Health Reports

Vol. 18 No. 4

- Flu shots
- Health care providers and work stress
- Birth outcomes
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x suppressed to meet the confidentiality requirements of the Statistics Act

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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
Jeff C. Kwong (416-480-4055 ext 7665; jeff.kwong@ices.on.ca) and Laura C. Rosella are with the Institute for Clinical Evaluative Sciences in Toronto; Helen Johansen is with the Health Information and Research Division at Statistics Canada in Ottawa.

Annual influenza epidemics continue to place a significant burden on society in terms of morbidity, mortality and lost productivity. 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.

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. 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. These targets were raised to 80% at another
consensus conference in 2005. 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.

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

The remaining provinces continue with targeted immunization programs, although the groups that are covered vary. Among the territories, Yukon has provided free influenza vaccines to all residents aged 18 or older since 1999; Northwest Territories has offered free influenza vaccines since 2003; and Nunavut introduced universal vaccination in the fall of 2005.


Methods
Data sources
This analysis used the master files for the 1996/1997 cycle of the 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.

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.

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.

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.\textsuperscript{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.\textsuperscript{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

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<td>23*</td>
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<td>65 to 74</td>
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<td>Effects of stroke</td>
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<tr>
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<td>Northwest Territories</td>
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<td>37*</td>
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<tr>
<td>Nunavut</td>
<td>..</td>
<td>24</td>
<td>25</td>
<td>41*</td>
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</tbody>
</table>

* 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.

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

<table>
<thead>
<tr>
<th>Low-risk group</th>
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<tr>
<td><strong>Aged 12 to 64</strong></td>
<td><strong>Aged 12 to 64</strong></td>
<td><strong>Aged 65 or older</strong></td>
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<tr>
<td>with no chronic conditions</td>
<td>with at least one chronic condition</td>
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<td>18*</td>
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<td><strong>Province or territory</strong></td>
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<td>9E</td>
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† 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)
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.

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### Chart 1
Percentage vaccinated for influenza, by age group and presence of chronic conditions, household population aged 12 or older, Canada, 2005

**Target set in 2005 for 65 or older and those with chronic conditions**

**Target set in 1993 for 65 or older and those with chronic conditions**

- **Chronic conditions**
  - None
  - At least one

**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

<table>
<thead>
<tr>
<th>Vaccination rate</th>
<th>Adjusted odds ratio</th>
<th>95% confidence interval</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>34</td>
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<td><strong>Sex</strong></td>
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<tr>
<td>Males†</td>
<td>31</td>
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</tr>
<tr>
<td>Females</td>
<td>36*</td>
<td>1.22*</td>
</tr>
<tr>
<td><strong>Age group</strong></td>
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<td></td>
</tr>
<tr>
<td>12 to 19†</td>
<td>23</td>
<td>1.00</td>
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<tr>
<td>20 to 49</td>
<td>23</td>
<td>1.10*</td>
</tr>
<tr>
<td>50 to 64</td>
<td>42*</td>
<td>2.40*</td>
</tr>
<tr>
<td>65 to 74</td>
<td>66*</td>
<td>6.55*</td>
</tr>
<tr>
<td>75 to 84</td>
<td>77*</td>
<td>10.57**</td>
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<td>85 or older</td>
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<tr>
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<td>53*</td>
<td>1.89*</td>
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<tr>
<td>Lowest†</td>
<td>34</td>
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<tr>
<td>Lower-middle</td>
<td>37*</td>
<td>1.05*</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>33</td>
<td>1.13*</td>
</tr>
<tr>
<td>Highest</td>
<td>33</td>
<td>1.28*</td>
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<tr>
<td><strong>Smoking status</strong></td>
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<tr>
<td>Never†</td>
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<tr>
<td>Former</td>
<td>39*</td>
<td>1.03*</td>
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<tr>
<td>Daily or occasional</td>
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<td>0.74*</td>
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<tr>
<td><strong>Has regular doctor</strong></td>
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<td></td>
</tr>
<tr>
<td>No†</td>
<td>15</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>37*</td>
<td>2.01*</td>
</tr>
<tr>
<td><strong>Self-reported health</strong></td>
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<td></td>
</tr>
<tr>
<td>Good or very good or excellent†</td>
<td>32</td>
<td>1.00</td>
</tr>
<tr>
<td>Poor or fair</td>
<td>50*</td>
<td>1.23*</td>
</tr>
<tr>
<td><strong>Province or territory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario†</td>
<td>42</td>
<td>1.00</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>22*</td>
<td>0.33*</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>31*</td>
<td>0.54*</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>39*</td>
<td>0.77*</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>28*</td>
<td>0.45*</td>
</tr>
<tr>
<td>Quebec</td>
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<td>0.42*</td>
</tr>
<tr>
<td>Manitoba</td>
<td>26*</td>
<td>0.47*</td>
</tr>
<tr>
<td>Saskatchewan</td>
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<td>0.46*</td>
</tr>
<tr>
<td>Alberta</td>
<td>28*</td>
<td>0.52*</td>
</tr>
<tr>
<td>British Columbia</td>
<td>33*</td>
<td>0.61*</td>
</tr>
<tr>
<td>Yukon</td>
<td>32*</td>
<td>0.72*</td>
</tr>
<tr>
<td>Northwest Territories</td>
<td>37*</td>
<td>1.36*</td>
</tr>
<tr>
<td>Nunavut</td>
<td>41</td>
<td>2.20*</td>
</tr>
</tbody>
</table>

† 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  

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

† chi-squared test for trend  
* significantly different 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.

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

No chronic conditions

At least one chronic condition

ærages 12 to 49

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario</td>
<td>13</td>
<td>18</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>Other provinces</td>
<td>18</td>
<td>39</td>
<td>36</td>
<td>39</td>
</tr>
</tbody>
</table>

ærages 50 to 64

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario</td>
<td>27</td>
<td>40</td>
<td>58</td>
<td>59</td>
</tr>
<tr>
<td>Other provinces</td>
<td>27</td>
<td>40</td>
<td>58</td>
<td>59</td>
</tr>
</tbody>
</table>

ærages 65 or older

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontario</td>
<td>52</td>
<td>69</td>
<td>82</td>
<td>80</td>
</tr>
<tr>
<td>Other provinces</td>
<td>52</td>
<td>69</td>
<td>82</td>
<td>80</td>
</tr>
</tbody>
</table>

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

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. Other avian influenza viruses such as H7N7 (the Netherlands, February 2003) and H7N3 (British Columbia, February 2004) 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. 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, 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. 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. 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. 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.

Acknowledgement

Jeff C. Kwong is supported by a Fellowship Award from the Canadian Institute for Health Research.
References


10. A-M Frescura, Public Health Agency of Canada (personal communication)


15. Colleen Hemsley, Yukon (personal communication)

16. Wanda White, Northwest Territories (personal communication)


### Appendix

#### Table A

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

<table>
<thead>
<tr>
<th>Sample size</th>
<th>Estimated population '000</th>
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</thead>
<tbody>
<tr>
<td>Total</td>
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<tr>
<td>Males</td>
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<td>Females</td>
<td>72,037</td>
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<tr>
<td><strong>Age group</strong></td>
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<tr>
<td>12 to 49</td>
<td>74,359</td>
</tr>
<tr>
<td>12 to 19</td>
<td>16,397</td>
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<tr>
<td>20 to 49</td>
<td>57,962</td>
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<td>50 to 64</td>
<td>30,391</td>
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<td>65 or older</td>
<td>28,197</td>
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<td>65 to 74</td>
<td>15,032</td>
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<tr>
<td>75 to 84</td>
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<tr>
<td>85 or older</td>
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<td><strong>Education</strong></td>
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<tr>
<td>Secondary graduation</td>
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<tr>
<td>At least some postsecondary</td>
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<td><strong>Household income</strong></td>
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<td>Lowest</td>
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<td>Lower-middle</td>
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<td>Poor or fair</td>
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<td>Effects of stroke</td>
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<td>Emphysema or chronic bronchitis</td>
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<td>Saskatchewan</td>
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<td>Alberta</td>
<td>11,800</td>
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<td>15,407</td>
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<td>Yukon</td>
<td>868</td>
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<tr>
<td>Northwest Territories</td>
<td>1,007</td>
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<tr>
<td>Nunavut</td>
<td>783</td>
</tr>
<tr>
<td><strong>Had flu shot in past year</strong></td>
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</tr>
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<td>Yes</td>
<td>47,333</td>
</tr>
<tr>
<td>No</td>
<td>82,126</td>
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</table>

**Source:** 2005 Canadian Community Health Survey, cycle 3.1.
Birth outcomes by neighbourhood income and recent immigration in Toronto

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

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,” 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 study found lower perinatal mortality among the offspring of Chinese compared with White women. Another study 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. 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. 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. 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.

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, 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. 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. 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. 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 Diseases 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>
<thead>
<tr>
<th>Below low-income cutoff</th>
<th>1996</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>All quintiles</td>
<td>27.6</td>
<td>16.6</td>
</tr>
<tr>
<td>Q1 (highest)</td>
<td>11.9</td>
<td>9.4</td>
</tr>
<tr>
<td>Q2</td>
<td>23.1</td>
<td>17.2</td>
</tr>
<tr>
<td>Q3</td>
<td>29.2</td>
<td>24.3</td>
</tr>
<tr>
<td>Q4</td>
<td>35.7</td>
<td>28.8</td>
</tr>
<tr>
<td>Q5 (lowest)</td>
<td>47.9</td>
<td>41.8</td>
</tr>
<tr>
<td>Ratio (Q5/Q1)</td>
<td>4.0</td>
<td>4.4</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Total</th>
<th>Neighbourhood income quintile</th>
<th>Recent* immigration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1 (highest)</td>
<td>Q2</td>
</tr>
<tr>
<td>Singleton live births (number)</td>
<td>143,030</td>
<td>28,512</td>
</tr>
<tr>
<td>Outcomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preterm birth</td>
<td>5.3</td>
<td>4.7</td>
</tr>
<tr>
<td>Low birthweight</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Full-term low birthweight</td>
<td>1.9</td>
<td>1.4</td>
</tr>
<tr>
<td>Maternal and infant characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recent immigrant</td>
<td>31.5</td>
<td>17.3</td>
</tr>
<tr>
<td>Maternal age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 20</td>
<td>3.6</td>
<td>1.8</td>
</tr>
<tr>
<td>20 to 34</td>
<td>74.3</td>
<td>68.2</td>
</tr>
<tr>
<td>35 or more</td>
<td>22.1</td>
<td>30.0</td>
</tr>
<tr>
<td>Maternal illness</td>
<td>12.5</td>
<td>11.6</td>
</tr>
<tr>
<td>Cesarean section</td>
<td>20.2</td>
<td>19.6</td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 26</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>26 to 37</td>
<td>4.9</td>
<td>4.5</td>
</tr>
<tr>
<td>38 to 41</td>
<td>94.2</td>
<td>94.8</td>
</tr>
<tr>
<td>42 or more</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Male infant sex</td>
<td>51.3</td>
<td>51.3</td>
</tr>
</tbody>
</table>

* 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.
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 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**

<table>
<thead>
<tr>
<th>Neighbourhood income quintiles</th>
<th>Preterm birth</th>
<th>Low birthweight</th>
<th>Full-term low birthweight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude odds ratio</td>
<td>95% confidence interval</td>
<td>Adjusted odds ratio</td>
</tr>
<tr>
<td>Q1 (highest)†</td>
<td>1.00</td>
<td>...</td>
<td>1.00</td>
</tr>
<tr>
<td>Q2</td>
<td>1.12* 1.03 to 1.20</td>
<td>1.14* 1.05 to 1.25</td>
<td>1.26* 1.16 to 1.37</td>
</tr>
<tr>
<td>Q3</td>
<td>1.12* 1.04 to 1.21</td>
<td>1.16 1.06 to 1.27</td>
<td>1.29* 1.19 to 1.40</td>
</tr>
<tr>
<td>Q4</td>
<td>1.15* 1.06 to 1.23</td>
<td>1.19* 1.09 to 1.30</td>
<td>1.33* 1.23 to 1.44</td>
</tr>
<tr>
<td>Q5 (lowest)</td>
<td>1.19* 1.11 to 1.28</td>
<td>1.25* 1.15 to 1.37</td>
<td>1.50* 1.39 to 1.62</td>
</tr>
</tbody>
</table>

**Recent immigrant**

<table>
<thead>
<tr>
<th></th>
<th>Preterm birth</th>
<th>Low birthweight</th>
<th>Full-term low birthweight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude odds ratio</td>
<td>95% confidence interval</td>
<td>Adjusted odds ratio</td>
</tr>
<tr>
<td>No†</td>
<td>1.00</td>
<td>...</td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>0.89* 0.84 to 0.93</td>
<td>0.89* 0.84 to 0.95</td>
<td>1.06* 1.01 to 1.12</td>
</tr>
</tbody>
</table>

† 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.

#### 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**

<table>
<thead>
<tr>
<th>Neighbourhood income quintiles</th>
<th>Preterm birth†</th>
<th>Low birthweight†</th>
<th>Full-term low birthweight†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adjusted odds ratio</td>
<td>95% confidence interval</td>
<td>Adjusted odds ratio</td>
</tr>
<tr>
<td>Q1 (highest)†</td>
<td>1.00</td>
<td>...</td>
<td>1.00</td>
</tr>
<tr>
<td>Q2</td>
<td>1.15* 1.05 to 1.26</td>
<td>1.05 0.88 to 1.27</td>
<td>1.32* 1.18 to 1.48</td>
</tr>
<tr>
<td>Q3</td>
<td>1.19* 1.09 to 1.30</td>
<td>1.01 0.85 to 1.21</td>
<td>1.36* 1.21 to 1.53</td>
</tr>
<tr>
<td>Q4</td>
<td>1.24* 1.13 to 1.35</td>
<td>1.02 0.85 to 1.21</td>
<td>1.30* 1.16 to 1.47</td>
</tr>
<tr>
<td>Q5 (lowest)</td>
<td>1.34* 1.22 to 1.46</td>
<td>1.03 0.87 to 1.22</td>
<td>1.48* 1.31 to 1.67</td>
</tr>
</tbody>
</table>

P value†† 0.0221 0.0497 0.0151

† reference category
‡ adjusted for infant sex and maternal age group
§ also adjusted for gestational age group
* 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, but not always, produces attenuated (and therefore, conservative) effect estimates. Nonetheless, area-based measures can be conceptualized as meaningful socioeconomic 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). 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.

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 socioeconomic 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. 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.

Acknowledgements
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References


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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 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.

**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 group reporting high work stress.

**Table 1**

<table>
<thead>
<tr>
<th>Percentage of health care providers reporting high work stress, by selected work-related and personal factors, household population aged 18 to 75, Canada, 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total health care workers</strong></td>
</tr>
<tr>
<td><strong>Work-related factors</strong></td>
</tr>
<tr>
<td>Personal income</td>
</tr>
<tr>
<td>Less than $20,000</td>
</tr>
<tr>
<td>$20,000 to $39,999</td>
</tr>
<tr>
<td>$40,000 to $59,999†</td>
</tr>
<tr>
<td>$60,000 or more</td>
</tr>
<tr>
<td>Shift</td>
</tr>
<tr>
<td>Involves shiftwork</td>
</tr>
<tr>
<td>Regular day shift†</td>
</tr>
<tr>
<td>Employer</td>
</tr>
<tr>
<td>Self-employed†</td>
</tr>
<tr>
<td>Not self-employed</td>
</tr>
<tr>
<td>Weekly work hours</td>
</tr>
<tr>
<td>Less than 35†</td>
</tr>
<tr>
<td>35 to 44</td>
</tr>
<tr>
<td>45 to 79</td>
</tr>
<tr>
<td>80 or more</td>
</tr>
<tr>
<td>Personal factors</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Men†</td>
</tr>
<tr>
<td>Women</td>
</tr>
<tr>
<td>Age group</td>
</tr>
<tr>
<td>18 to 24†</td>
</tr>
<tr>
<td>25 to 34</td>
</tr>
<tr>
<td>35 to 44</td>
</tr>
<tr>
<td>45 to 54</td>
</tr>
<tr>
<td>55 to 75</td>
</tr>
<tr>
<td>Day-to-day stress</td>
</tr>
<tr>
<td>Low (not at all/not very/a bit stressful)†</td>
</tr>
<tr>
<td>High (quite/extremely)</td>
</tr>
<tr>
<td>Life satisfaction</td>
</tr>
<tr>
<td>Satisfied†</td>
</tr>
<tr>
<td>Dissatisfied</td>
</tr>
<tr>
<td>General health</td>
</tr>
<tr>
<td>Good/Very good/Excellent†</td>
</tr>
<tr>
<td>Fair/Poor</td>
</tr>
</tbody>
</table>

† reference category  
* significantly different from estimate for reference category (p < 0.05)  
Source: 2003 Canadian Community Health Survey, cycle 2.1.

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. 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
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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### Table 2

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

† 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.

### References

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. 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. Although significant declines in independence and increases in need for support were noted, these people were able to rejoin the household population.

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

| Estimated number and median age of adults aged 60 or older, by fracture and/or effects of stroke status, household population, Canada, 2003 |
|:--|:--|:--|
| Fracture in past year and/or effects of stroke | Estimated number | Median age (years) |
| 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.
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. By comparison, individuals who were implicated as a risk factor for fall-related fractures 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

<table>
<thead>
<tr>
<th>Arthritis/Rheumatism</th>
<th>Chronic condition(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 or more</td>
</tr>
<tr>
<td>Hip fracture, no stroke†</td>
<td>66</td>
</tr>
<tr>
<td>Thigh, knee, lower leg, ankle, or foot fracture, no stroke</td>
<td>54</td>
</tr>
<tr>
<td>Shoulder, arm, wrist, or hand fracture, no stroke</td>
<td>51</td>
</tr>
<tr>
<td>Effects of stroke, no fracture</td>
<td>51*</td>
</tr>
<tr>
<td>No fracture, no effects of stroke</td>
<td>43*</td>
</tr>
</tbody>
</table>

* significantly different from corresponding estimate for reference category (p < 0.05)
† reference category
$ not applicable
$ 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...
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

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

* 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 children only or with 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 bathing, 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?”

**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?”

**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.

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.
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

<table>
<thead>
<tr>
<th>Needed help with ADL or IADL tasks</th>
<th>Needed help with ADL tasks</th>
<th>Received government-subsidized home care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fracture in past year and/or effects of stroke</strong></td>
<td><strong>Fracture in past year and/or effects of stroke</strong></td>
<td><strong>Fracture in past year and/or effects of stroke</strong></td>
</tr>
<tr>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
<td><strong>Odds ratio</strong></td>
</tr>
<tr>
<td>Hip fracture, no stroke</td>
<td>4.1*</td>
<td>2.0 to 8.5</td>
</tr>
<tr>
<td>Thigh, knee, lower leg, ankle or foot fracture, no stroke</td>
<td>1.3</td>
<td>0.8 to 2.0</td>
</tr>
<tr>
<td>Shoulder, arm, wrist or hand fracture, no stroke</td>
<td>1.4</td>
<td>1.0 to 2.1</td>
</tr>
<tr>
<td>Effects of stroke, no fracture</td>
<td>4.1</td>
<td>3.2 to 5.2</td>
</tr>
<tr>
<td>No fracture, no effects of stroke†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td><strong>Age‡</strong></td>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
</tr>
<tr>
<td>Men</td>
<td>0.4*</td>
<td>0.4 to 0.4</td>
</tr>
<tr>
<td>Women†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td><strong>Living arrangements</strong></td>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
</tr>
<tr>
<td>With kin</td>
<td>0.8*</td>
<td>0.7 to 0.9</td>
</tr>
<tr>
<td>With others, other living arrangements</td>
<td>1.2</td>
<td>1.0 to 1.5</td>
</tr>
<tr>
<td>Alone†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td><strong>Very strong sense of community belonging</strong></td>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
</tr>
<tr>
<td>Yes</td>
<td>0.8*</td>
<td>0.8 to 0.9</td>
</tr>
<tr>
<td>No†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
</tr>
<tr>
<td>Postsecondary graduation†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td>Some postsecondary</td>
<td>0.9</td>
<td>0.7 to 1.1</td>
</tr>
<tr>
<td>Secondary graduation</td>
<td>0.9</td>
<td>0.8 to 1.0</td>
</tr>
<tr>
<td>Less than secondary graduation</td>
<td>1.2*</td>
<td>1.1 to 1.3</td>
</tr>
<tr>
<td><strong>Chronic condition(s)</strong></td>
<td><strong>Odds ratio</strong></td>
<td><strong>95% confidence interval</strong></td>
</tr>
<tr>
<td>None or one†</td>
<td>1.0</td>
<td>...</td>
</tr>
<tr>
<td>Two or more</td>
<td>2.8*</td>
<td>2.6 to 3.1</td>
</tr>
</tbody>
</table>

* 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. 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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