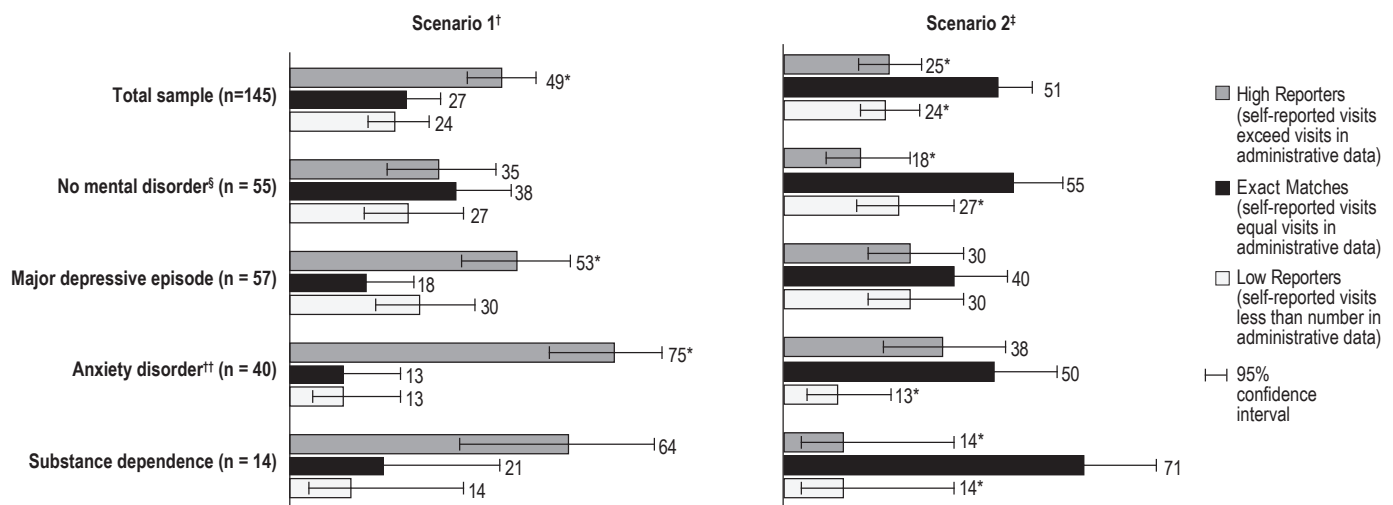
main GP, regardless of diagnostic codes, the percentage of Exact Matches was significantly higher for all mental health status categories (Figure 1, Scenario 2). The overall percentage of High Reporters was halved from 49% to 25%, with a corresponding doubling of the percentage of Exact Matches from 27% to 51%. Nonetheless, even under the broadened definition of a visit, only half the cases were Exact Matches.

Discussion

Survey respondents who had at least one mental health visit to a GP in the past 12 months according to both data sources, particularly those who had a measured mental disorder, tended to report more mental health visits per person than were recorded in administrative data. This is consistent with previous research,⁵ although parallels are drawn cautiously because of differences in methodologies and data sources.

Figure 1

Percentage distribution of type of reporter of mental health visits to main General Practitioner in past 12 months, by definition of visit in administrative data and mental health status in past 12 months, household population aged 15 or older, British Columbia, 2002



[†] compares number of self-reported visits to main GP for mental health with number in administrative data (based on mental health diagnostic code)

[‡] compares number of self-reported visits to main GP for mental health with number in administrative data (for any reason)

* significantly different from estimate for Exact Matches ($p < 0.05$)

[‡] did not meet any criteria for any of measured mental disorders (major depressive episode, manic episode, social phobia, panic disorder, agoraphobia) or substance dependence (alcohol or illicit drugs) in past 12 months

^{††} social phobia, panic disorder, agoraphobia

Note: Respondents could meet criteria for more than one measured mental disorder and/or substance dependence.

Sources: 2002 Canadian Community Health Survey: Mental Health and Well-being; British Columbia Medical Services Plan.

Table 2

Difference in number of mental health visits to main General Practitioner (GP) in past 12 months in self-reported data versus administrative data, by mental health status in past 12 months and type of reporter, household population aged 15 or older, British Columbia, 2002

	Total sample		Exact matches	Absolute difference in number of GP visits (self-reported data versus administrative data)					
				High Reporters			Low Reporters		
	Number of respondents	Missing	Number of respondents	Number of respondents	Median difference	Maximum difference	Number of respondents	Median difference	Maximum difference
Total sample	145	-	39	71	3	42	35	2	36
No mental disorder in past 12 months	55	8	21	19	3	11	15	1	4
Major depressive disorder	57	2	10	30	4	19	17	2	12
Anxiety disorder [†]	40	12	5	30	4.5	42	5	1	36
Substance dependence	14	2	3	9	2	17	2	18.5 [‡]	36

[†] social phobia, panic disorder, agoraphobia

[‡] median of two cases: one case with a difference of 1 visit, the other with a difference of 36 visits

Notes: The analyses pertain to individuals with at least one visit in both data sources. Respondents could meet criteria for more than one mental disorder and/or substance dependence.

Sources: 2002 Canadian Community Health Survey: Mental Health and Well-being; British Columbia Medical Services Plan.

Discrepancies between the two data sources were substantial. For instance, CCHS respondents who met the criteria for depression reported as many as 19 more mental health visits to GPs than were found in their Medical Services Plan records, with a median difference of 4 visits. Thus, in research in which the exact number of mental health visits to GPs is important, such as studies of adherence to treatment follow-up guidelines, the two data sources could potentially yield different results.

Agreement between the two sources improved when the definition of a mental health visit in the administrative records was broadened to include all visits to the main GP. Even so, one-quarter of individuals in the linked subsample reported more *mental health* visits than the *total* number of visits to the main GP for *any* reason in their administrative records. It is possible that these respondents did not distinguish between GPs; in fact, according to administrative records, more than two-thirds of the 145 individuals in the sample saw more than one GP during the 12-month reference period (data not shown). For 28% of the High Reporters, the number of self-reported mental health visits to the main GP was higher than the *total* number of visits to all GPs for *any* diagnosis in the administrative data, which could suggest respondent over-reporting in some cases (data not shown).

For a number of reasons, some GP visits that CCHS respondents reported may not have appeared in the Medical Services Plan data. It could be that the GPs were reimbursed under an Alternative Payment Plan arrangement. As well, reflecting the broad nature of the CCHS questions, respondents might have counted mental health contacts not reimbursed by the Medical Services Plan, such as telephone calls, which would not have been captured in the administrative data. The extent to which these factors influenced the observed prevalence of High Reporting is not known, but evidence suggests that it would have been low. According to the Canadian Institute for Health Information, more than 80% of physician payments in British Columbia were made on a fee-for-service basis (which appear in the Medical Services Plan database) during the fiscal years covering the study period.¹³ Moreover, when CCHS respondents were asked to select from a list of possible settings where their GP contacts took place, only one High Reporter (1.4%) selected “telephone consultation only,” and no respondents in the analytic sample selected a location outside a health care setting (such as home, school, work, church or “other”).

Even if improvements to either or both data sources increased the comparability of estimates, it may not be realistic to expect perfect agreement between data sources designed for different purposes

What is already known on this subject?

- The major sources of data about the number of times individuals talk to their GPs about mental health are self-reports from surveys and physician reimbursement records in provincial administrative databases.
- The number of self-reported mental health-related visits per person in surveys exceeds estimates from provincial administrative records.

What does this study add?

- The number of self-reported mental health visits to GPs tends to exceed estimates from administrative data that are based on mental health-related diagnostic codes, particularly among people with major depressive disorder and anxiety disorder.
- Even when the definition of a visit in the administrative records is broadened to include all GP visits, only half of the sample have exact agreement.

and offering different perspectives—that of consumers and that of providers. Analyses using both data sources, linked or in parallel, would enable data users to capitalize on the strengths and perspectives offered by each, and to evaluate the sensitivity of the results to the data source used.

Qualitative research would be useful to obtain information about diagnostic coding of mental health issues by GPs and by medical office staff, in order to understand if and why over- or under-representation of mental health visits may occur in administrative data. More complex algorithms using additional sources of administrative information about each individual, such as medical prescription data, could provide additional insight into the nature of medical visits.

Qualitative research would also be helpful in assessing potential causes of misreporting, such as the methods used by respondents to estimate the number of visits; difficulty recalling which visits occurred within the study reference period and which ones pertained to mental health; classifying other health professionals as a GP or family doctor; or misunderstanding the question. The possibility that respondents' mental health status affected their ability to accurately recall and report their visits should also be considered.

The findings of this analysis do not necessarily apply to other types of health professionals. For example, in British Columbia, some psychiatrist visits may not appear in the Medical Services Plan data because psychiatrists are reimbursed on a fee-for-service basis to a lesser extent than are GPs.

Although the characteristics of the individuals in the linked study sample were similar to the characteristics of

individuals in the complete 2002 CCHS Public Use Microdata File (PUMF) for British Columbia (Table 1), unmeasured psychological characteristics of non-linkers may have affected their recall and reporting of mental health visits. Compared with the full PUMF or full linked samples, a higher percentage of respondents in the analytic subsample (at least one mental health visit in both data sources) had a mental disorder or were in the low-income category, and fewer were younger than 25 or older than 65.

This study focuses on *methodological issues* surrounding estimates of the number of mental health visits *per person*. Consequently, the comparisons were made for people who had at least one primary mental health visit in *both* data sources. These findings cannot be generalized beyond their intended scope; other research on this sample has examined differences among people who had mental health care according to *one data source but not the other*.⁶

The CCHS asked about mental health visits to the *main* GP. Self-reported data were not available about the *total* number of visits to *all* GPs per person, for mental health issues or for other health issues.

Conclusion

Data linkage studies such as this provide opportunities to examine individual-level agreement between self-reported data and provincial administrative health records. This is the first known study to compare the number of mental health visits reported to the Canadian Community Health Survey: Mental Health and Well-being with provincial administrative records, using diagnostic codes to identify visits in the administrative data, a method that was recently adopted by the Public Health Agency of Canada for national surveillance. The study

also involves a second stage of analysis using a broader definition encompassing “possibly” mental health-related visits (any diagnosis) and includes analyses of individuals who had anxiety disorders and/or substance dependence, in addition to those who had depression.

Although the median number of mental health visits to GPs in the self-reported and administrative data did not vary greatly for the total analytic sample (3 visits versus 2 visits), substantial per-person variations emerged between the data sources. High Reporting was common, particularly among individuals with mental disorders, and the size of the difference was not trivial. Even when all GP visits in the administrative data were counted, only half of the cases had exact agreement. As well, one-quarter of the individuals in the sample were Low Reporters.

Data users may find it beneficial to conduct parallel analyses with each data source, or to use linked data, in order to get a more complete picture of possible mental health care use. ■

Acknowledgements

This research was supported by a grant from the Canadian Institutes of Health Research (CIHR), and by training fellowships for JoAnne Palin from the CIHR; the Western Region Training Centre for Health Services Research (funded by the Canadian Health Services Research Foundation, the Alberta Heritage Foundation for Medical Research and the CIHR); the CIHR Strategic Training Program in Research in Addictions and Mental Health Policy and Services; and the British Columbia Health Research Foundation. The authors gratefully acknowledge the statistical advice provided by Dr. Bruno Zumbo at the University of British Columbia.

References

1. Starkes JM, Poulin CC, Kisely SR. Unmet need for the treatment of depression in Atlantic Canada. *Canadian Journal of Psychiatry* 2005; 50: 580-90.
2. Katz SJ, Kessler RC, Lin E, Wells KB. Medication management of depression in the United States and Ontario. *Journal of General Internal Medicine* 1998; 13: 77-85.
3. Gravel R, Beland Y. The Canadian Community Health Survey: Mental Health and Well-being. *Canadian Journal of Psychiatry* 2005; 50: 573-9.
4. Statistics Canada. *Canadian Community Health Survey (CCHS): Mental Health and Well-being - Cycle 1.2*. Available at: http://www.statcan.ca/english/concepts/health/cycle1_2/index.htm. Accessed April 2, 2007.
5. Rhodes AE, Lin E, Mustard CA. Self-reported use of mental health services versus administrative records: Should we care? *International Journal of Methods in Psychiatric Research* 2002; 11: 125-33.
6. Palin J, Koehoorn M, Goldner EM, Hertzman C. Hidden mental health care in general practice: a comparison between national survey data and administrative health records in a universal health care setting (*under review*). 2011.
7. British Columbia Ministry of Health Services. *Diagnostic Code Descriptions (ICD9)*. Available at: <http://www.health.gov.bc.ca/msp/infoprac/diagcodes/index.html>.
8. Kisley G, Lin E, Lesage A, et al. Use of administrative data for the surveillance of mental disorders in 5 provinces. *Canadian Journal of Psychiatry* 2009; 54: 571-5.
9. Craven MA, Cohen M, Campbell D, et al. Mental health practices of Ontario family physicians: A study using qualitative methodology. *Canadian Journal of Psychiatry* 1997; 42: 943-9.
10. British Columbia Ministry of Health Services. *Medical Services Plan of B. C.* Available at <http://www.health.gov.bc.ca/msp/>.
11. Kessler RC, Ustun TB. The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research* 2004; 13: 93-121.
12. Mustard CA, Goel V, Barer ML, et al. *Validity of Self-reported Utilization of Insured Health Care Services*. Institute for Work and Health Working Paper, Number 108. Toronto: Institute for Work & Health, 2000.
13. Canadian Institute for Health Information. *The Status of Alternative Payment Programs for Physicians in Canada: 2002-2003 and Preliminary Information for 2003-2004*. Ottawa: Canadian Institute for Health Information, 2005.