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Health Reports

Vol. 18 No. 4

- Flu shots
- Health care providers and work stress
- Birth outcomes
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..... **In this issue**

Research articles

Trends in influenza vaccination in Canada, 1996/1997 to 2005 9

Jeff C. Kwong, Laura C. Rosella and Helen Johansen

Influenza vaccination rates have more than doubled since the mid-1990s, but rates for most high-risk groups still fall short of national targets.

Birth outcomes by neighbourhood income and recent immigration in Toronto 21

Marcelo L. Urquia, John W. Frank, Richard H. Glazier and Rahim Moineddin

In Toronto, while low neighbourhood income is generally associated with a higher risk of preterm birth, this is not the case for recent immigrants.

Health matters

Work stress among health care providers 33

Kathryn Wilkins

Levels of work stress tend to be higher among health care providers than among Canadian workers overall. Work stress is particularly high among physicians, nurses, and medical lab technicians.

Hip fracture outcomes in the household population 37

Gisèle Carrière

In 2003/2004, close to 24,000 Canadians aged 60 or older were discharged from hospital after treatment for a hip fracture. The median age of seniors suffering hip fractures was 80. Nearly all the hip fractures had resulted from a fall.

Subject index 45

Author index 75



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Trends in influenza vaccination in Canada, 1996/1997 to 2005

Jeff C. Kwong, Laura C. Rosella and Helen Johansen

Abstract

Objectives

This article reports recent trends in influenza vaccination rates in Canada, provides data on predictors of vaccination in Canada for 2005, and examines longer-term effects of Ontario's universal influenza immunization program on vaccine uptake.

Data sources

Data are from the 1996/1997 National Population Health Survey (NPHS) and the 2000/2001, 2003, and 2005 Canadian Community Health Survey (CCHS).

Analytical techniques

NPHS and CCHS data were used to estimate influenza vaccination rates of the population aged 12 or older. The Z test was used to assess differences between surveys, and the chi-squared test for trend was used to examine trends over time. Logistic regression was used to identify predictors of vaccination and to compare the odds of being vaccinated in Ontario versus other provinces.

Main results

Nationally, influenza vaccination rates rose from 15% in 1996/1997 to 27% in 2000/2001, stabilized between 2000/2001 and 2003, and increased further to 34% by 2005. Vaccination rates for most high-risk groups still fall short of national targets. Ontarians continue to be more likely to be vaccinated than are residents of any other province, while residents of two of the territories—Nunavut and the Northwest Territories—are even more likely to be vaccinated than are Ontarians.

Keywords

preventive health services, community health services, population-based health planning

Authors

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Annual influenza epidemics continue to place a significant burden on society in terms of morbidity, mortality and lost productivity.¹⁻⁵ For healthy adults and older children, most influenza infections are not severe, but for vulnerable populations such as the elderly, young children, and those with chronic medical conditions, influenza can lead to serious complications and even death.^{6,7}

The segments of the population for whom influenza vaccination is recommended have been broadened over time. The National Advisory Committee on Immunization (NACI) currently recommends that those at increased risk of serious complications of influenza infection and those capable of transmitting influenza to these vulnerable groups should receive influenza vaccines annually.⁸ The Committee also states that individuals who wish to reduce their chances of suffering from influenza should receive the vaccine.

In 1993, a national consensus conference on influenza set target vaccination coverage rates of 70% for adults aged 65 or older and for all adults with chronic medical conditions.⁹ These targets were raised to 80% at another

consensus conference in 2005.¹⁰ Most provinces and territories had already established publicly funded programs to offer free influenza vaccinations to vulnerable populations and to those who have contact with vulnerable populations, including health care workers.¹¹

In 2000, Ontario introduced a universal influenza immunization program (UIIP) to provide free vaccines to the entire population aged 6 months or older.¹² A previous study found that between that time and 2003, vaccination rates rose more in Ontario than in the other provinces.¹³

The remaining provinces continue with targeted immunization programs, although the groups that are covered vary.¹⁴ Among the territories, Yukon has provided free influenza vaccines to all residents aged 18 or older since 1999¹⁵; Northwest Territories has offered free influenza vaccines since 2003¹⁶; and Nunavut introduced universal vaccination in the fall of 2005.¹⁷

Earlier work reported on influenza vaccination rates for 1996/1997, 2000/2001,¹⁸ and 2003.¹⁹ The objectives of this study are to report on the latest trends in vaccination rates in Canada for the entire period from 1996/1997 to 2005, to provide more in-depth data on rates and predictors of vaccination in Canada for 2005, and to examine longer-term effects of Ontario's UIIP on vaccine uptake.

Methods

Data sources

This analysis used the master files for the 1996/1997 cycle of the National Population Health Survey (NPHS) and the first three cycles of the Canadian Community Health Survey (CCHS), conducted in 2000/2001 (cycle 1.1), 2003 (cycle 2.1), and 2005 (cycle 3.1). These national population-based health surveys cover the household population. They exclude residents of Indian reserves, institutions (for example, nursing homes and prisons), and some remote areas; full-time members of the Canadian Forces; and residents (civilian and military) of Canadian Forces bases. This study pertains to the population aged 12 or older in the 10 provinces and three territories.

National Population Health Survey

The biennial National Population Health Survey (NPHS), which began in 1994/1995, has both cross-sectional and longitudinal components, with data collected mainly through telephone interviews. Details of the design and sampling techniques have been previously described.²⁰

Respondents to the cross-sectional component of NPHS 1996/1997 were surveyed from June 1996 to August 1997, with an overall response rate of approximately 83%. The sample for this study comprised 73,402 respondents aged 12 or older, weighted to represent an approximate population of 24.6 million.

Canadian Community Health Survey

The Canadian Community Health Survey (CCHS), which began in 2000/2001, is a cross-sectional survey conducted through telephone and in-person interviews over a two-year repeating cycle. Data for cycle 1.1 were collected over 12 months starting in September 2000, but questions on influenza vaccination were asked only in the fourth quarter (June to August 2001). By contrast, these questions were asked in all four quarters for cycles 2.1 and 3.1 (January to December of both 2003 and 2005). Details of the CCHS design and sampling techniques have been previously described.²¹

The response rates for the CCHS 1.1, 2.1, and 3.1 were approximately 85%, 81%, and 79%. The samples used in this study were 35,187, 133,026, and 132,947 respondents, weighted to represent populations of approximately 25.9 million, 26.5 million, and 27.1 million, respectively. Selected characteristics of the 2005 sample are presented in the appendix (Table A).

Definitions and outcome measures

Survey respondents were asked: "Have you ever had a flu shot?" Those who responded affirmatively were asked when they had last been vaccinated. Those who reported having had a flu shot within the last 12 months were considered to be actively immunized.

To determine chronic condition status, respondents were asked if they had any “long-term conditions that had lasted or were expected to last 6 months or more and that had been diagnosed by a health professional,” and a list of conditions was read to them. Those who reported having heart disease, diabetes, cancer, effects of stroke, asthma, or emphysema/chronic bronchitis were considered to have a chronic condition for which influenza immunization is recommended.

Two sets of age groups were considered in this analysis: 1) 12 to 19, 20 to 49, 50 to 64, 65 to 74, 75 to 84, 85 or older; and 2) 12 to 49, 50 to 64, 65 or older.

Risk groups were defined as high or low. Those deemed high risk were 65 or older, or aged 12 to 64 with at least one chronic condition. Individuals aged 12 to 64 with no chronic conditions were considered low risk.

The definitions of education, household income, smoking status, self-reported health, and having a regular doctor have been previously described.¹³

Statistical analysis

Cross-tabulations were used to estimate the proportion of people who reported having had an influenza vaccination in the previous year for the overall population aged 12 or older, for various subgroups of the population defined by socio-demographic characteristics, and by risk group for influenza immunization. Cross-sectional vaccine coverage rates between consecutive surveys were compared using Z tests for proportions. A chi-squared test for trend was performed to examine trends over time.

Multivariate analyses to identify independent predictors of vaccination included age group, sex, presence of a chronic condition, household income, smoking status, having a regular doctor, self-perceived health status, and province of residence as covariates in a logistic regression model. The model excluded education because many people younger than 20 have not completed their education. Logistic regression models were also used to examine the odds of being vaccinated in Ontario compared with other provinces. These models were

stratified by age group (12 to 49, 50 to 64, and 65 or older) and by chronic condition status, and adjusted for age as a continuous variable, sex, household income, smoking status, having a regular doctor, and self-perceived health status.

All estimates were calculated using bootstrap survey weights to accurately reflect the demographics of the Canadian population and to account for the survey sampling design of the NPHS and CCHS. Variance estimates were calculated using bootstrap survey weights.²² All tests were two-sided, and a significance level of $p < 0.05$ was used. As a result of the large sample sizes, small changes were statistically significant. Consequently, only changes in vaccination rates greater than 5 percentage points were considered meaningful. All statistics were computed using SAS statistical software (version 9.1, SAS Institute Inc., Cary, NC).

Results

Trends in influenza vaccination rates

At the national level, influenza vaccination rates approximately doubled between 1996/1997 and 2000/2001; were essentially unchanged between 2000/2001 and 2003; and increased further between 2003 and 2005 (Table 1). This pattern was consistent between sexes and across age groups except 50- to 64-year-olds, among whom vaccination rates rose during all three intervals. For people reporting chronic conditions, only those suffering the effects of stroke did not have an increase in vaccine uptake between 2003 and 2005. Vaccination rates increased over time in all provinces and territories, with most mirroring the national trend. Ontario had the highest rates at each of the four survey dates (rising from 18% to 42%), while Newfoundland and Labrador generally had the lowest (a rise from 11% to 22%).

Vaccination rates rose among both high- and low-risk groups nationally and in all provinces and territories, except for seniors in Newfoundland and Labrador, Prince Edward Island, Yukon and Nunavut, and younger people with chronic conditions in the territories (Table 2).

Table 1
Percentage vaccinated for influenza, by selected characteristics, household population aged 12 or older, Canada, 1996/1997, 2000/2001, 2003 and 2005

	1996/ 1997	2000/ 2001	2003	2005
Overall (excluding territories)	15	27*	28	34*
Sex				
Males	13	24*	25*	31*
Females	16	30*	30	36*
Age group				
12 to 49	7	18*	17	23*
12 to 19	9	17*	17	23*
20 to 49	7	18*	17*	23*
50 to 64	17	30*	35*	42*
65 or older	51	67*	67	71*
65 to 74	47	63*	63	66*
75 to 84	60	74*	73	77*
85 or older	51	72*	73	78*
Chronic conditions				
One or more	31	45*	47*	53*
Heart disease	50	59*	62	68*
Effects of stroke	46	67*	63	61
Diabetes	38	58*	59	64*
Cancer	45	51	57*	64*
Asthma	22	36*	38	43*
Emphysema or chronic bronchitis	33	51*	50	57*
No conditions	12	23*	23	29*
Province or territory				
Newfoundland and Labrador	11	11	16*	22*
Prince Edward Island	16	21*	23	31*
Nova Scotia	19	23*	31*	39*
New Brunswick	15	19*	22*	28*
Quebec	8	18*	20*	25*
Ontario	18	36*	35	42*
Manitoba	14	22*	20	28*
Saskatchewan	13	19*	24*	28*
Alberta	15	23*	23	28*
British Columbia	17	26*	27	33*
Yukon	..	26	21	32*
Northwest Territories	..	25	24	37*
Nunavut	..	24	25	41*

* significantly different from estimate from previous survey ($p < 0.05$)

.. not available

Note: All chi-squared tests for trend were significant ($p < 0.05$).

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Progress toward targets

In 2005, vaccination rates among the elderly compared favourably with the 70% target set for seniors and people with chronic conditions in 1993. However, the new 80% target set in 2005 was reached only by those 75 or older with chronic conditions (Chart 1). Vaccination rates among people younger than 65 with chronic conditions fell far short of both targets.

Predictors of vaccination

In 2005, characteristics that were associated with an increased likelihood of getting a flu shot included female sex, advancing age, presence of a chronic condition, increasing household income, having a regular doctor, and self-reported poor/fair health; being a current smoker was associated with decreased odds of vaccination (Table 3). Residing in any province other than Ontario was associated with lower odds of being vaccinated, compared with Ontario; people in Newfoundland and Labrador were the least likely to report vaccination. Residents of Nunavut had over twice the odds of Ontarians of having received a flu shot, and the odds for those from the Northwest Territories were also significantly higher. Although everyone aged 18 or older in Yukon was covered by an influenza vaccination program, residents of this territory were less likely to be vaccinated than were people in Ontario.

Reasons for not getting vaccinated

Among seniors (65 or older) who reported not having had a flu shot in the previous year, the proportion who felt that it was not necessary has decreased over time, and the percentage citing “other” reasons for not getting vaccinated has risen (Table 4). The percentage reporting not being vaccinated because of a previous bad reaction has grown slightly since the mid-1990s, as might be expected with the increasing numbers getting vaccinated. Yet despite consistently higher vaccination rates in Ontario throughout the period, the proportion of Ontarians reporting a previous bad reaction did not differ from that in the other provinces (data not shown).

Effect of universal vaccination in Ontario

Among all age groups, with and without chronic conditions, vaccination rates in Ontario were higher than in other provinces at all four survey dates (Chart 2). For those aged 12 to 49, the gap between Ontario and other provinces that appeared in 2000/2001 was reduced slightly among those with chronic conditions, but not among those without. A similar pattern was evident for 50- to 64-year-olds. For

Table 2

Percentage vaccinated for influenza, by age, presence of chronic conditions and province or territory, household population aged 12 or older, Canada, 1996/1997, 2000/2001, 2003 and 2005

	Low-risk group					High-risk groups									
	Aged 12 to 64 with no chronic conditions [†]					Aged 12 to 64 with at least one chronic condition [†]					Aged 65 or older				
	1996/ 1997	2000/ 2001	2003	2005	p-value [†]	1996/ 1997	2000/ 2001	2003	2005	p-value [†]	1996/ 1997	2000/ 2001	2003	2005	p-value [†]
Canada (excluding territories)	7	18*	19	25*	<0.001	20	33*	36*	42*	<0.001	51	67*	67	71*	<0.001
Province or territory															
Newfoundland and Labrador	5	4 ^E	8*	14*	<0.001	20 ^E	14 ^E	26*	28	0.001	47	49	50	58*	0.06
Prince Edward Island	7 ^E	10	15*	21*	<0.001	22 ^E	31	25	38*	<0.001	56	65	63	70	0.09
Nova Scotia	8	13*	19*	27*	<0.001	34 ^E	29	43*	52*	<0.001	60	71*	74	77	<0.001
New Brunswick	8	9 ^E	14*	18*	<0.001	23 ^E	29	28	38*	0.002	48	62*	57	64*	<0.001
Quebec	3 ^E	10*	11	16*	<0.001	10 ^E	20*	29*	32*	<0.001	34	59*	59	62*	<0.001
Ontario	10	27*	26	34*	<0.001	24	46*	44	50*	<0.001	60	72*	74	77*	<0.001
Manitoba	6	12*	10	17*	<0.001	18	29 ^E	26	38*	<0.001	52	62*	60	71*	<0.001
Saskatchewan	4 ^E	9*	13*	19*	<0.001	13 ^E	20 ^E	29*	31	<0.001	53	63*	63	66	<0.001
Alberta	9	16*	17	20*	<0.001	21	26	27	37*	<0.001	59	69*	64	69*	<0.001
British Columbia	9	16*	18	23*	<0.001	23	31	35	41*	<0.001	52	68*	69	72*	<0.001
Yukon	..	21 ^E	18	27*	0.006	..	35 ^E	25	34	0.80	..	66 ^E	50	73*	0.15
Northwest Territories	..	20	19	33*	<0.001	..	38 ^E	36	47	0.14	..	56 ^E	64	78	0.03
Nunavut	..	21	22	39*	<0.001	..	46	34 ^E	46 ^E	0.17	..	53	74*	89	0.11

[†] chi-squared test for trend

[‡] heart disease, effects of stroke, diabetes, cancer, asthma, emphysema/chronic bronchitis

* significantly different from estimate from previous survey ($p < 0.05$)

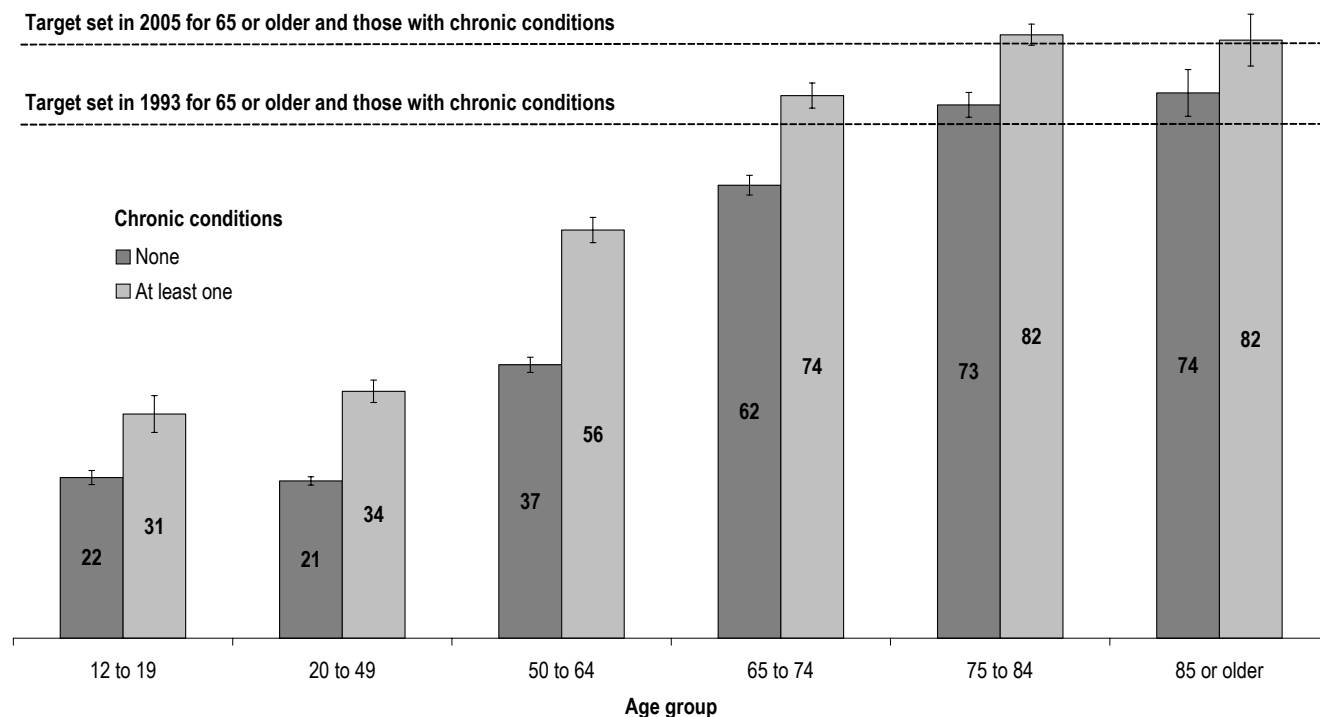
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^E use with caution (coefficient of variation 16.6% to 33.3%)

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Chart 1

Percentage vaccinated for influenza, by age group and presence of chronic conditions, household population aged 12 or older, Canada, 2005



┆ = 95% confidence interval

Source: 2005 Canadian Community Health Survey, cycle 3.1.

Table 3
Rates of and adjusted odds ratios for influenza vaccination, by selected characteristics, household population aged 12 or older, Canada, 2005

	Vaccination rate	Adjusted odds ratio	95% confidence interval
Total	34
Sex			
Males [†]	31	1.00	...
Females	36*	1.22*	1.17 to 1.28
Age group			
12 to 19 [†]	23	1.00	...
20 to 49	23	1.10*	1.03 to 1.19
50 to 64	42*	2.40*	2.21 to 2.60
65 to 74	66*	6.55*	5.98 to 7.18
75 to 84	77*	10.57*	9.55 to 11.69
85 or older	78*	10.27*	8.57 to 12.31
At least one chronic condition[‡]			
No [†]	29	1.00	...
Yes	53*	1.89*	1.79 to 1.99
Household income			
Lowest [†]	34	1.00	...
Lower-middle	37*	1.05	0.96 to 1.14
Upper-middle	33	1.13*	1.04 to 1.23
Highest	33	1.28*	1.18 to 1.39
Smoking status			
Never [†]	33	1.00	...
Former	39*	1.03	0.98 to 1.09
Daily or occasional	25*	0.74*	0.70 to 0.79
Has regular doctor			
No [†]	15	1.00	...
Yes	37*	2.01*	1.86 to 2.16
Self-reported health			
Good or very good or excellent	32	1.00	...
Poor or fair	50*	1.23*	1.14 to 1.32
Province or territory			
Ontario [†]	42	1.00	...
Newfoundland and Labrador	22*	0.33*	0.29 to 0.37
Prince Edward Island	31*	0.54*	0.46 to 0.63
Nova Scotia	39*	0.77*	0.70 to 0.86
New Brunswick	28*	0.45*	0.40 to 0.49
Quebec	25*	0.42*	0.40 to 0.45
Manitoba	28*	0.47*	0.43 to 0.52
Saskatchewan	28*	0.46*	0.42 to 0.50
Alberta	28*	0.52*	0.48 to 0.57
British Columbia	33*	0.61*	0.57 to 0.65
Yukon	32*	0.72*	0.57 to 0.90
Northwest Territories	37*	1.36*	1.09 to 1.70
Nunavut	41	2.20*	1.65 to 2.93

[†] reference category

[‡] heart disease, effects of stroke, diabetes, cancer, asthma, emphysema or chronic bronchitis

* significantly different from reference category (p < 0.05)

... not applicable

Source: 2005 Canadian Community Health Survey, cycle 3.1.

Table 4
Reasons for not having influenza vaccination, household population aged 65 or older, Canada excluding territories, 1996/1997, 2000/2001, 2003 and 2005

	1996/1997	2000/2001	2003	2005	p-value [†]
Seniors not vaccinated ('000)	1,567	1,146	1,150	1,071	...
Reason (%)					
Unnecessary	71	63*	66	61*	<0.001
Previous bad reaction	9	9	12*	13	0.01
Did not get around to it	12	13	11	9*	<0.001
Fear	3	3 ^E	6*	5	0.49
Doctor said unnecessary	6	5	6	3*	<0.001
Not available	2 ^E	F	1	1	<0.001
Other	1 ^E	7*	1*	16*	<0.001

[†] chi-squared test for trend

* significantly different from estimate from previous survey (p < 0.05)

^E use with caution (coefficient of variation 16.6% to 33.3%)

^F too unreliable to be published (coefficient of variation greater than 33.3%)

... not applicable

Note: Because more than one answer was accepted, totals add to more than 100%.

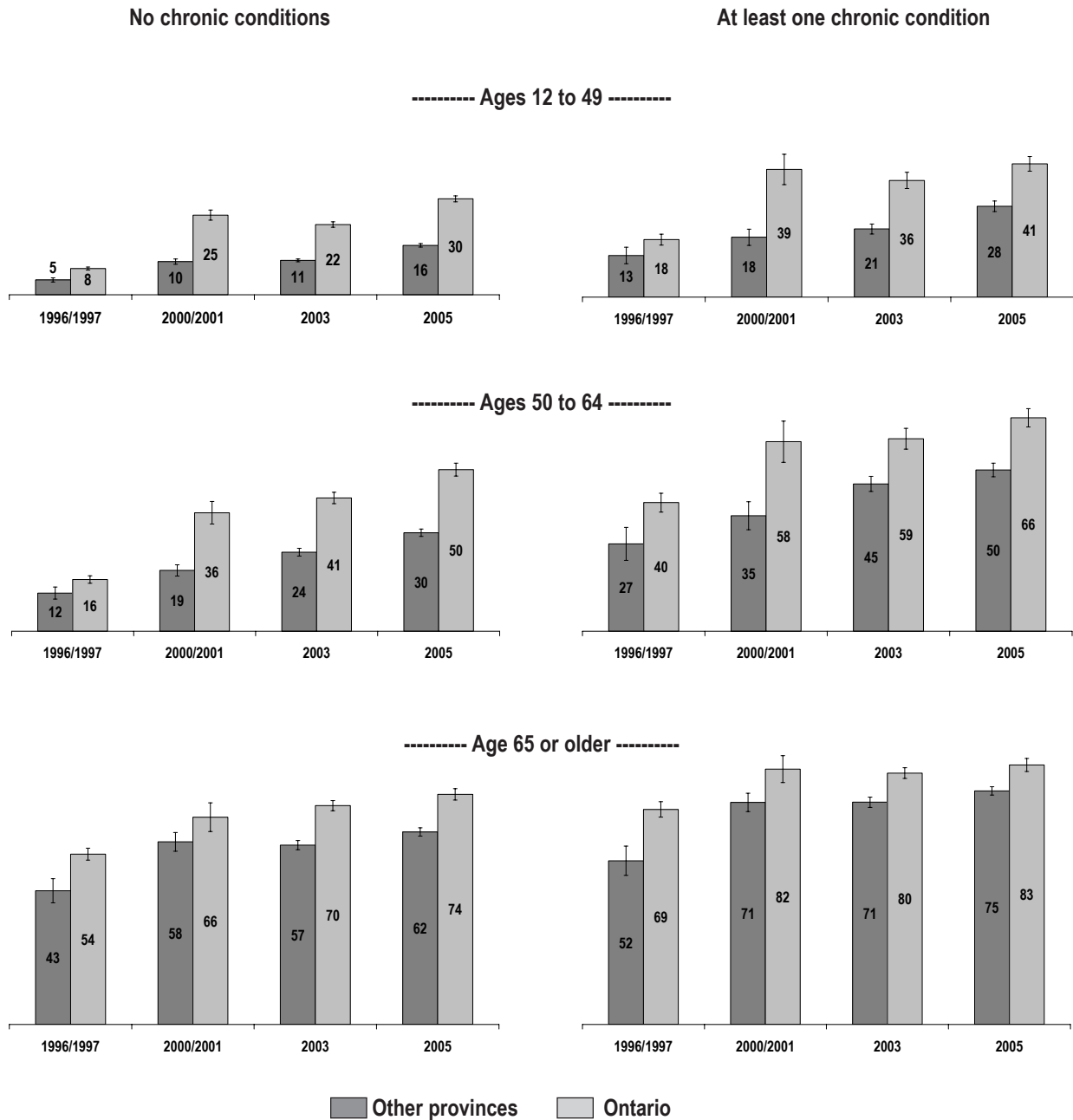
Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

older adults, the difference between Ontario and other provinces has narrowed slightly over time.

In the adjusted analyses, the odds of vaccination were almost always significantly greater for Ontarians, compared with residents of the other provinces (Chart 3). Among people aged 12 to 49 with chronic conditions, the OR increased from 1.21 (95% confidence interval [C.I.] 0.91-1.62) in 1996/1997 to 2.74 (95% C.I. 2.06-3.65) in 2000/2001, but then declined to 1.67 (95% C.I. 1.45-1.91) by 2005, suggesting some “catch-up” by other provinces. A similar pattern was observed for those aged 12 to 49 and 50 to 64 without chronic conditions. The differences between the surveys for 50- to 64-year-olds with chronic conditions were not statistically significant, likely because of the smaller sample size. As expected, relatively few differences over time were noted for those aged 65 or older, since seniors have traditionally been included in most targeted vaccination programs.

Chart 2

Percentage vaccinated for influenza, by age group and presence of chronic conditions, household population aged 12 or older, Ontario versus other provinces combined, 1996/1997, 2000/2001, 2003 and 2005

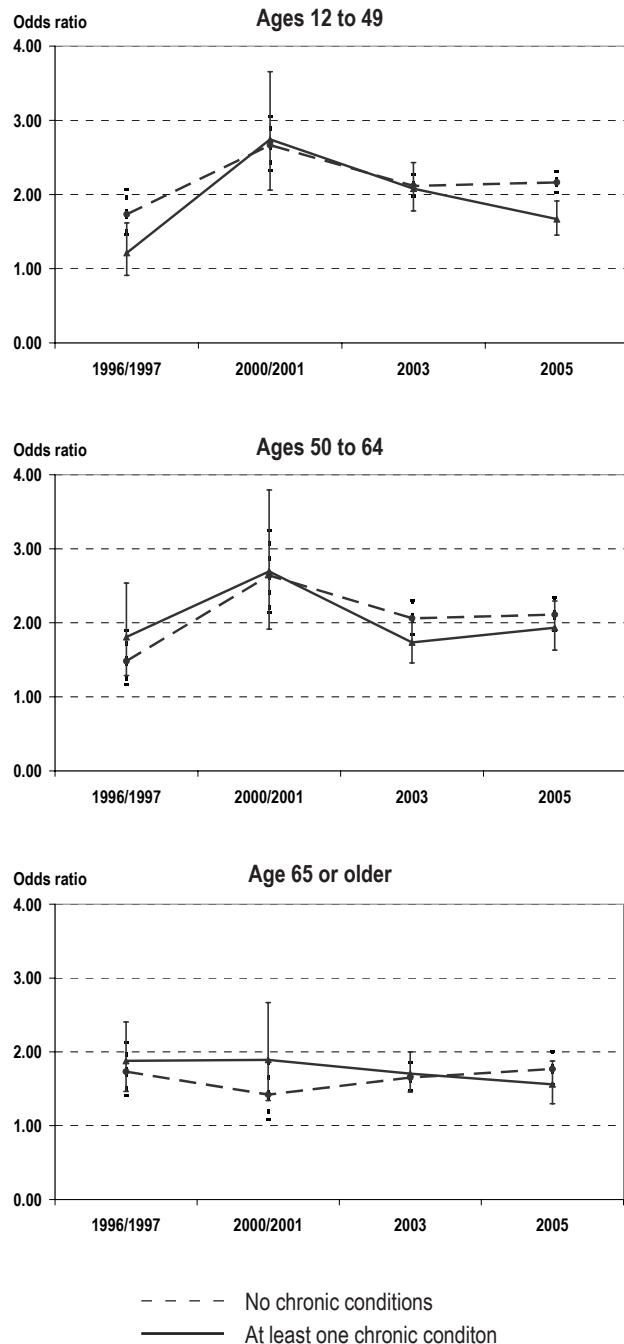


I = 95% confidence interval

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Chart 3

Adjusted odds ratios for influenza vaccination, by age group and presence of chronic conditions, household population aged 12 or older, Ontario versus other provinces combined, 1996/1997, 2000/2001, 2003 and 2005



□ = 95% confidence interval

Note: Adjusted for sex, age group, presence of chronic conditions, household income, smoking status, having regular doctor, self-reported health, and province or territory.

Sources: 1996/1997 National Population Health Survey; 2000/2001 Canadian Community Health Survey, cycle 1.1 (fourth quarter); 2003 Canadian Community Health Survey, cycle 2.1; 2005 Canadian Community Health Survey, cycle 3.1.

Discussion

As of 2005, influenza vaccination rates were increasing across Canada after an apparent levelling off in 2003. Even so, many who are considered to be at high risk for serious complications from influenza infection, specifically younger people with chronic conditions and healthy seniors, are not being vaccinated. Consequently, the vaccination rates for these high-risk groups fall short of national targets. Ontarians are still more likely to be vaccinated than are residents of any other province, likely reflecting Ontario's universal vaccination program. Nunavut achieved the highest vaccination rates among the elderly, as well as among young, healthy individuals, even before introduction of their universal vaccination program.

The explanation for the "rise-plateau-rise" pattern is a matter of speculation, since the surveys did not ask respondents why they got vaccinated. The past decade, however, has seen a number of outbreaks of novel viral respiratory diseases around the world. First detected in Hong Kong in 1997, H5N1 avian influenza has caused several outbreaks and is associated with high mortality rates among poultry, humans and other species.²³ Other avian influenza viruses such as H7N7 (the Netherlands, February 2003)²⁴ and H7N3 (British Columbia, February 2004)²⁵ have also caused disease in humans. Because almost forty years have elapsed since the last influenza pandemic in 1968, leading to consensus among experts that the world is overdue for a pandemic, and given the global increase in avian influenza activity, public health officials have stepped up pandemic planning, an important component of which is educating the public about the importance of potentially mitigating activities such as annual vaccination against seasonal human influenza.²⁶ In addition to these growing concerns about pandemic influenza, the spring 2003 epidemic of Severe Acute Respiratory Syndrome (SARS) coronavirus, which was associated with 438 cases and 44 deaths in Canada,²⁷ heightened media attention on infectious diseases. Collectively, these outbreaks may have influenced flu vaccination rates between 2003 and 2005.

The impact of Ontario's UIIP has apparently been sustained over time, with the province persistently having higher vaccination rates. Immediately after introduction of the program, the adjusted relative effect on vaccination of being in Ontario rather than the other provinces spiked for younger age groups. A subsequent slight drop-off reflected rising rates in other provinces rather than declines in vaccine uptake among Ontarians. By contrast, the trend was flat among the elderly, who were previously covered in most provinces. This further bolsters the arguments that the increases observed among younger people may be attributed to the UIIP, and that universal or age-based recommendations may be more effective than selective targeting of people with chronic conditions if the goal is to maximize vaccination rates in the entire population.

Nonetheless, vaccination rates are not solely determined by the type of program employed. Although Yukon has offered free flu shots to everyone aged 18 or older since 1999, its vaccination rates are generally the lowest among the territories. And, even without a universal program, Nova Scotia has matched Ontario's vaccination rates among high-risk groups.

This study has a number of limitations. The NPHS and CCHS exclude some important populations who are at very high risk of complications from influenza infections, notably, children younger than 12 and the institutionalized elderly. Also, these surveys do not ask about all the chronic conditions for which influenza vaccination is recommended, such as immunodeficiency, renal disease, anemia and hemoglobinopathy; therefore, the group identified in this study as having one or more chronic conditions is actually a subset of those with important chronic conditions.²⁸ Another limitation is that it is not possible to confirm the accuracy of survey participants' responses, although previous studies have demonstrated that self-reported influenza immunization status is reasonably accurate.²⁹⁻³¹ The NPHS and the CCHS differed slightly in terms of timing of survey administration

and data collection, both of which may have affected participant recall. Unfortunately, annual data are not available, so it is not possible to examine changes in risk factors and vaccination rates between surveys. Inferences about trends over time are limited because of the cross-sectional nature of the data. Associations between predictors of vaccination status and respondent characteristics in 2005 are also cross-sectional, thus limiting the ability to make inferences about temporal associations between individual characteristics and vaccination status. Finally, provincial health system variables, such as vaccine delivery methods (for example, school-, workplace-, and community-based clinics) and policy incentives (for example, remuneration of vaccine providers), were not available for this analysis, although they might have helped to explain the strong provincial effect in vaccination rates.

Despite these limitations, it is safe to conclude that influenza vaccination rates across Canada have more than doubled between 1996/1997 and 2005. However, targets for important risk groups, especially those younger than 65 with chronic conditions, are still not being met in any province or territory. Therefore, additional strategies and/or efforts will likely be needed to achieve further increases in vaccine uptake. The many available interventions to increase influenza vaccination coverage rates by targeting clients, providers, and/or systems have been previously and extensively reviewed.³²⁻³⁴ As well, it has been suggested that the development of immunization registries would facilitate monitoring trends in vaccine uptake and informing policymaking for vaccine programs at the population level.^{35,36} ●

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Appendix

Table A
Distribution of selected characteristics, household population aged 12 or older, 2005

	Sample size	Estimated population	
		'000	%
Total	132,947	27,132	100.0
Males	60,910	13,372	49.3
Females	72,037	13,760	50.7
Age group			
12 to 49	74,359	17,397	64.1
12 to 19	16,397	3,354	12.4
20 to 49	57,962	14,043	51.8
50 to 64	30,391	5,807	21.4
65 or older	28,197	3,928	14.5
65 to 74	15,032	2,245	8.3
75 to 84	10,332	1,356	5.0
85 or older	2,833	327	1.2
Education			
Less than secondary graduation	37,391	6,282	23.9
Secondary graduation	19,315	3,998	15.2
At least some postsecondary	72,839	16,054	61.0
Household income			
Lowest	12,812	1,752	7.6
Lower-middle	24,175	4,057	17.7
Upper-middle	39,205	7,748	33.8
Highest	37,356	9,392	40.9
Smoking status			
Never	48,349	10,683	39.6
Former	53,043	10,424	38.6
Daily or occasional	30,957	5,875	21.8
Has regular doctor			
Yes	112,732	23,232	85.7
No	20,042	3,868	14.3
Self-reported health			
Poor or fair	18,344	3,028	11.2
Good or very good or excellent	114,438	24,077	88.8
Chronic conditions			
One or more	29,883	5,174	19.1
Heart disease	8,561	1,288	4.8
Effects of stroke	2,003	299	1.1
Diabetes	8,200	1,325	4.9
Cancer	2,293	371	1.4
Asthma	11,766	2,250	8.3
Emphysema or chronic bronchitis	5,752	908	3.4
No conditions	102,688	21,886	80.9
Province or territory			
Newfoundland and Labrador	4,111	449	1.7
Prince Edward Island	2,031	117	0.4
Nova Scotia	5,066	796	2.9
New Brunswick	5,100	638	2.4
Quebec	29,891	6,473	23.9
Ontario	41,766	10,570	39.0
Manitoba	7,352	935	3.4
Saskatchewan	7,765	788	2.9
Alberta	11,800	2,686	9.9
British Columbia	15,407	3,602	13.3
Yukon	868	27	0.1
Northwest Territories	1,007	35	0.1
Nunavut	783	15	0.1
Had flu shot in past year			
Yes	47,333	8,881	33.8
No	82,126	17,430	64.2

Source: 2005 Canadian Community Health Survey, cycle 3.1.

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Birth outcomes by neighbourhood income and recent immigration in Toronto

Marcelo L. Urquia, John W. Frank, Richard H. Glazier, Rahim Moineddin

Abstract

Objectives

This article examines differences in birth outcomes by neighbourhood income and recent immigration for singleton live births in Toronto, Ontario.

Data sources

The birth data were extracted from hospital discharge abstracts compiled by the Canadian Institute for Health Information.

Analytical techniques

A population-based cross-sectional study of 143,030 singleton live births to mothers residing in Toronto, Ontario from 1 April 1996 through 31 March 2001 was conducted. Neighbourhood income quintiles of births were constructed after ranking census tracts according to the proportion of their population below Statistics Canada's low-income cutoffs. Logistic regression was used to estimate odds ratios for the effects of neighbourhood income quintile and recent immigration on preterm birth, low birthweight and full-term low birthweight, adjusted for infant sex and maternal age.

Main results

Low neighbourhood income was associated with a moderately higher risk of preterm birth, low birthweight, and full-term low birthweight. The neighbourhood income gradient was less pronounced among recent immigrants compared with longer-term residents. Recent immigration was associated with a lower risk of preterm birth, but a higher risk of low birthweight and full-term low birthweight.

Keywords

preterm, low birthweight, socioeconomic factors, immigration

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Despite improvements over time in indicators such as infant mortality and low birthweight, adverse birth outcomes continue to be a concern in industrialized countries. This is especially true for preterm birth, which is the single most important cause of perinatal mortality and is associated with infant morbidity and other long-term health consequences.¹⁻³

Socio-economic disparities in birth outcomes are one of the most persistent findings in perinatal research. Evidence of an association between several measures of low socio-economic status and adverse birth outcomes exists across and within countries,^{4,5} even in those with universal access to health care such as Canada.⁶⁻⁸ Measures reflecting economic deprivation have generally (though not always) detected stronger associations than have other markers of socio-economic status.^{9,10}

Unlike socio-economic disadvantage, recent immigration is a dimension of potential health disparities that is poorly understood. One debated phenomenon is the “healthy migrant effect,”¹¹ according to which first-generation immigrants are often healthier than native-born residents, despite lower standards of living on arrival. Only a few Canadian studies have assessed the relationship between immigration and perinatal outcomes. One study¹² found lower perinatal mortality among the offspring of Chinese compared with White women. Another study¹³ did not find significant differences in low birthweight between foreign-born and Canadian-born mothers, and a third suggested that the risk of low birthweight among immigrant women increased as they became more acculturated to Canadian society.¹⁴ From an equity perspective, it is important to know how outcomes for recent immigrants compare with those of longer-term residents, particularly in areas that receive a large influx of immigrants each year, such as Toronto.

In 2001, the newly amalgamated city of Toronto had a population of 2.48 million, and the larger Toronto Census Metropolitan Area (CMA) was the destination of around half of all immigrants to Canada that year (roughly 125,000). In 2001, immigrants made up about 40% of the population of the Toronto CMA. The objective of this study is to examine differences in non-fatal birth outcomes in Toronto by recent immigration and neighbourhood income.

Methods

Data sources

Although vital statistics data are considered the gold standard for studying perinatal outcomes in Canada, several data quality concerns have led to separate reporting of Ontario in recent national statistics on birth outcomes.¹⁵ Ontario’s vital statistics data consist of records that compile information from two forms, one completed by the parents, and the second by the attending health practitioner. Both forms must be submitted for a birth to be included in the vital statistics. In 1996, Ontario municipalities were allowed to introduce an administrative fee for birth registrations, which at that time ranged from

\$10 to \$27.50. This had the effect of discouraging some parents from submitting their birth registration documents.¹⁶ Selective under-reporting was detected as early as 1997 (around 4%, with wide variability across municipalities) for those at higher risk for low birthweight, and for births to mothers younger than 25. As well, in Ontario vital statistics data for 1994 to 1997, approximately 4% of records had incomplete or invalid postal codes, and so could not be used to assign neighbourhood income. Other data quality concerns with Ontario vital statistics include the measurement of gestational age, and missing links of live births to corresponding infant deaths.¹⁵

As an alternative to vital statistics, this study uses hospitalization records from the Discharge Abstract Database of the Canadian Institute for Health Information to identify a population of liveborn singleton births in Toronto for whom information on various non-fatal birth outcomes and on certain infant, birth and maternal characteristics was available. Hospital discharge abstracts cover almost 99% of all live births in Ontario, excluding only home births. The use of hospital discharge abstracts for perinatal research has been evaluated by Wen and colleagues,¹⁷ proving to have excellent coverage and to provide plausible rates for Ontario. The information used in this analysis was obtained subsequent to a comprehensive research agreement between the Institute for Clinical Evaluative Sciences (ICES) and the Ontario Ministry of Health and Long-Term Care.

Until fiscal year 2002/2003, the discharge database maintained separate and unrelated records for the mother and newborn. In order to allow analyses combining newborn and maternal characteristics before that date, an algorithm was developed to link the records of each mother and newborn. Newborns were selected if their admission date coincided with the birth date and the “institution from” number was missing (an indication that the patient had not been transferred from another institution). Potential mothers were selected mainly through case-mix group (CMG) codes.¹⁷ A small number (N=589) of obstetric deliveries missed by the CMG codes were captured by additional criteria such as “main patient service

code 51” and the 16 diagnostic and 10 procedure fields. The linkage of mothers and newborns was based on a combination of institution number, postal codes in the discharge abstract and the provincial health insurance registry (Registered Persons Database), municipal residence codes, and admission and discharge dates from both the mother and the newborn records. This probabilistic linkage resulted in 95% of all newborn records in the Discharge Abstract Database having a valid match to a mother.

Records for all 154,458 infants *live-born* to women residing within the 2001 boundaries of the city of Toronto (including the formerly separate boroughs of Etobicoke, York, East York, North York, and Scarborough) in the five fiscal years from 1996/1997 through 2000/2001 (including births from 1 April, 1996 through 31 March, 2001) were extracted from hospital discharge abstracts. After exclusion of newborns weighing less than 500 grams (N=125) or more than 6,000 grams (N=28) or with missing information on birthweight (N=13), births missing links to mothers (N=6,241), records with missing information on key maternal characteristics such as place of residence (N=692) and new registration with the provincial health insurance program (N=26) and records to which census neighbourhood income information could not be assigned (N=286), records for 147,047 infants remained (95.2% of the original records). After further exclusion of multiple live births (N=4,017 twins, triplets and higher order births), 143,030 newborn-mother pairs remained (44,977 recent registrants and 98,053 longer-term residents). This population was distributed across 474 census tracts. Small-area data from the closest census years (1996 or 2001) were used to determine neighbourhood income, defined as the proportion of the population in the census tract with family income below Statistics Canada’s low-income cutoff (which is specific to family size). The date of first registration for health insurance coverage in Ontario was obtained from the Registered Persons Database.

The study was approved by Research Ethics Boards at the University of Toronto, St. Michael’s Hospital, and Sunnybrook Health Sciences Centre, all in Toronto.

Analytical techniques

A cross-sectional design aggregating the five fiscal years 1996/1997 through 2000/2001 was used to assess associations of neighbourhood income and recent immigration with preterm birth, low birthweight and full-term low birthweight. These outcomes were modeled by means of multiple logistic regression. When the variability in the outcome across clusters is higher than that assumed by the binomial probability model, the data are said to be overdispersed, and the model may underestimate the true variance. Therefore, standard errors were adjusted for such overdispersion in the data.^{18,19} As the assumption of the independence of observations may not hold true in clustered data with a contextual exposure variable, generalized estimating equation methods were used to account for any correlation between observations within the census tracts.^{19,20} However, because the results of those analyses were virtually identical, the ordinary estimates are reported. To evaluate whether the neighbourhood income gradient in non-fatal birth outcomes differed by recent immigration status, an interaction term was included in the adjusted models. Stratified analyses by recent immigration status are thus reported. All analyses were carried out using SAS Version 9.1 for UNIX (SAS Institute, Cary, NC) at the Institute for Clinical Evaluative Sciences in Toronto.

Definitions

Outcomes

Gestational age in completed weeks was not recorded on hospital discharge abstracts in Ontario during the study period. Therefore, morbidity codes assigned according to the Ninth Revision of the International Classification of Diseases²¹ were used to approximate the missing gestational age categories of interest: very premature birth (ICD-9 765.0: “*Extreme immaturity*. Usually implies a birthweight of less than 1,000 grams and/or a gestational age of less than 28 completed weeks.”); moderately premature birth (ICD-9 765.1: “*Other preterm infants*. Prematurity or small size, not classifiable to 765.0 or as ‘light-for-dates’ in 764.– : Usually implies a

birthweight of 1,000 to 2,499 grams and/or a gestation of 28 to 37 completed weeks”); post-term birth (ICD-9 766.2: “Post-term infant, not ‘heavy-for-date’ with gestation period of 42 or more completed weeks”); and full-term birth (residual category not classified above, so approximately 38 weeks to 41 weeks completed gestation).

Preterm births were defined by the ICD-9 codes 765.0 or 765.1.

Low birthweight was defined as less than 2,500 grams. Infants whose reported birthweight was less than 500 grams or more than 6,000 grams were excluded from the analyses.²¹

Full-term low birthweight was defined as births of low birthweight who were not premature, as a proxy for intrauterine growth retardation when there is no gestational age in weeks available to construct small-for-gestational-age based on percentiles.²²

Neighbourhood income and recent immigration

Using postal code conversion software (PCCF+ Versions 3G and 4D),^{23,24} postal codes of the mother’s place of residence at the time of delivery were assigned to the corresponding census tract from the closest census years (1996 census for births in 1996/1997 and 1997/1998; 2001 census for births that occurred from 1998/1999 through 2000/2001). Census tracts are relatively stable urban neighbourhoods, with a population typically from 2,500 to 8,000. The percentage of the population living in private households with family income below Statistics Canada’s low-income cutoff was used to rank and group²⁵ census tracts into approximate quintiles of births. Based on the mother’s place of residence at the time of the birth, the neighbourhood income quintile of the census tract was assigned to each birth record. For ratio measures of effect, the highest income quintile was used as the reference category.

When newcomers to Ontario are approved for coverage, their client registration and identification information is entered into the provincial health insurance registry. For this study, first-time registration with the provincial health insurance program within 5 years of the birth was used as a proxy for recent immigration (yes/no).

Birth, infant and maternal characteristics

Relevant birth, infant and maternal characteristics reported in the hospital discharge data included infant sex (male, female), maternal age (less than 20, 20 to 34, 35 or older), mode of delivery (cesarean section or not), and maternal morbidity assessed by ICD-9 codes for any of 14 conditions (yes/no):²¹ diabetes mellitus, abnormal glucose tolerance, epilepsy, maternal asthma, pre-existing hypertension, anemia, thyroid dysfunction, renal and liver disorders, genitourinary tract infection, incompetent cervix, preeclampsia, eclampsia, placenta previa, and abruptio placenta.

Results

Socio-economic disadvantage

In both 1996 and 2001, there was a clear gradient across Toronto neighbourhood income quintiles in the percentage of the population with family income below Statistics Canada’s low-income cutoff (Table 1). Although the proportion of the population below the cutoff decreased from 1996 to 2001 overall and for each quintile, the ratio of the lowest to the the highest quintiles increased slightly.

Each of the adverse birth outcomes examined in this analysis—preterm birth, low birthweight and full-term low birthweight—was more common as the percentage of the population below the low-income cutoff in the neighbourhood increased (Table 2). Compared with mothers in the highest

Table 1
Percentage of population with family income below Statistics Canada low-income cutoff, by neighbourhood income quintile, Toronto, 1996 and 2001

	Below low-income cutoff	
	1996	2001
	%	%
All quintiles	27.6	16.6
Q1 (highest)	11.9	9.4
Q2	21.3	17.2
Q3	29.2	24.3
Q4	35.7	28.8
Q5 (lowest)	47.9	41.8
Ratio (Q5/Q1)	4.0	4.4

Source: 1996 and 2001 Census of Population.

neighbourhood income quintile, those from the lowest quintile were more likely to be younger than 20, to have had at least one illness during pregnancy, and to have given birth to a very preterm infant. Older mothers were more heavily concentrated in the highest compared with the lowest income quintile. Mothers in the lowest income quintile were 2.5 times more likely to be recent immigrants than were mothers in the highest income quintile. For cesarean section, significant differences across income quintiles reflect a high power to detect small differences because of the large sample size, rather than substantial differences across the quintiles.

Even when adjustments were made for infant sex, maternal age group and recent immigration (plus gestational age group in the low birthweight model), all adverse birth outcomes remained more common among women in the lowest neighbourhood income quintile (Table 3). While these adjustments somewhat reduced the effect sizes for low birthweight and full-term low birthweight, the effect

size became stronger for preterm birth. All the odds ratios remained statistically significant after adjustment. Compared with women in the highest neighbourhood income quintile, those in the lowest had 25% higher odds of preterm birth, 46% higher odds of low birthweight, and 53% higher odds of full-term low birthweight.

Recent immigration

Singleton infants liveborn to recent immigrant mothers accounted for 31.5% of all births in the study population. Births to recent immigrants were less likely than those to longer-term residents to be preterm, but they were more likely to be low birthweight and full-term low birthweight (Table 2). Recent immigrant mothers were more likely to live in lower-income neighbourhoods, and less likely to be younger than age 20, or aged 35 or older. Longer-term residents were more likely than recent immigrant mothers to have had at least one illness during pregnancy and to have delivered by cesarean section.

Table 2
Birth outcomes and infant and maternal characteristics, by neighbourhood income quintile and recent immigrant status, Toronto, 1996/1997 to 2000/2001

	Total	Neighbourhood income quintile					Recent [†] immigration	
		Q1 (highest)	Q2	Q3	Q4	Q5 (lowest)	Yes	No
Singleton live births (number)	143,030	28,512	28,367	28,789	28,698	28,664	44,977	98,053
Outcomes	%	%	%	%	%	%	%	%
Preterm birth	5.3	4.7	5.3	5.3	5.4	5.6**	4.9	5.4**
Low birthweight	5.0	4.0	4.9	5.1	5.2	5.8**	5.2	4.9*
Full-term low birthweight	1.9	1.4	1.9	1.9	1.9	2.3**	2.2	1.7**
Maternal and infant characteristics								
Recent immigrant	31.5	17.3	27.4	31.9	36.7	43.8**	100.0	0.0
Maternal age								
Less than 20	3.6	1.8	3.4	3.8	4.3	4.7**	2.5	4.1**
20 to 34	74.3	68.2	74.1	74.8	76.5	77.8**	82.9	70.3**
35 or more	22.1	30.0	22.5	21.4	19.2	17.5**	14.5	25.6**
Maternal illness	12.5	11.6	12.3	12.5	12.8	13.5**	11.5	13.0**
Cesarean section	20.2	19.6	20.3	20.3	20.2	20.6*	19.3	20.6**
Gestational age (weeks)								
Less than 28	0.4	0.2	0.4	0.3	0.4	0.5**	0.4	0.4**
28 to 37	4.9	4.5	4.9	5.0	5.0	5.1**	4.5	5.1**
38 to 41	94.2	94.8	94.3	94.2	94.1	93.8	94.6	94.1**
42 or more	0.5	0.4	0.5	0.5	0.5	0.6*	0.6	0.5**
Male infant sex	51.3	51.3	50.8	51.3	50.6	51.5*	51.3	51.3

[†] within 5 years

* p < 0.05

** p < 0.01

Note: Chi-square tests were used for differences in proportions and the Cochran-Armitage test for trend in binomial proportions across the five neighbourhood income quintiles.

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

Table 3

Crude and adjusted odds ratios comparing neighbourhood income quintiles Q2, Q3, Q4 and Q5 with Q1, and recent immigrants with longer-term residents, Toronto, 1996/1997 to 2000/2001

Neighbourhood income quintiles	Preterm birth				Low birthweight				Full-term low birthweight			
	Crude odds ratio	95% confidence interval	Adjusted odds ratio [‡]	95% confidence interval	Crude odds ratio	95% confidence interval	Adjusted odds ratio [§]	95% confidence interval	Crude odds ratio	95% confidence interval	Adjusted odds ratio [§]	95% confidence interval
Q1 (highest) [†]	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...
Q2	1.12*	1.03 to 1.20	1.14*	1.05 to 1.25	1.26*	1.16 to 1.37	1.23*	1.11 to 1.36	1.37*	1.20 to 1.56	1.33*	1.15 to 1.52
Q3	1.12*	1.04 to 1.21	1.16*	1.06 to 1.27	1.29*	1.19 to 1.40	1.28*	1.16 to 1.41	1.36*	1.19 to 1.55	1.30*	1.13 to 1.49
Q4	1.15*	1.06 to 1.23	1.19*	1.09 to 1.30	1.33*	1.23 to 1.44	1.28*	1.16 to 1.41	1.38*	1.21 to 1.57	1.29*	1.12 to 1.49
Q5 (lowest)	1.19*	1.11 to 1.28	1.25*	1.15 to 1.37	1.50*	1.39 to 1.62	1.46*	1.32 to 1.61	1.66*	1.46 to 1.88	1.53*	1.34 to 1.76
Recent immigrant												
No [†]	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...
Yes	0.89*	0.84 to 0.93	0.89*	0.84 to 0.95	1.06*	1.01 to 1.12	1.18*	1.10 to 1.26	1.30*	1.20 to 1.40	1.24*	1.14 to 1.35

[†] reference category

[‡] adjusted for infant sex, maternal age group, neighbourhood income quintile, and recent immigrant status

[§] also adjusted for gestational age group

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

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

Adjustment for infant sex, maternal age group, and neighbourhood income quintile did not modify the association between recent immigration and preterm birth. The adjusted odds of preterm birth for recent immigrants were only 89% those of longer-term residents (Table 3). However, the adjusted odds of low birthweight and of full-term low birthweight were 18% and 24% higher among recent immigrants than among longer-term residents.

Neighbourhood income and recent immigration

A product term between neighbourhood income quintile and recent immigration status was added to the adjusted models to test for interaction. Because the interaction terms were statistically significant ($p < 0.05$) in the adjusted models for all outcomes, stratified analyses of the effects of neighbourhood income on birth outcomes were calculated by recent immigration status (Table 4).

Table 4

Adjusted odds ratios comparing neighbourhood income quintiles Q2, Q3, Q4 and Q5 with Q1, by recent immigration status, Toronto, 1996/1997 to 2000/2001

Neighbourhood income quintiles	Preterm birth [‡]					Low birthweight [§]					Full-term low birthweight [‡]				
	Longer-term residents		Recent immigrants			Longer-term residents		Recent immigrants			Longer-term residents		Recent immigrants		
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval			
Q1 (highest) [†]	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...	1.00	...			
Q2	1.15*	1.05 to 1.26	1.05	0.88 to 1.27	1.32*	1.18 to 1.48	0.98	0.82 to 1.17	1.49*	1.28 to 1.74	0.94	0.72 to 1.22			
Q3	1.19*	1.09 to 1.30	1.01	0.85 to 1.21	1.36*	1.21 to 1.53	1.04	0.88 to 1.23	1.41*	1.21 to 1.65	1.00	0.78 to 1.28			
Q4	1.24*	1.13 to 1.35	1.02	0.85 to 1.21	1.30*	1.16 to 1.47	1.15	0.97 to 1.35	1.37*	1.17 to 1.60	1.05	0.82 to 1.33			
Q5 (lowest)	1.34*	1.22 to 1.46	1.03	0.87 to 1.22	1.48*	1.31 to 1.67	1.30*	1.11 to 1.53	1.66*	1.42 to 1.94	1.21	0.96 to 1.52			
P value ^{††}	0.0221					0.0497					0.0419				

[†] reference category

[‡] adjusted for infant sex and maternal age group

[§] also adjusted for gestational age group

^{††} for the interaction between neighbourhood income quintiles and recent immigrant status

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

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

When infant sex, maternal age group and gestational age group (in the low birthweight model) were taken into account, the adjusted odds ratios comparing the lowest with the highest neighbourhood income quintiles were consistently higher among longer-term residents than among recent immigrants for all birth outcomes. As well, among recent immigrants, the effect of neighbourhood socio-economic disadvantage disappeared for preterm birth and full-term low birthweight.

Discussion

Conclusion

Despite universal access to most physician and hospital services, and consistent with previous studies of urban areas,⁶⁻⁸ socio-economic disparities in adverse birth outcomes existed in Toronto during the 1996/1997 to 2000/2001 period. Recent immigrants appeared to be protected from preterm birth, but at higher risk of low birthweight. However, among recent immigrants, there was a virtual absence of disparities in preterm birth and full-term low birthweight rates across neighbourhood income quintiles. Longer-term residents in low-income neighbourhoods were clearly the subgroup experiencing the highest risk of adverse birth outcomes, probably because of the influence of lasting socio-economic disadvantage.²⁶

Preterm birth and low birthweight have generally been regarded as less-than-favourable outcomes that often occur together. For example, low birthweight can result from being born early (preterm birth), from being born small for gestational age (which is a proxy for intrauterine growth restriction), or from a combination of the two. Yet paradoxically, while births to recent immigrant mothers in Toronto were less likely to be preterm, they were also more likely to be low birthweight and full-term low birthweight. To some extent, this may be because of a “healthy migrant effect” among recent immigrant women that makes them less susceptible to conditions that can cause preterm birth, and because the distribution of causes of low birthweight differs between recent immigrant women and longer-term residents.

The prevalence of maternal illnesses, such as genito-urinary infection, pregnancy-induced hypertension, incompetent cervix and abruption placenta, which are important predictors of preterm birth, was lower among recent immigrants than among longer-term residents. The lower rates of preterm birth among recent immigrants may also be influenced by another example of the “healthy migrant effect”: less exposure to negative health behaviours, notably, cigarette smoking and alcohol consumption, compared with longer-term residents.^{11,27} By the same token, it is very unlikely that low birthweight among recent immigrant mothers could be due to higher smoking and alcohol consumption, although these behaviours would be factors in low birthweight among longer-term residents. A more plausible speculation is that the higher rates of low birthweight may reflect differences in the anthropometry and diet of recent immigrant mothers, given that low weight gain during pregnancy, low body mass index, and short stature are important predictors of intrauterine growth restriction.^{5,28} The Discharge Abstract Database contains no information about recent immigrant mothers’ country of origin, but according to the 2001 census, the top five countries of origin of immigrants to Toronto from 1996 to 2001 were China, India, Pakistan, the Philippines, and Sri Lanka. Women born in southern and eastern Asia tend to be shorter and lighter and to have lower caloric intake than Canadian-born women—factors that contribute to smaller babies, and consequently, to lower birthweight.²⁸

Limitations

These findings should be interpreted with certain limitations in mind. The use of recent registration for provincial health insurance as a proxy for recent immigration has not been validated. Even so, according to census data, 81.2% of the people new to the Toronto CMA between 1996 and 2001 who were not from another part of the province came directly from other countries. As well, many of the remainder (that is, interprovincial migrants) might also be recent immigrants to Canada who came to Ontario via other provinces. However, if a

substantial number of new registrants were not recent immigrants, the measures of effect in this analysis would tend to be biased towards the null.

The lack of information about recent immigrants' country of origin implies that the findings apply only to the recent immigrant population in the study period as a whole, but cannot be extrapolated to specific ethnic groups or nationalities. Further research designed to examine ethnic variations in birth outcomes would be needed for that purpose.

Another limitation was the inability to obtain an individual measure of socio-economic disadvantage. Instead, the analysis relied on a neighbourhood-based measure, which usually,²⁹ but not always,^{7,30,31} produces attenuated (and therefore, conservative) effect estimates. Nonetheless, area-based measures can be conceptualized as meaningful socio-economic indicators in their own right, since they provide information on contextual influences that are not reducible to the individual level (that is, physical and social environment).⁹ However, without data on individual income, it is not possible to separate the effects of individual and neighbourhood-level income on birth outcomes.

The use of ICD codes to approximate preterm birth and full-term low birthweight may have introduced some measurement error, since the categories are not completely specific to gestational age. Even so, it is unlikely that this produced serious bias in the estimates, since a fifth digit is reserved in the ICD-9 to indicate birthweight categories, and a broad overlap in the distribution of birthweight between gestational age groups in this analysis (not shown) suggests that this categorization was driven primarily by gestational age cutoffs. Imperfect measurement of gestational age also somewhat undermined the efficiency of adjustment for this factor, thus leading to some degree of residual confounding. However, control for gestational age was applied only for the low birthweight model.

Analyses aimed at assessing potential bias due to characteristics of the majority of the excluded births (data not shown) showed that these births were at high risk for the adverse birth outcomes studied, and that the distribution of the excluded births was shifted towards the lower income quintiles. The

consequence is that the true effect of neighbourhood income would likely have been somewhat greater had this bias not been present. Yet even with these limitations, the effect sizes were within the range of previously reported in Canada.^{6-8,10}

Other limitations included a lack of information on maternal marital status, living arrangements, place of birth, occupation, household income, education, smoking, and Aboriginal identity, as well as a complete lack of information on paternal characteristics. Some of those variables would have been available from vital statistics birth registrations. Also, current place of residence recorded on hospital discharge abstracts may differ from usual place of residence recorded on vital statistics birth registrations. Finally, because live births in this study were not linked to infant deaths, no information was available on fatal outcomes (except for deaths occurring during the initial hospitalization).

Implications

One of the main challenges in perinatal health continues to be the reduction of preterm birth. Further research on maternal and general health status differences between recent immigrants and longer-term residents may inform interventions that could help to reduce preterm birth and socio-economic inequalities in preterm birth.

Lower neighbourhood income was associated with higher rates of preterm delivery, low birthweight and full-term low birthweight among longer-term residents (most of whom were not immigrants). Longer-term residents could be seen as the main target population, not only for fetal growth interventions, but also for the prevention of preterm birth.

In fact, for the study population as a whole, the relatively good outcomes for recent immigrants appeared to partially mask the deleterious effects of low neighbourhood income on preterm birth among longer-term residents. Studies of socioeconomic disparities in birth outcomes should be designed to account for the full extent of such effects.

More research is needed to fully validate the use of the Discharge Abstract Database as an alternative

source of data on pregnancy outcomes, especially since fiscal year 2001/2002. At that time, a major redevelopment of the database took place, including the reporting of gestational age in weeks, obstetric history, and a straightforward linkage between mothers' and infants' records.³² These innovations have made the database an attractive source of information for further studies of pregnancy outcomes. Linkage of the Discharge Abstract Database to Ontario vital statistics is desirable in order to exploit the strengths of each for a more complete picture of birth outcomes and their determinants at the population level. In addition, a side-by-side comparison of results obtained from the two sources would shed light on their relative strengths and limitations, and probably lead to suggestions on how to address data quality issues.

In the absence of complete registration of births in Ontario vital statistics, hospital discharge abstracts from 1996/1997 to 2000/2001 can serve as an alternate source of data on non-fatal birth outcomes, despite serious limitations in the variables that are

available. However, complete birth registration in Ontario vital statistics is needed, as well as routine linkage of all live births to corresponding infant deaths, so that fatal outcomes such as birthweight and gestational-age-specific infant mortality can also be assessed. ●

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Work stress among health care providers

by Kathryn Wilkins

Keywords: occupational health, workload, health occupations

According to data from the 2003 Canadian Community Health Survey (CCHS), nearly one in three employed Canadians, about 5.1 million, reported that most days at work were “quite” or “extremely” stressful.

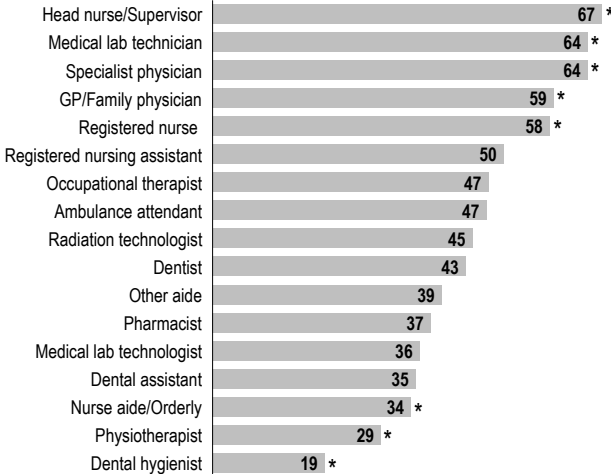
This article focuses on workers entrusted with providing health care to Canadians. Clearly, the well-being of this group of workers, which includes not only doctors and nurses, but also occupations such as ambulance attendants, technicians and therapists, is an important concern. The analysis compares levels of work stress—a factor that has been linked to poor physical and mental health and to occupational injury—among various types of health care providers.^{1,2} Associations between stress and selected job-related, socio-demographic and personal characteristics are also described.

Health care providers highly stressed

In 2003, health care providers comprised 6% of the Canadian work force aged 18 to 75 (data not shown). Nearly half (45%) of these workers, or 413,000, reported that most days on the job were “quite” or “extremely” stressful (hereafter referred to as “high” stress). This compared with 31% of all other employed people (data not shown).

The likelihood of high job stress among health care providers varied from a low of one in five (19%) dental hygienists to two-thirds (67%) of head nurses and nurse supervisors (Chart 1). Others with high work stress were medical laboratory technicians, specialist physicians, general practitioners and family physicians, and registered nurses (other than head nurses and supervisors); in these groups, the

Chart 1
Percentage of health care providers reporting high work stress, by occupation, household population aged 18 to 75, Canada, 2003



* significantly different from combined estimate for all other health care providers (p < 0.05)
Source: 2003 Canadian Community Health Survey, cycle 2.1.

proportions reporting high work stress ranged from 58% to 64%.

In addition to dental hygienists, health care providers who were relatively *less* likely to report high work stress included physiotherapists (29%) and nurse aides and orderlies (34%).

Work-related factors

The likelihood of high work stress was positively related to income. About half of health care providers whose personal income was \$40,000 or more reported high work stress, compared with 28% of those with incomes less than \$20,000, and 42% of those in the \$20,000 to \$39,999 range (Table 1).

Work stress also varied according to logistical features of the job, such as shifts and number of hours worked. Health care providers whose schedule was other than a regular daytime shift were more likely to report high work stress. Those who worked less than 35 hours per week were not as

likely as those with longer hours to report high stress. Self-employed health care providers were less likely to report high work stress than were those who worked for others.

Table 1

Percentage of health care providers reporting high work stress, by selected work-related and personal factors, household population aged 18 to 75, Canada, 2003

	%
Total health care workers	45.0
Work-related factors	
Personal income	
Less than \$20,000	27.8*
\$20,000 to \$39,999	41.8*
\$40,000 to \$59,999†	54.0
\$60,000 or more	49.8
Shift	
Involves shiftwork	47.7*
Regular day shift†	42.4
Employer	
Self-employed†	36.8
Not self-employed	46.3*
Weekly work hours	
Less than 35†	36.9
35 to 44	44.5*
45 to 79	60.3*
80 or more	56.8*
Personal factors	
Sex	
Men†	42.4
Women	45.6
Age group	
18 to 24†	31.0
25 to 34	42.4*
35 to 44	48.0*
45 to 54	49.9*
55 to 75	40.9*
Day-to-day stress	
Low (not at all/not very/a bit stressful)†	28.7
High (quite/extremely)	78.3*
Life satisfaction	
Satisfied†	44.4
Dissatisfied	75.2*
General health	
Good/Very good/Excellent†	42.7
Fair/Poor	54.7*

† reference category

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

Source: 2003 Canadian Community Health Survey, cycle 2.1.

Personal factors

High work stress was reported by 42% of male health care providers and 46% of their female counterparts, a difference that was not statistically significant (Table 1). However, there were differences by age. Health care providers younger than 25 were less likely to report high work stress (31%) than were those aged 25 or older. This may reflect the nature of the jobs that people these ages hold, specifically, having less responsibility at younger ages. Work stress peaked at ages 35 to 54, with about 50% of health care providers in this age

The questions

Occupation was defined using the Standard Occupational Classification (SOC) 1991 - Canada. "Health occupations" is one of 10 occupational sectors defined by the SOC.

The estimates for *work stress* were based on responses to the question, "The next question is about your main job or business in the past 12 months. Would you say that most days at work were: not at all stressful, not very stressful, a bit stressful, quite stressful, or extremely stressful?" Respondents who indicated either of the last two categories were classified as reporting high work stress.

Day-to-day stress was assessed by the question, "Thinking about the amount of stress in your life, would you say that most days are not at all stressful, not very stressful, a bit stressful, quite stressful, or extremely stressful?" Respondents who indicated either of the last two categories were classified as reporting high day-to-day stress.

Life satisfaction was measured by the question, "How satisfied are you with your life in general? very satisfied? satisfied? neither satisfied nor dissatisfied? dissatisfied? very dissatisfied?"

Self-perceived general health was measured by asking, "In general, would you say your physical health is excellent? very good? good? fair? poor?"

range reporting high work stress. The proportion fell to 41% among those aged 55 to 75.

In addition to questioning respondents about stress at work, the CCHS asked about stress in their daily lives. Nearly four in five (78%) health care providers who reported that their lives were “quite a bit” or “extremely” stressful also reported high work stress. This may partly reflect the impact that work stress has on a person’s life in general, or perhaps a tendency for people who feel stressed at work to perceive high stress in other situations.

Data source and limitations

Estimates are based on data from the 2003 Canadian Community Health Survey (CCHS) (cycle 2.1). The CCHS is a general health survey that collects cross-sectional information about the health of Canadians every two years. It covers the non-institutionalized household population aged 12 or older in all provinces and territories, except members of the regular Canadian Forces and residents of Indian reserves, Canadian Forces bases, and some remote areas. In cycle 2.1, the overall response rate was 80.6%; the total sample size was 135,573 respondents. Of these, 75,184 respondents were aged 18 to 75 and had worked at some time during the year; 4,551 reported that they had worked in a health occupation. Job categories in the health care sector for which sample size was sufficient were included in the analysis. The analysis was based on weighted data from these respondents.

To account for survey design effects, standard errors and coefficients of variation were estimated using the bootstrap technique.³⁻⁵

The data used for this analysis are self-reported and not validated according to any external source. Perceptions of work stress may vary depending on factors that were not measured in the CCHS, such as an individual’s resilience, outlook or other personal or socio-cultural traits.

Because the study is based on cross-sectional data, a cause-and-effect relationship between job category and stress cannot be inferred. Although it is probable that some jobs are more stressful than others, it also may be that people who are more likely to report high stress are also more likely to be employed in certain jobs.

Links to dissatisfaction

Similar to the association between day-to-day stress and work stress, life dissatisfaction was strongly related to work stress. Three-quarters (75%) of health care providers who were “dissatisfied” or “very dissatisfied” with their lives reported high work stress.

Work stress differed to a smaller, but significant, extent by level of general health. Health care providers who described their health as “good,” “very good” or “excellent” were less likely to report high work stress (43%) than were those who saw their health as “fair” or “poor” (55%). It is reasonable to assume that coping with compromised health may compound the stressfulness of work.

To summarize, the results of bivariate analysis indicate that the proportion of health care providers who reported high work stress varied according to their job and to conditions intrinsic to the job, such as shift work and number of hours worked. But the likelihood of perceiving stress on the job also varied according to personal characteristics of the worker.

Doctors, nurses most stressed

Multivariate analysis was used to examine the relationship between the job and perceived work stress, while controlling for the effects of personal characteristics and other influences. The association between work stress and each job category was examined in separate logistic regression models that adjusted for the potentially confounding effects of day-to-day stress, life satisfaction, general health, sex and age.

Even when influences outside the workplace were taken into consideration, specialist physicians, general practitioners/family physicians, and registered nurses (excluding supervisors and head nurses) had a statistically elevated likelihood of work stress relative to other health care providers (Table 2). Consistent with the bivariate results, the odds ratio for nurse supervisors and head nurses also appeared to be elevated, but fell just short of significance ($p = 0.053$), likely because of inadequate

Table 2

Adjusted odds ratios relating occupation to high work stress among health care providers, household population aged 18 to 75, Canada, 2003

	Adjusted odds ratio	95% confidence interval
Specialist physician	2.8*	1.4 to 5.5
Registered nurse†	2.1*	1.6 to 2.8
Head nurse/Supervisor	2.1	1.0 to 4.3
General practitioner/Family physician	2.0*	1.1 to 3.7
Dentist	1.5	0.5 to 4.5
Registered nursing assistant	1.3	0.7 to 2.4
Medical lab technician	1.2	0.6 to 2.5
Radiation technologist	1.2	0.5 to 2.8
Occupational therapist	0.9	0.4 to 2.1
Ambulance attendant/Other paramedic	0.9	0.3 to 2.4
Pharmacist	0.8	0.4 to 1.8
Physiotherapist	0.7	0.4 to 1.2
Other aide	0.7	0.3 to 1.5
Dental assistant	0.6	0.3 to 1.3
Nurse aide/Orderly	0.5*	0.4 to 0.7
Dental hygienist	0.4*	0.2 to 0.8
Medical lab technologist/Pathologist's assistant	0.4*	0.2 to 0.9

† other than Head nurse/Supervisor

* significantly different from estimate for all other health care workers ($p < 0.05$)

Note: A separate model was fitted for each occupation; thus the odds ratios cannot be compared with each other. Each model was controlled for sex, age, general physical health, life stress, life satisfaction and self-employment (or not).

Source: 2003 Canadian Community Health Survey, cycle 2.1.

statistical power. For medical laboratory technicians, the elevated likelihood of high work stress did not persist when other influences were controlled, suggesting that the association observed in bivariate analysis was at least partially accounted for by factors outside the job.

The multivariate analysis also indicated that the odds of high work stress were significantly lower, compared with all other health care workers, for laboratory technologists, dental hygienists, and nurse aides and orderlies.

This multivariate analysis indicates that health care providers are far more likely than employed people in general to feel that their jobs are highly stressful. Physicians and nurses report the most stress, even when influences outside the job are taken into account. Because doctors and nurses bear a major responsibility for delivering health care, these findings should concern all Canadians.

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Hip fracture outcomes in the household population

by Gisèle Carrière

Keywords: hip fracture, stroke, outcomes, self-perceived health, health status, home care

According to national information based on hospital records (see *Data sources*), during the 2003/2004 fiscal year, 23,621 Canadians aged 60 or older were discharged from acute care hospitals after being treated at least once for a hip fracture (data not shown). They accounted for 3% of all patients in this age group discharged from such hospitals over this period.

In addition to the expense of initial hospitalization, the ongoing health and social services care for individuals with fractured hips is very costly; one study has placed the cost at \$650 million annually.¹ For many people, hip fractures result in a permanent loss of function, dependency on others, or a move out of the community to an institution. However, according to a recent Canadian study, 59% of patients continued to reside in households one year after a hip fracture.¹ Although significant declines in independence and increases in need for support were noted, these people were able to rejoin the household population.¹

This article presents a profile of Canadians aged 60 or older who had sustained a hip fracture and were living in a household during the year after that fracture. The information is based on nationally representative data from the 2003 Canadian Community Health Survey (CCHS) (see *Data sources*).

Most hip fractures at or near home

To assess the burden of hip fracture, the outcomes for people aged 60 or older who had suffered a hip fracture are compared with those for four other groups in the same age range (Table 1). Those who had sustained another type of fracture that could potentially impair mobility and functionality make

up two of these groups. Another comprises those who were coping with the effects of a stroke that had occurred sometime in the past, as stroke is another major source of disability in older adults. And, finally, a “control group” captures those who reported no fracture in the past year and no effects of a stroke.

The median age of the adults who had suffered a hip fracture was 80—older than those in any of the other comparison groups. Over a third of the people (37%) who had sustained a hip fracture in the past year were living alone at the time of the survey (data not shown). (Information on individuals’ living arrangements at the time of the fracture is not available from the CCHS.) Most of their hip fractures (53%) had occurred at or close to home, often while they were doing household chores or other unpaid work (38%; data not shown). Nearly all the hip fractures (93%) had resulted from a fall, and just over half (53%) of those injured had tripped, slipped or stumbled on some type of surface other than snow or ice. These findings are consistent

Table 1

Estimated number and median age of adults aged 60 or older, by fracture and/or effects of stroke status, household population, Canada, 2003

	Estimated number '000	Median age (years)
Fracture in past year and/or effects of stroke		
Hip fracture, no stroke [†]	12	80
Thigh, knee, lower leg, ankle, or foot fracture, no stroke	25	70*
Shoulder, arm, wrist, or hand fracture, no stroke	44	71*
Effects of stroke, no fracture	175	75*
No fracture, no effects of stroke	4,575	69*

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

[†] reference category

Source: 2003 Canadian Community Health Survey.

with those reported in a previous study of injuries among seniors.²

Fracture and chronic condition(s)

Two-thirds of people aged 60 or older (66%) who had suffered a hip fracture also reported having arthritis or rheumatism, as did approximately half of those who had some other kind of limb fracture (Table 2). The presence of arthritis is not unexpected in either group, as the condition is relatively common at older ages and has been implicated as a risk factor for fall-related fractures in the elderly.³ By comparison, individuals who were living with the effects of a stroke and those who reported no serious injury/fracture were much less likely to have reported arthritis or rheumatism than were those who had fractured a hip.

About 7 in 10 members of the hip fracture group (71%) also had at least one of 17 selected chronic conditions captured by the CCHS. More than a third (37%) reported two or more such conditions. The presence of chronic conditions was similar in the other comparison groups, except stroke survivors, who were more likely to have at least one, as well as more than one, chronic condition.

Table 2

Percentage of adults aged 60 or older with chronic condition(s), by fracture and/or effects of stroke status, household population, Canada, 2003

	Arthritis/ Rheumatism	Chronic condition(s)	
		1 or more	2 or more
Fracture in past year and/or effects of stroke			
Hip fracture, no stroke [†]	66	71	37 ^E
Thigh, knee, lower leg, ankle, or foot fracture, no stroke	54	65	40
Shoulder, arm, wrist, or hand fracture, no stroke	51	74	47
Effects of stroke, no fracture	51*	91*	64*
No fracture, no effects of stroke	43*	66	34

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

[†] reference category

^E use with caution (coefficient of variation 16.6% to 33.3%)

Source: 2003 Canadian Community Health Survey.

Importance of mental health

The people who lived in households after a hip fracture must have retained enough functionality and

Data sources

Numbers of acute care hospital patients for the 2003/2004 fiscal year are based on information extracted from the *Health Person-oriented Database (HPOI)*, which is maintained by Statistics Canada. Records of individual patients were linked to produce patient-oriented data. The HPOI represents a subset of information from a national database of hospital discharge records, the *Hospital Morbidity Database (HMDB)*. The HMDB is constructed annually and maintained by the Canadian Institute for Health Information. The reported number of hip fracture patients excludes those admitted to non-acute hospitals or acute-care settings that were not part of the Discharge Abstract Database (DAD) frame in 2003/2004 (e.g., psychiatric hospitals). This analysis used only HPOI records with valid person identifiers that were constructed, in part, from health insurance numbers. For the 2003/2004 fiscal year, less than 2% of the HPOI acute care discharge records for patients aged 60 or older did not have a valid person identifier.

The information on members of the household population who had sustained hip or other fractures is based on data from the 2003 *Canadian Community Health Survey (CCHS)*, cycle 2.1. The CCHS covers the household population aged 12 or older in all provinces or territories, except residents of institutions, all members of the regular Armed Forces, people living on Indian reserves and some remote areas, and civilian residents of military bases. Cycle 2.1 began in January 2003 and ended in December that year. The response rate was 80.6%, yielding a sample of 135,573 respondents. More information on the CCHS can be found in a published report.⁴

A total of 34,743 respondents aged 60 or older provided information on their most serious injury and presence/absence of stroke effects; they represent an estimated 4.8 million people. Previous research indicates that the risk of hip fracture begins to increase substantially at age 60 (data not shown). In this analysis, several potentially confounding factors that may influence health or health care use were taken into account. Aspects of Andersen's behavioural model of medical care utilization⁵ were used to select pertinent variables available from the CCHS: sex, age, education and living arrangements, and presence of chronic conditions.

Variance on estimates and on differences between estimates was calculated using the bootstrap technique, which accounts for the complex sampling design of the survey.^{6,7}

mental resilience, and had sufficient support, to do so. Indeed, the odds of household residents aged 60 or older who had sustained a hip fracture reporting “very good” or “excellent” mental health were similar to those for people without a serious injury or the effects of a stroke (Table 3). A similar pattern emerged for being “somewhat” to “very satisfied” with life in general. Feelings of community connection may have played a role. The odds of reporting excellent or very good mental

health were 80% higher for those declaring a “very strong” sense of community belonging, compared with those whose attachment to the community was not as strong.

Despite positive feelings about their mental health and satisfaction with life in general, the odds of seniors who had fractured a hip reporting their general health as “fair” or “poor” were nearly three times as high as those for the reference group (no fracture and no effects of stroke), and their odds

Table 3

Odds ratios relating fracture and/or effects of stroke status and other selected characteristics to self-perceived health and life satisfaction, adults aged 60 or older, household population, Canada, 2003

	Excellent or very good self-perceived mental health		Somewhat to very satisfied with life		Fair or poor general health		Health is somewhat or much worse than 1 year ago	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Fracture in past year and/or effects of stroke								
Hip fracture, no stroke	0.6	0.3 to 1.1	0.4	0.2 to 1.0	2.9*	1.6 to 5.3	5.3*	2.9 to 9.8
Thigh, knee, lower leg, ankle or foot fracture, no stroke	0.8	0.6 to 1.3	0.7	0.4 to 1.4	0.9	0.5 to 1.6	1.8*	1.2 to 3.0
Shoulder, arm, wrist or hand fracture, no stroke	1.2	0.8 to 2.0	0.5	0.3 to 1.0	1.1	0.7 to 1.8	1.2	0.8 to 1.9
Effects of stroke, no fracture	0.5*	0.4 to 0.6	0.3*	0.3 to 0.5	3.5*	2.8 to 4.4	1.7*	1.4 to 2.2
No fracture, no effects of stroke†	1.0	...	1.0	...	1.0	...	1.0	...
Age‡	1.0*	1.0 to 1.0	1.0*	1.0 to 1.0	1.0*	1.0 to 1.0	1.0*	1.0 to 1.0
Sex								
Men	0.9	0.9 to 1.0	1.0	0.9 to 1.2	1.1	1.0 to 1.2	0.8*	0.7 to 0.9
Women†	1.0	...	1.0	...	1.0	...	1.0	...
Living arrangements								
With kin	1.1	1.0 to 1.2	1.8*	1.6 to 2.1	1.0	0.9 to 1.0	1.0	0.9 to 1.1
With others, other living arrangements	0.9	0.8 to 1.1	1.4*	1.0 to 1.8	1.2	0.9 to 1.4	1.0	0.8 to 1.3
Alone†	1.0	...	1.0	...	1.0	...	1.0	...
Very strong sense of community belonging								
Yes	1.8*	1.6 to 1.9	2.1*	1.8 to 2.5	0.7*	0.6 to 0.8	0.7*	0.6 to 0.8
No†	1.0	...	1.0	...	1.0	...	1.0	...
Education								
Postsecondary graduation†	1.0	...	1.0	...	1.0	...	1.0	...
Some postsecondary	1.1	0.9 to 1.3	0.8	0.6 to 1.1	1.0	0.8 to 1.3	1.1	0.9 to 1.4
Secondary graduation	0.9	0.8 to 1.0	0.8*	0.7 to 1.0	1.2*	1.0 to 1.3	1.0	0.9 to 1.2
Less than secondary graduation	0.5*	0.5 to 0.6	0.6*	0.6 to 0.8	1.9*	1.7 to 2.2	1.3*	1.2 to 1.5
Chronic condition(s)								
None or one†	1.0	...	1.0	...	1.0	...	1.0	...
Two or more	0.6*	0.6 to 0.7	0.4*	0.4 to 0.5	4.4*	4.0 to 4.8	2.2*	2.0 to 2.5

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

† reference category

‡ continuous variable

... not applicable

Note: Because of rounding, some odds ratios with 1.0 as the lower/upper confidence interval are statistically significant.

Source: 2003 Canadian Community Health Survey.

The questions

Respondents to the 2003 Canadian Community Health Survey (CCHS) were asked if they had suffered an injury in the past 12 months. Those who had were then asked about the nature of the most serious injury. Respondents whose most serious injury involved broken or fractured bones were asked which body part was involved. Three groups were used for this analysis: *hip fracture; thigh, knee, lower leg, ankle or foot fracture; shoulder, arm, wrist or hand fracture.*

A dichotomous variable for the *effects of a stroke* was created from responses to a question asking if the respondent was currently experiencing such problems. Those who were and who also belonged to one of the identified fracture comparison groups were excluded from the analysis; thus the fracture groups represented those with these injuries, but without the compounded effects of a stroke. Respondents with missing information about injuries or stroke were excluded from the analysis; this amounted to 241 respondents, or 1% of the weighted sample of respondents aged 60 or older.

Chronic condition(s) indicates the self-reported presence of one or more of the following, as asked of CCHS respondents: asthma, high blood pressure, chronic bronchitis, emphysema, diabetes, heart disease, heart attack (ever), angina, congestive heart failure, cancer, ulcers, bowel disorder, dementia, thyroid condition, schizophrenia, mood disorder, or anxiety.

For *living arrangements*, respondents were categorized as living with kin if they were living with their spouse or partner with or without their children, with children only, or with a parent. Living with others captures those who were unattached but living with others, or had some arrangement other than “alone” or “with kin.”

Needed help with ADL or IADL tasks was based on responses to several CCHS questions. Two questions captured activities of daily living (ADL): “Because of any physical condition or mental condition or health problem, do you need the help of another person with personal care such as washing, dressing, eating or taking medication?” and “Because of any physical condition or mental condition or health problem, do you need the help of another person with moving about inside the house?” The instrumental activities of daily living (IADL) were covered by asking: “Because of any physical condition or mental condition or health problem, do you need the help of another person with preparing meals? . . . getting to appointments and running errands such as shopping for groceries? . . . doing normal everyday housework? . . . doing heavy household chores such as spring cleaning or yard work? . . . looking after your personal finances such as making bank transactions or paying bills?”. Needing help was a dichotomous variable coded as ‘1’ if respondents answered “yes” to any one of these questions. If a response was not provided, the respondent was excluded from the analysis of this needs variable.

A very strong sense of *community belonging* represents those who selected the first response when asked, “How would you describe your sense of belonging to your local community? Would you say it is very strong, somewhat strong, somewhat weak, very weak?”

Receipt of government-subsidized home care was determined by asking if respondents had “received any home care services within the past 12 months, with the cost being entirely or partially covered by government?”

of feeling that their health was “somewhat worse” or “much worse” than it had been a year earlier were five times as high—even when taking into account the effects of other potentially confounding variables.

Needing help

It is likely that compromised independence plays a role in negative self-perceived health among the hip fracture group. Among adults aged 60 or older who had had such an injury, the odds of needing help with various activities of daily living (ADL) or with activities that were instrumental to daily living (IADL) were four times as high as those for their non-injured counterparts. For ADL involving personal care such as bathing or dressing, the odds of needing help were eight times as high (Table 4).

Consistent with their needs for assistance, the odds that the hip fracture group was receiving government-subsidized home care were 10 times those of the non-injured group, and over three times those of stroke survivors. The adults who had

Limitations

Interviews for 1,300 Canadian Community Health Survey (CCHS) respondents aged 60 or older (5.6% of the weighted total used) were completed by proxy; therefore, the accuracy of the responses about self-perceived general health and health status compared with one year earlier cannot be determined. Questions about mental health, life satisfaction and sense of community belonging were not asked in proxy interviews and were coded as “not stated.”

CCHS information was self-reported and there was no external validation of responses. No information was available on the chronology of injury events or past stroke. The data are cross-sectional; no inferences about temporal ordering or causality can be made. While living arrangements may suggest social support, this variable does not measure frequency or quality of contact, or whether support or assistance was provided.

fractured a hip in the 12 months before the CCHS interview may have been more closely tied to health care and social assistance providers than were those who had had a stroke at some (unknown) time in the past.

Challenges

If hip fractures are viewed as part of a continuum that begins with efforts to prevent such injuries in the first place, then this examination of CCHS respondents represents the later effects of the injury, but not the end of the story. For older Canadians,

avoiding a move to an institution can be a goal worth pursuing.

The population aged 60 or older examined in this analysis likely represents the “best” hip fracture cases discharged from acute care hospitals since they subsequently rejoined the household population. Despite their relatively higher perceptions of poor health and dependence on others, they were still just as likely as uninjured adults these ages to report very good or excellent mental health and being somewhat or very satisfied with life. This is important, as evidence suggests that good mental health is

Table 4

Odds ratios relating fracture and/or effects of stroke status and other selected characteristics to the need for assistance with activities of daily living, activities instrumental to daily living and receipt of government-subsidized home care, adults aged 60 or older, household population, Canada, 2003

	Needed help with ADL or IADL tasks		Needed help with ADL tasks		Received government-subsidized home care	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Fracture in past year and/or effects of stroke						
Hip fracture, no stroke	4.1*	2.0 to 8.5	7.9*	3.6 to 17.5	10.1*	5.2 to 19.5
Thigh, knee, lower leg, ankle or foot fracture, no stroke	1.3	0.8 to 2.0	1.8	0.8 to 4.2	2.6*	1.5 to 4.4
Shoulder, arm, wrist or hand fracture, no stroke	1.4	1.0 to 2.1	1.4	0.8 to 2.5	2.8*	1.8 to 4.5
Effects of stroke, no fracture	4.1	3.2 to 5.2	4.9*	3.4 to 7.0	2.9*	2.2 to 3.8
No fracture, no effects of stroke†	1.0	...	1.0	...	1.0	...
Age‡	1.1*	1.1 to 1.1	1.1*	1.1 to 1.1	1.1*	1.1 to 1.1
Sex						
Men	0.4*	0.4 to 0.4	0.8	0.6 to 1.1	0.9	0.8 to 1.0
Women†	1.0	...	1.0	...	1.0	...
Living arrangements						
With kin	0.8*	0.7 to 0.9	1.0	0.8 to 1.3	0.6*	0.5 to 0.7
With others, other living arrangements	1.2	1.0 to 1.5	1.9*	1.3 to 2.8	0.8	0.6 to 1.1
Alone†	1.0	...	1.0	...	1.0	...
Very strong sense of community belonging						
Yes	0.8*	0.8 to 0.9	0.8*	0.6 to 1.0	1.0	0.9 to 1.2
No†	1.0	...	1.0	...	1.0	...
Education						
Postsecondary graduation†	1.0	...	1.0	...	1.0	...
Some postsecondary	0.9	0.7 to 1.1	1.0	0.6 to 1.6	0.9	0.6 to 1.2
Secondary graduation	0.9	0.8 to 1.0	1.3	1.0 to 1.9	1.1	0.9 to 1.4
Less than secondary graduation	1.2*	1.1 to 1.3	1.6*	1.3 to 2.1	1.3*	1.1 to 1.6
Chronic condition(s)						
None or one†	1.0	...	1.0	...	1.0	...
Two or more	2.8*	2.6 to 3.1	2.0*	1.6 to 2.5	2.2*	2.0 to 2.6

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

† reference category

‡ continuous variable

... not applicable

Note: Because of rounding, some odds ratios with 1.0 as the lower or upper confidence interval are statistically significant.

Source: 2003 Canadian Community Health Survey.

protective against institutionalization.⁸ Perhaps the very strong sense of community belonging reported by those who had suffered a hip fracture may provide the thread.

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The image features a vertical strip on the left side with a dark grey background. It contains stylized, high-contrast white and light grey shapes. At the top, there are two square shapes flanking a vertical bar, resembling a face. Below this, there are thick, curved lines that suggest a profile or a stylized figure. In the lower part of the strip, there is a large, white, stylized letter 'e' or a similar shape, set against a background of jagged, star-like patterns. The overall aesthetic is modern and graphic.

Subject index

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Subject index

Volumes 1 to 18

A

Abdominal aortic aneurysm

Gender differences in abdominal aortic aneurysm surgery. Parsons GF, Gentleman JF, Johnston KW. 1997; 9(1): 9-18.

Trends in mortality and hospital morbidity due to abdominal aortic aneurysms. Millar WJ, Cole CW, Hill GB. 1995; 7(1): 19-27.

Aboriginal Peoples

Cancer incidence by ethnic group in the Northwest Territories (NWT), 1969-1988. Gaudette LA, Gao RN, Freitag S, et al. 1993; 5(1): 23-32.

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Premature mortality in health regions with high Aboriginal populations. Allard YE, Wilkins R, Berthelot J-M. 2004; 15(1): 51-60.

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See also Miscarriage

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Deaths

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Infection after cholecystectomy, hysterectomy or appendectomy. Rotermann M. 2004; 15(4): 11-23.

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Leading cancers—changes in five-year relative survival. Ellison LF, Gibbons L. 2004; 15(2): 19-32.

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V

Vision

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See also Births
Deaths
Divorce
Health status indicators
Marriage
Survival rates

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W

Weight

See also Obesity

Adult obesity. Tjepkema M. 2006; 17(3): 9-25.

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Overweight and obesity among children and youth. Shields M. 2006; 17(3): 27-42.

Parent and child factors associated with youth obesity. Carrière G. 2003; 14(Suppl.): 29-39.

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Regional differences in obesity. Shields M, Tjepkema M. 2006; 17(3): 61-7.

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Trends in weight change among Canadian adults. Orpana HM, Tremblay MS, Finès P. 2007; 18(2): 9-16.

Y

Youths

See also Adolescent behaviour
Children

Adolescent self-concept and health into adulthood. Park J. 2003; 14(Suppl.): 41-52.

Alcohol and drug use in early adolescence. Hotton T, Haans D. 2004; 15(3): 9-19.

Children who become active. Pérez CE. 2003; 14(Suppl.): 17-28.

Early sexual intercourse. Garriguet D. 2005; 16(3): 9-18.

Factors associated with bicycle helmet use. Millar WJ, Pless IB. 1997; 9(2): 31-9.

Factors related to adolescents' self-perceived health. Tremblay S, Dahinten S, Kohen D. 2003; 14(Suppl.): 7-16.

Health status of children. Wilkins R, Houle C. 1999; 11(3): 25-34.

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Overweight and obesity among children and youth. Shields M. 2006; 17(3): 27-42.

Parent and child factors associated with youth obesity. Carrière G. 2003; 14(Suppl.): 29-39.

Second or subsequent births to teenagers. Rotermann M. 2007; 18(1): 39-42.

Sex, condoms and STDs among young people. Rotermann M. 2005; 16(3): 39-45.

Teenage pregnancy. Dryburgh H. 2000; 12(1): 9-19.

Teenage pregnancies, 1974 to 1994. Wadhwa S, Millar WJ. 1997, 9(3): 9-17.

Teenage pregnancies, 1975-1989. Wadhwa S, Strachan J. 1990; 3(4): 327-47.

Weekly work hours and health-related behaviours in full-time students. Carrière G. 2005; 16(4): 11-22.

Youth smoking. Shields M. 16(3): 53-7.

The image features a vertical strip on the left side with a dark grey background. It contains stylized, white-outlined faces. The top face has a vertical line for a nose and two small squares for eyes. Below it, another face is partially visible with a horizontal line for a mouth. At the bottom, a third face is shown with a large, circular, swirling shape for a nose. The right side of the page is plain white, with the text 'Author index' positioned in the upper right area.

Author index

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Author index

Volumes 7 to 18

Ali, Jennifer

Mental health of Canada's immigrants, 2002; 13(Suppl.): 101-11.

Allard, Yvon E.

Premature mortality in health regions with high Aboriginal populations (with Russell Wilkins and Jean-Marie Berthelot), 2004; 15(1): 51-60.

Beaudet, Marie P.

Characteristics of women on hormone replacement therapy (with Wikke Walop and Christel Le Petit), 1997; 9(2): 9-18.

Depression, 1996; 7(4): 11-24.

Psychological health—depression, 1999; 11(3): 63-75.

Béland, Yves

Canadian Community Health Survey—methodological overview, 2002; 13(3): 9-14.

Bender, Rosemary

Impact of new population estimates on health and vital statistics, 1995; 7(1): 7-18.

Bryan, Shirley

Canadian Health Measures Survey: Clinic operations and logistics. Bryan S, St-Denis M, Wojtas D. 2007; 18(Suppl.): 53-70.

Burr, K.F.

Interprovincial data requirements for local health indicators: the British Columbia experience (with B. McKee, L.T. Foster and F. Nault), 1995; 7(2): 17-24.

Caron Malenfant, Éric

Suicide in Canada's immigrant population, 2004; 15(2): 9-17.

Carrière, Gisèle

Consultations with doctors and nurses, 2005; 16(4): 45-8.

Hip fracture outcomes in the household population. Carrière G. 2007; 18(4): 37-42.

Parent and child factors associated with youth obesity, 2003; 14(Suppl.): 29-39.

Seniors' use of home care, 2006; 17(4): 43-7.

Use of hospital emergency rooms, 2004; 16(1): 35-9.

Weekly work hours and health-related behaviours in full-time students, 2005; 16(4): 11-22.

Chaplin, Robin

Household spending on health care (with Louise Earl), 2000; 12(1): 57-65.

Che, Janet

Food insecurity in Canadian households (with Jiajian Chen), 2001; 12(4): 11-22.

Chen, Jiajian

Age at diagnosis of smoking-related disease, 2003; 14(2): 9-19.

Age of smoking initiation: Implications for quitting (with Wayne J. Millar), 1998; 9(4): 39-46.

Are recent cohorts healthier than their predecessors? (with Wayne J. Millar), 2000; 11(4): 9-23.

Birth outcome, the social environment and child health (with Wayne J. Millar), 1999; 10(4): 57-67.

Health effects of physical activity (with Wayne J. Millar), 1999; 11(1): 21-30.

Health expectancy by immigrant status, 1986 and 1991 (with Russell Wilkins and Edward Ng), 1996; 8(3): 29-38.

Health in mid-life (with Margot Shields), 1999; 11(3): 35-46.

Heart disease, family history and physical activity (with Wayne J. Millar), 2001; 12(4): 23-32.

Maternal education and fetal and infant mortality in Quebec (with Martha Fair, Russell Wilkins, Margaret Cyr and the Fetal and Infant Mortality Study Group of the Canadian Perinatal Surveillance System), 1998; 10(2): 53-64.

Seniors' needs for health-related personal assistance (with Russell Wilkins), 1998; 10(1): 39-50.

Starting and sustaining physical activity (with Wayne J. Millar), 2001; 12(4): 33-43.

The health of Canada's immigrants in 1994/95 (with Edward Ng and Russell Wilkins), 1996; 7(4): 33-45.

Unmet needs for health care (with Feng Hou), 2002; 13(2): 23-34.

Chen, Yue

Asthma (with Helen Johansen, Satha Thillaiampalam and Christie Sambell), 2005; 16(2): 43-6.

Connors, Cathy

Changes in children's hospital use (with Wayne J. Millar), 1999; 11(2): 9-19.

Day, Brent

Canadian Health Measures Survey: Ethical, legal and social issues. Day B, Langlois R, Tremblay M, Knoppers B-M. 2007; 18(Suppl.): 37-51.

Diverly, Brent

Depression: An undertreated disorder? (with Marie P. Beaudet), 1997; 8(4): 9-18.

The health of Northern residents (with Claudio Pérez), 1998; 9(4): 49-58.

Dryburgh, Heather

Teenage pregnancy, 2000; 12(1): 9-19.

Ellison, Larry F.

Five-year relative survival from prostate, breast, colorectal and lung cancer (with Laurie Gibbons and the Canadian Cancer Survival Analysis Group), 2001; 13(1): 23-34.

Leading cancers—changes in five-year relative survival (with Laurie Gibbons), 2004; 15(2): 19-32.

Survival from cancer—up-to-date predictions using period analysis (with Laurie Gibbons), 2006; 17(2): 19-30.

Ford, David

Changing fertility patterns, 1974 to 1994 (with François Nault), 1996; 8(3): 39-46.

Galambos, Nancy L.

Multiple-risk behaviour in adolescents and young adults (with Lauree C. Tilton-Weaver), 1998; 10(2): 9-20.

Garriguet, Didier

Canadians' eating habits, 2007; 18(2): 17-32.

Early sexual intercourse, 2005; 16(3): 9-18.

Medication use among pregnant women, 2005; 17(2): 9-18.

Sodium consumption at all ages, 2007; 18(2): 47-52.

Gaudette, Leslie A.

Cancer incidence and mortality across Canada (with Christopher A. Altmayer, Marek Wysocki and Ru-Nie Gao), 1998; 10(1): 51-66.

Changing trends in melanoma incidence and mortality (with Ru-Nie Gao), 1998; 10(2): 29-41.

Trends in breast cancer incidence and mortality (with Carol Silberberger, Chris A. Altmayer and Ru-Nie Gao), 1996; 8(2): 29-37.

Trends in mammography utilization, 1981 to 1994 (with Chris A. Altmayer, Karla M.P. Nobrega and Judy Lee), 1996; 8(3): 17-27.

Update on breast cancer mortality, 1995 (with Ru-Nie Gao, Marek Wysocki and François Nault), 1997; 9(1): 31-4.

Which workers smoke? (with Anne Richardson and Sara Huang), 1998; 10(3): 35-45.

Gentleman, Jane F.

Divorce in the 1990s (with Evelyn Park), 1997; 9(2): 53-8.

Who doesn't get a mammogram? (with Judy Lee), 1997; 9(1): 19-28.

Gibbons, Laurie

Prostate cancer—testing, incidence, surgery and mortality (with Chris Waters), 2003; 14(3): 9-20.

Trends in colorectal cancer incidence and mortality (with Chris Waters, Yang Mao and Larry Ellison), 2001; 12(2): 41-55.

Gilmour, Heather

Dependency, chronic conditions and pain in seniors (with Jungwee Park), 2006; 16(Suppl.): 21-31.

Depression and work impairment (with Scott B. Patten), 2007; 18(1): 9-22.

Migraine (with Kathryn Wilkins), 2001; 12(2): 23-40.

Mortality in metropolitan areas (with Jane F. Gentleman), 1999; 11(1): 9-19.

Physically active Canadians, 2007; 18(3): 45-65.

Gilmore, Jason

Body mass index and health, 1999; 11(1): 31-43.

Life expectancy (with Brenda Wannell), 1999; 11(3): 9-24.

Giroux, Suzelle

Canadian Health Measures Survey: Sampling strategy overview. Giroux S. 2007; 18(Suppl.): 31-6.

Grootendorst, Paul

Validity of self-reported prescription drug insurance coverage (with Edward C. Newman and Mitchell A.H. Levine), 2003; 14(2): 35-46.

Hill, Gerry

Dementia among seniors (with William Forbes, Jean-Marie Berthelot, Joan Lindsay and Ian McDowell), 1996; 8(2): 7-10.

Hood, Sheila C.

A healthy outlook (with Marie P. Beaudet and Gary Catlin), 1996, 7(4): 25-32.

Hou, Feng

Neighbourhood low income, income inequality and health in Toronto (with Jiajian Chen), 2003; 14(2): 21-34.

Hotton, Tina

Alcohol and drug use in early adolescence (with Dave Haans), 2004; 15(3): 9-19.

James, Robert

The health of Canadians with diabetes (with T. Kue Young, Cameron A. Mustard and Jamie Blanchard), 1997; 9(3): 47-52.

Johansen, Helen

At risk of first or recurring heart disease (with Mukund Nargundkar, Cyril Nair, Greg Taylor and Susie ElSaadany), 1998; 9(4): 19-29.

Current and future hospitalization after heart attack (with Cyril Nair and Gregory Taylor), 1998; 10(2): 21-8.

Diseases of the circulatory system—hospitalization and mortality (with Satha Thillaiampalam, Denis Nguyen and Christie Sambell), 2005; 17(1): 49-53.

Flu shots—national and provincial/territorial trends (with Christie Sambell and Wenxia Zhao), 2006; 17(2): 43-8.

Influenza vaccination (with Kathy Nguyen, Luling Mao, Richard Marcoux, Ru-Nie Gao and Cyril Nair), 2004; 15(2): 33-43.

Living with heart disease—the working-age population, 1999; 10(4): 33-45.

Revascularization and heart attack outcomes (with Cyril Nair, Luling Mao and Michael Wolfson), 2002; 13(2): 35-46.

Variations in angioplasty and bypass surgery (with Cyril Nair and Gregory Taylor), 1998; 10(3): 63-76.

Kwong, Jeff C.

The effect of universal influenza immunization on vaccination rates in Ontario (with Christie Sambell, Helen Johansen, Thérèse A. Stukel and Douglas G. Manuel), 2006; 17(2): 31-40.

Trends in influenza vaccination in Canada, 1996/1997 to 2005. Kwong JC, Rosella LC, Johansen H. 2007; 18(4): 9-19.

Lafrenière, Sylvie A.

Dependent seniors at home—formal and informal help (with Yves Carrière, Laurent Martel and Alain Bélanger), 2003; 14(4): 31-40.

Langlois, Stéphanie

Suicide deaths and suicide attempts (with Peter Morrison), 2002; 13(2): 9-22.

Le Petit

Obesity—a growing issue (with Jean-Marie Berthelot), 2006; 17(3): 43-50.

Ledrou, Ingrid

Food insecurity (with Jean Gervais), 2005; 16(3): 47-51.

Lee, Judy

Falling short of Pap test guidelines (with Greg F. Parsons and Jane F. Gentleman), 1998; 10(1): 9-19.

MacNab, Ying C.

The risks of childbearing at older ages (with Julie Macdonald and Terry A. Tuk), 1997; 9(2): 41-50.

Martel, Laurent

Loss and recovery of independence among seniors (with Alain Bélanger and Jean-Marie Berthelot), 2002; 13(4): 35-48.

Mayer, Francine

Disability-free life expectancy by health region (with Nancy Ross, Jean-Marie Berthelot and Russell Wilkins), 2002; 13(4): 49-60.

Millar, Wayne J.

Accidents in Canada, 1988 and 1993, 1995; 7(2): 7-16.

Breastfeeding practices (with Heather Maclean), 2005; 16(2): 23-31.

Childhood asthma (with Gerry B. Hill), 1998; 10(3): 9-21.

Chronic pain, 1996; 7(4): 47-53.

Declining cesarean section rates: a continuing trend? (with Cyril Nair and Surinder Wadhwa), 1996; 8(1): 17-24.

Dental consultations, 2004; 16(1): 41-4.

Dental insurance and use of dental services (with David Locker), 1999; 11(1): 55-67.

Disparities in prescription drug insurance coverage, 1999; 10(4): 11-31.

Edentulism and denture use (with David Locker), 2005; 17(1): 55-8.

Factors associated with bicycle helmet use (with Ivan B. Pless), 1997; 9(2): 31-9.

Folic acid supplementation, 2004; 15(3): 49-52.

Health care services—recent trends (with Helen Johansen), 1999; 11(3): 91-109.

Hearing problems among seniors, 2005; 16(4): 49-52.

Hip and knee replacement, 2002; 14(1): 37-50.

Hysterectomy, 1981/82 to 1996/97, 2001; 12(2): 9-22.

Life expectancy of Canadians, 1995; 7(3): 23-6.

Maternal education and risk factors for small-for-gestational-age births (with Jiajian Chen), 1998; 10(2): 43-51.

Multiple medication use among seniors, 1998; 9(4): 11-7.

Older drivers—a complex public health issue, 1999; 11(2): 59-71.

Patterns of use—alternative health care practitioners, 2001; 13(1): 9-21.

Pregnancy and smoking (with Gerry Hill), 2004; 15(4): 53-6.

Reaching smokers with lower educational attainment, 1996; 8(2): 11-9.

The elimination of disease: a mixed blessing (with Gerry B. Hill), 1995; 7(3): 7-13.

Tracking diabetes: Prevalence, incidence and risk factors (with T. Kue Young), 2003; 14(3): 35-47.

Trends in mortality and hospital morbidity due to abdominal aortic aneurysms (with C.W. Cole and Gerry B. Hill), 1995; 7(1): 19-27.

Vision problems among seniors, 2004; 16(1): 45-9.

Moss, Kathleen

Witnessing violence—aggression and anxiety in young children, 2003; 14(Suppl.): 53-66.

Nabalamba, Alice

Going to the doctor (with Wayne J. Millar), 2007; 18(1): 23-35.

Inflammatory bowel disease—hospitalization (with Charles N. Bernstein and Craig Seko), 2004; 15(4): 25-40.

Nault, François

Deaths 1993 (with Kathryn Wilkins), 1995; 7(1): 51-60.

Infant mortality and low birthweight, 1975 to 1995, 1997; 9(3): 39-46.

Narrowing mortality gaps, 1978 to 1995, 1997; 9(1): 35-41.

Twenty years of marriages, 1996; 8(2): 39-47.

Neutel, C. Ineke

Shorter hospital stays for breast cancer (with Ru-Nie Gao, Leslie Gaudette and Helen Johansen), 2004; 16(1): 19-31.

Ng, Edward

Disability among Canada's Aboriginal peoples in 1991, 1996; 8(1): 25-32.

How far to the nearest physician? (with Russell Wilkins, Jason Pole and Owen B. Adams), 1997; 8(4): 19-31.

The impact of estimation method and population adjustment on Canadian life table estimates (with Jane F. Gentleman), 1995; 7(3): 15-22.

Orpana, Heather

Trends in weight change among Canadian adults (with Mark S. Tremblay and Philippe Fines), 2007; 18(2): 9-16.

Park, Jungwee

Adolescent self-concept and health into adulthood, 2003; 14(Suppl.): 41-52.

Medically unexplained physical symptoms (with Sarah Knudson), 2007; 18(1): 43-7.

Use of alternative health care, 2005; 16(2): 39-42.

Parsons, Greg F.

Gender differences in abdominal aortic aneurysm surgery (with Jane F. Gentleman and K. Wayne Johnston), 1997; 9(1): 9-18.

Pérez, Claudio E.

Children who become active, 2003; 14(Suppl.): 17-28.

Chronic back problems among workers, 2000; 12(1): 41-55.

Fruit and vegetable consumption, 2002; 13(3): 23-31.

Health status and health behaviour among immigrants, 2002; 13(Suppl.): 89-100.

Ontario hospitals—mergers, shorter stays and readmissions, 2002; 14(1): 25-36.

Passengers of intoxicated drivers, 2005; 16(2): 35-7.

Personal health practices: Smoking, drinking, physical activity and weight, 1999; 11(3): 83-90.

Second-hand smoke exposure—who's at risk? 2004; 16(1): 9-17.

The health of lone mothers (with Marie P. Beaudet), 1999; 11(2): 21-32.

Ramage-Morin, Pamela L.

Creutzfeldt-Jakob disease, 2004; 15(4): 49-51.

Panic disorder and coping, 2004; 15(Suppl.): 31-43.

Successful aging in health care institutions, 2006; 16(Suppl.): 47-56.

Randhawa, Jean

Mental health statistics, 1982-83 to 1993-94 (with Rod Riley), 1996; 7(4): 55-61.

Trends in hospital utilization, 1982-83 to 1992-93 (with Rod Riley), 1995; 7(1): 41-9.

Roberge, Roger

The Health Utility Index: measuring health differences in Ontario by socioeconomic status (with Jean-Marie Berthelot and Michael Wolfson), 1995; 7(2): 25-32.

Ross, Nancy

Attitudes toward smoking (with Claudio Pérez), 1998; 10(3): 23-33.

Community belonging and health, 2002; 13(3): 33-9.

Rotermann, Michelle

Infection after cholecystectomy, hysterectomy or appendectomy, 2004; 15(4): 11-23.

Marital breakdown and subsequent depression, 2007; 18(2): 33-44.

Second or subsequent births to teenagers, 2007; 18(1): 39-42.

Seniors' health care use, 2006; 16(Suppl.): 33-45.

Sex, condoms and STDs among young people, 2005; 16(3): 39-45.

Sanmartin, Claudia

Changes in unmet health care needs (with Christian Houle, Stéphane Tremblay and Jean-Marie Berthelot), 2002; 13(3): 15-22.

Schultz, Susan E.

Impact of chronic conditions (with Jacek A. Kopec), 2003; 14(4): 41-53.

Shields, Margot

Determinants of self-perceived health (with Shahin Shooshtari), 2001; 13(1): 35-52.

Health among older adults (with Jiajian Chen), 1999; 11(3): 47-61.

The health of Canada's communities (with Stéphane Tremblay), 2002; 13(Suppl.): 9-32.

Healthy living among seniors (with Laurent Martel), 2006; 16(Suppl.): 7-20.

The journey to quitting smoking, 2005; 16(3): 19-36.

Long working hours and health, 1999; 11(2): 33-48.

Overweight and obesity among children and youth, 2006; 17(3): 27-42.

Proxy reporting in the National Population Health Survey, 2000; 12(1): 21-39.

Proxy reporting of health information, 2004; 15(3): 21-33.

Regional differences in obesity (with Michael Tjepkema), 2006; 17(3): 61-7.

Shift work and health, 2002; 13(4): 11-33.

Smoking—prevalence, bans and exposure to second-hand smoke, 2007; 18(3): 67-85.

Smoking bans: Influence on smoking prevalence, 2007; 18(3): 9-24.

Social anxiety disorder—beyond shyness, 2004; 15(Suppl.): 45-61.

Stress and depression in the employed population, 2006; 17(4): 11-29.

Stress, health and the benefit of social support, 2004; 15(1): 9-38.

Trends in adult obesity (with Michael Tjepkema), 2006; 17(3): 53-9.

Unhappy on the job, 2006; 17(4): 33-7.

Use of wheelchairs and other mobility support devices, 2004; 15(3): 37-41.

Youth smoking, 2005; 16(3): 53-57.

St-Arnaud, Julie

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