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Table of Contents

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Chronic Diseases in Canada
Public Health Agency of Canada
130 Colonnade Road
Address Locator: 6501G
Ottawa, Ontario K1A 0K9

Fax: (613) 941-3605
E-mail: cdic-mcc@phac-aspc.gc.ca

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Prevalence and predictors of depression in elderly Canadians: The Canadian Study of Health and Aging

Truls Østbye, Betsy Kristjansson, Gerry Hill, Stephen C Newman, Rebecca N Brouwer and Ian McDowell

Abstract

Depression in elderly Canadians is an important but often unrecognized public health problem. Numerous studies have examined depression in the general community, but studies of depression in the elderly have generally been small and limited. The Canadian Study of Health and Aging (CSHA) includes a large and national representation of both the cognitively intact and the cognitively impaired elderly. The current analyses of 2,341 participants from the CSHA who completed a clinical rating scale for depression have two objectives: 1) to determine the prevalence of minor and major depression and 2) to examine the importance of several risk factors. The prevalences of major and minor depression were 2.6 percent and 4.0 percent, respectively, and were higher for females, specifically those in institutions, those who reported that their health problems limited activities, and those with chronic health conditions. Women were more likely to exhibit depression (OR = 3.5; 95% CI: 1.4-8.8) than men, and those with dementia more likely to exhibit depression than those without (OR = 2.4; 95% CI: 0.9–3.1). Depression is a significant mental health problem among elderly Canadians, particularly among women and those with physical limitations. More attention should be paid to the detection and treatment of depression in the elderly, particularly among those most at risk.

Key words: *Canadian, depression, elderly, prevalence, risk factor, survey*

Introduction

Depression is an important public health problem, causing personal distress, problems with interpersonal relationships and an inability to function in daily societal roles. In extreme cases it can lead to suicide. However, depression is likely under-diagnosed in the elderly and, when diagnosed, often under-treated.[1,2,3] The presence of dementia in the elderly can make the assessment of depression difficult. Accurate prevalence estimates are important for both clinicians and health policy planners.

Numerous studies from several different countries have examined the prevalence of depression among the elderly living in the community. These studies have differed in sample size, location, community sampled, the instrument used to estimate prevalence and definition of major, minor or overall depression. Many of these studies have been too restricted to estimate the prevalence of major depression with precision. Nevertheless, when the smaller studies are aggregated, reasonably consistent results are obtained. Combining earlier studies and reviews,[4–7] we have estimated the overall prevalence of major depression among those 65 years of age and above to be 2.4 percent, and the prevalence of all forms of depression to be 12.3 percent in the same age group. The prevalence of depression appears to be higher in samples of elderly people receiving home care, in residential care, in rehabilitation and in those seeking treatment in emergency rooms; estimates range from 13 percent among outpatients to 50 percent among nursing home residents.[8]

Studies of depression in Canada[9] and the United States[5] have shown the prevalence of depression to be inversely related to age, to be higher in women than men, inversely related to education and income, and higher in the unmarried than the married. A follow-up of a Canadian sample has shown that these patterns hold for incident depression and that smoking, the presence of chronic conditions and lack of social support are risk factors.[10] The noted decline in the prevalence of depression with age has been the subject of much discussion since it is contrary to the general clinical impression of a higher risk in the elderly.[11,12] Gender, marital status and education are fairly well documented determinants of dysphoria in the elderly, but the importance of these factors in relation to major depression needs to be estimated more precisely. The importance of lifestyle factors and comorbidity to depression also needs to be clarified.

Cohort studies have identified both illness and disability as independent risk factors for depression in the elderly.[13,14] In a Canadian cross-sectional study, Østbye et al.[15] found significant associations between dysphoria and restriction in activities of daily living, poor health (self-rated), severe pain, arthritis in women, digestive problems in men and diabetes in women, after adjustment for confounding variables.

Although several population studies of depression in the elderly have been

Author References

Truls Østbye, Rebecca N Brouwer, Duke University, Department of Community and Family Medicine, Durham, North Carolina, USA
Betsy Kristjansson, Ian McDowell, University of Ottawa, Ottawa, Ontario, Canada
Stephen C Newman, University of Alberta, Edmonton, Alberta, Canada
Gerry Hill, Queens University, Kingston, Ontario, Canada
Correspondence: Truls Ostbye, Duke University, Department of Community and Family Medicine, DUMC Box 2914, Durham, NC 27710 USA; fax: (919) 684-8675; e-mail: truls.ostbye@duke.edu

conducted, certain problems limit the accuracy of the findings and our ability to generalize from them. For example, samples have typically been limited to those elderly living in the community. Also, they have usually not included clinical assessments. Additionally, minor and major depression have usually not been considered separately.

In this examination, we use clinical diagnostic data from a large population-based study of elderly Canadians living in the community and in institutions to 1) determine the prevalence of minor and major depression and 2) examine the relative importance of several risk factors proposed in the literature for clinically diagnosed depression.

Methods

Sample

The Canadian Study of Health and Aging (CSHA) is a longitudinal, population-based epidemiological study whose objectives covered the prevalence, incidence and the risk factors for dementia, and patterns of care for elderly with and without dementia in Canada. Supplementary objectives covered broader aspects of health and disability. The CSHA began in 1991, with follow-up assessments in 1996 and 2001; 10,263 people aged 65 and older were involved in the study cohort. Age- and sex-stratified samples were drawn in the community (n = 9,008) and in institutions (n = 1,255). A two-stage procedure was used in the community; a cognitive screening test was followed by a clinical examination. Participants were screened for cognitive impairment with the Modified Mini-Mental State Examination (3MS)[16]; all participants who screened positive (scores < 78) and a sample of those who screened negative were asked to attend a clinical examination consisting of an extensive clinical history, a physical exam and neuropsychological testing. All institutional residents completed the clinical examination. The 2,914 subjects who underwent a clinical exam (1,659/community, 1,255/ institution) in 1991 will be referred to as the "clinical sample"; they were attributed a physician's rating of depression. Within the clinical sample, all subjects with a missing value on any of the depression variables ("Don't know" or non-response) were not considered for further analyses. Thus, the resulting 2,341 subjects will be referred to as the "clinical analysis sample" and are the primary focus of the current analyses.

In addition, several self-reported health measures were obtained for a subset of people living in the community. The 1,421 subjects with these health measures available will be referred to as the "community sample" (community dwelling elderly people who had screened either negative [n = 457] or positive [n = 964] on the 3MS).

Measures

All subjects who participated in the clinical examination were interviewed by study physicians using a questionnaire that included a 12-item clinical rating scale for depression. These items represent nine symptoms comprising criterion A of the DSM-III-R definition for major depression[17] (see Appendix 1). To meet criteria for a major depressive episode, the subject had to exhibit at least five of nine symptoms; the symptoms must have included either depressed mood or markedly diminished interest or pleasure in activities. Criteria for minor depression required that the subject exhibit two to four of nine symptoms. Also required was a confirmative answer to a question on whether most of the symptoms occurred in the same two- week period.

In order to examine risk factors, we developed two logistic regression models. For the clinical analysis sample, the independent variables considered were age, gender, marital status, dementia and location of residence. For the community sample, the independent variables considered were age, gender, marital status, dementia, services, overall health, interference of health problems with activities, sensory impairment, chronic disease, problems with an organ system (heart or respiratory disease, kidney problems or incontinence), currently taking an antidepressant, and level of education.

Analyses

Because of the two-stage design in the community sample and because different sampling fractions were used in different age- and sex-groups, it was necessary to calculate survey weights to derive representative population estimates.[18] The calculation of study weights made use of census counts for Canada, 1991, according to region (Atlantic, Quebec, Ontario, Prairies, British Columbia), age (65–74, 75–84, 85+), gender and place of residence (community, institution). Based on 3MS screening data, the proportion of positively screened community residents was used to estimate the number of individuals in the Canadian population who would have screened positive. In this way, census counts were stratified by region, age, gender and screening status (i.e. community positive, community negative, institution). Survey weights for the clinical analysis sample were calculated using the clinical sample weighting approach. The weighted proportion of people over 65 with DSM-III-R[17] symptoms of major and minor depression and the associated standard errors were calculated using SUDAAN (Research Triangle Institute, Research Triangle Park, NC, 1992), a statistical package designed for the analysis of complex survey data. The study was approved by the ethics committees of the 18 participating centers in Canada as well as by the Institutional Review Board at Duke University Medical Center.

Multivariate analyses

Using SUDAAN, logistic regression analysis was performed on the clinical analysis and community samples, with the presence of major or minor depression as the outcomes. Final multivariate models were constructed using a step-up approach. Only main effects models were considered; no interaction terms were included. Given the association between age and depression in previous studies, age was included in all models. For the other independent variables, a (conservative) *p*-value of 0.10 was selected as the cut-off for the Wald test as a criterion for inclusion into the models.

Finally, we compared the characteristics of the full clinical sample (n = 2,914) to the clinical analysis sample (n = 2,341) in order to determine if there were any systematic differences.

Results

The prevalence of depression

Table 1 gives the prevalence rates of DSM-III-R depression based on the clinical analysis sample by subgroup. The prevalence of major depression among Canadians who were 65 and older was 2.6 percent (95% CI: 1.0–4.2), while the prevalence of minor depression was 4.0 percent (95% CI: 0.97–7.1). The prevalences of both major and minor depression were higher for females (9.3 percent overall; 95% CI: 3.7–15.0) than for males (2.9 percent overall; 95% CI: 1.5–4.2). The prevalence of major depression was higher for people in institutions (7.7 percent; 95% CI: 5.6–9.8) than for those in the community (2.2 percent; 95% CI: 0.5–3.9). However, there was little difference in the prevalence of minor depression between people in institutions (5.0 percent; 95% CI: 3.1–7.0) and that of those in the community (4.0 percent; 95% CI: 0.7–7.2). Similarly, the prevalence of major depression was much higher (9.5 percent; 95% CI: 3.2–15.8) for people with dementia than for those without dementia (2.1 percent; 95% CI: 0.4–3.7), while the difference in minor depression between people with and without dementia was slight.

Across age groups, females had consistently higher prevalences of major depression than males, the largest difference being in the youngest age group. The prevalence of major depression was higher in the middle age groups for both males and females. The prevalence of minor depression rose with age for men, while for women the prevalence was highest in the youngest age group. The prevalence of minor depression was higher among females than males in the youngest age group, but this relationship was reversed above age 75, where the prevalence was higher among males.

In analyses (unadjusted) of the community sample (Table 1), factors associated with depression included poorer overall health, the interference of health problems with activities, sensory impairment, chronic disease, diseases of organ system, and education.

TABLE 1
Canadian Study of Health and Aging: Prevalence of major and minor depression in clinical analysis and community samples (95% CI)

Variable	Major depression		Minor depression		Major or minor depression	
Clinical analysis sample (N = 2,341)	%	CI	%	CI	%	CI
All	2.6	1.0, 4.2	4.0	1.0, 7.1	6.6	3.2, 10.1
Males – all	1.5	0.3, 2.6	1.4	0.7, 2.1	2.9	1.5, 4.2
Males age 65–74	0.6	0,0 1.1	0.4	0.0, 0.8	1.0	0.2, 1.9
Males age 75–84	3.4	0.2, 32.0	2.6	0.7, 4.4	5.9	2.3, 9.5
Males age 85 +	2.1	0.3, 13.9	5.7	1.7, 9.8	7.9	3.7, 12.3
Females – all	3.4	0.7, 6.0	6.0	0.8, 11.1	9.3	3.7, 15.0
Females age 65–74	2.9	0.1, 7.1	8.5	0.0, 17.5	11.3	0.2, 22.5
Females age 75–84	4.2	0.9, 7.5	2.4	0.8, 4.0	6.6	2.3, 9.5
Females age 85 +	3.8	2.1, 5.4	3.7	1.0, 6.5	7.5	3.5, 12.3
Marital status						
Married, common law	2.5	0.2, 5.2	1.1	0.5, 1.6	3.5	0.8, 6.3
Never married	1.6	0.3, 3.0	2.3	0.0, 4.9	3.9	0.9, 6.9
Widowed/separated/divorced	2.9	1.2, 4.6	8.5	0.0, 15.9	11.4	3.9, 18.9
Residence						
Institution	7.7	5.6, 9.8	5.0	3.1, 7.0	12.7	9.9, 15.5
Community	2.2	0.5, 3.9	4.0	0.7, 7.2	6.2	2.5, 9.8
Dementia						
Yes	9.5	3.2, 15.8	4.7	2.8, 6.6	14.2	7.9, 20.5
No	2.1	0.4, 3.7	4.0	0.7, 7.3	6.0	2.4, 9.7
Community sample (N = 1,421)						
Overall health						
Very good	0.03	0.0, 0.1	0.8	0.0, 1.5	0.8	0.0, 1.6
Pretty good	2.3	0.0, 5.5	4.5	1.3, 5.8	6.8	8.9, 12.7
Very poor	5.2	0.9, 9.5	8.4	0.0, 20.2	13.6	1.3, 25.7
Health trouble limits activities						
Not at all	0.3	0.0, 0.6	0.6	0.1, 1.2	0.9	0.2, 1.6
A little	2.5	0.0, 6.4	3.7	0.0, 9.5	6.2	0.0, 13.1
A great deal	7.5	1.3, 13.7	16.4	0.0, 32.9	23.9	7.5, 40.2
Chronic disease						
Present	2.7	0.2, 5.3	4.5	0.0, 9.3	7.2	2.2, 12.2
Absent	0.7	0.0, 1.4	2.8	0.0, 4.1	3.5	2.8, 4.2
Disease of organ system						
Present	3.3	0.1, 6.4	7.0	0.8, 13.2	10.3	3.5, 17.1
Absent	0.7	0.0, 1.7	0.6	0.2, 1.0	1.3	0.3, 2.4
Sensory impairment						
Present	2.1	0.5, 3.8	3.4	0.0, 7.9	5.5	0.7, 10.3
Absent	2.0	0.0, 5.0	4.5	0.0, 9.3	6.5	0.9, 12.1
Education						
Primary school or less	1.0	0.3, 1.7	4.8	0.0, 11.5	5.8	0.0, 12.4
Secondary school	3.1	0.0, 7.1	0.8	0.1, 1.4	3.9	0.0, 7.9
More than high school	1.9	0.0, 7.6	7.4	0.0, 16.3	9.3	0.3, 18.4

Risk factors for depression

In the final logistic regression model for the clinical analysis sample (Table 2), only gender and dementia were significantly related to depression. Females were significantly more likely to exhibit depression than males (OR = 3.5; 95% CI: 1.4–8.8). Elderly people with dementia were significantly more likely to have depression than those without dementia (OR = 2.4; 95% CI: 1.0–5.3). Residents in institutions were more likely to have depression than those not in institutions, but the odds ratio was not significant (OR = 1.7, 95% CI: 0.9–3.1).

In the final model for the community sample, gender, activity limitations due to health problems, and diseases of organ systems were significantly related to depression. Females were significantly more likely than males to be depressed (OR = 4.7; 95% CI: 1.2–17.6). Those older people whose health problems limited activities "a little" were significantly more likely to be depressed than those who did not have activity limitations due to health problems (OR = 4.6; 95% CI: 1.1–19.5). Those whose health problems limited activities "a great deal" had a much higher likelihood of being depressed than those who were not limited due to health problems (OR = 21.5; 95% CI: 5.4–85.0). Similarly, those who reported a condition affecting their stomach or kidneys, or who had problems with incontinence, were more likely to be depressed than those who did not have any of these health problems (OR = 5.3; 95% CI: 1.5–19.2).

Our comparison of the clinical analysis samples and the full clinical sample demonstrated that elderly people with dementia were less likely to be included in the clinical analysis sample (due to missing data); people with probable Alzheimer's Disease comprised 15.4 percent of the overall clinical sample, but only 12 percent of the clinical analysis sample. Also, the clinical analysis sample had slightly fewer people in the oldest age group, and slightly more in the younger two age groups.

TABLE 2
Canadian Study of Health and Aging: Odds ratios (OR) and confidence intervals (95%) of final logistic regression models for the clinical analysis and community samples, with major or minor depression as the outcome

Variable	Clinical analysis sample (N=2,341)		Community sample (N=1,421)	
	OR	CI	OR	CI
Age				
65–74	1.0		1.0	
75–84	0.8	0.3–2.1	0.5	0.1–1.7
85+	0.6	0.2–1.6	0.3	0.1–1.3
Gender				
Male	1.0		1.0	
Female	3.5	1.4–8.8	4.7	1.2–17.6
Place of residence				
Community	1.0			
Institution	1.7	0.9–3.1		
Dementia				
Absent	1.0		1.0	
Present	2.4	1.0–5.3	2.5	0.9–7.4
Health trouble limits activities				
Not at all		–	1.0	
A little		–	4.6	1.1–19.5
A great deal		–	21.5	5.4–85.0
Disease of organ system				
Absent		–	1.0	
Present		–	5.3	1.5–19.2

Discussion

We found that 2.6 percent of older Canadians had major depression. This finding is consistent with results of 2.3 percent in the 1994–95 National Population Health Survey (NPHS) and 2.2 percent in the 1998–99 NPHS. The finding is also broadly consistent with the results of other epidemiological studies in the U.S. and Europe. The criteria for major depression are fairly standard; most sets require five or more symptoms. The 2.6 percent prevalence reported in our study is very close to the 2.0 percent combined estimate from a large set of studies from different countries reviewed above. Our slightly higher rate may be due to the inclusion of people living in institutions.

Four percent of older Canadians had minor depression, and the overall prevalence of depression was 6.6 percent. This figure is much lower than the average of 12 percent found in the literature,[4–7] although there is a wide variation across studies in estimates of minor depression. Several authors have commented on reasons for this variation, including geographic and cultural differences, varying sample sizes and sampling frames, different institutionalization rates, and

differences in methods of assessment and case definition.[19,20] Newman et al.[20] demonstrated that much of the variation in prevalence rates of overall depression could be due to differences in assessment tools.

When our findings are compared to those of studies using DSM criteria for minor or overall depression, our results lie near the middle of the estimates. For example, Newman[20] reported a prevalence of 3.6 percent, Madianos[21] reported a prevalence of 7.5 percent, and Kay[22] reported 4.8 percent. For overall depression with DSM criteria, Steffens[23] reported a prevalence of 5.3 percent, Kay reported 15 percent, Komahashi et al.[24] reported 2.8 percent, and Heeren et al.[25] reported 7.1 percent.

Studies of depression in Canada[9] and in the United States[5] have shown the prevalence of depression to decline with age, to be higher in women than men, to be negatively related to education and income, and to be higher in unmarried than in married people. We did not find a significant relationship between depression and education or marital status in our study. We did not measure income, and so cannot tell whether income relates to depression, but income is related to educational level, which was not related to depression.

In both the clinical analysis and community samples, gender was significantly related to depression. In the clinical analysis sample, women were 3.5 times more likely to be depressed than men; in the community sample, women were 4.6 times more likely than men to be depressed. This is consistent with findings from most other studies.[10,15,26] Our findings suggest that the difference in prevalence for men and women may disappear in the oldest age group; the largest differences between men and women are found in the young-old group; in the old-old group there is very little gender difference in the prevalence of depression. This may be due to an increase in depression with age in men; this increase was not noted in women. This pattern is consistent with findings from other studies[27,28] which have shown that gender differences in depression decline with advancing age.

In the clinical analysis sample, people with dementia were twice as likely to have depression as those without dementia; in the community sample, the odds ratio was similar, but not statistically significant. This is consistent with a wide body of literature showing the coexistence of depression and dementia. In the case of depression and dementia, it is particularly difficult to disentangle cause and effect. Depression may be a psychological reaction to dementia as depression is more common among those with mild or moderate dementia.[28] Depression also may be an early symptom of dementia.

We found a significant relationship between depression and the presence of serious diseases that affected an organ system (heart disease, respiratory disease, kidney problems or incontinence). Serious illness is likely to limit activities and role functioning, so it is not surprising that people with one or more of these illnesses were five times more likely to be depressed than those without these illnesses. Several mechanisms may link the two: physical illness can lead to depression, while depression can hinder recovery.[29] It is also possible that depression can lead to physical illness; depression can suppress the immune system, thereby promoting disease, and it can discourage healthy behaviors and preventive actions.

Depression also was strongly related to activity limitations caused by health problems; those whose health "limited them a little" were five times more likely to be depressed than those whose health did not, while people whose health "limited them a great deal" were 21 times more likely to be depressed than those whose health did not. This finding is congruent with previous studies, several of which highlight the central importance of functional limitations for depression in older people.[15,28,29] Elderly people who are unable to perform self-care activities or their accustomed role may tend towards a negative self-image and depression. Furthermore, it is possible that depression leads to apathy, a lack of interest in interaction and a reduction in activities.

Palsson & Skoog[28] found institutional residence to be associated with an increased risk of depression among the elderly. In our study, depression also was more prevalent among people in institutions, but when other variables such as age, gender and dementia status were taken into consideration the 1.6 increased risk of depression among institutional residents failed to reach significance.

Strengths and limitations

Strengths of this study include its large sample size, its inclusion of both community-living and institutionalized elderly and its national relevance. The inclusion of institutional residents is important since depression occurs more often in institutions and studies which exclude institutions are likely to underestimate its prevalence. The complexity of the sample design also can be considered a strength of the study. The oldest age group was over-sampled, offering more stable prevalence estimates among the oldest old. The analyses controlled for design effects, thus providing more accurate confidence intervals and regression estimates.

Another major strength of the study is the assessment of depression by a physician using a standardized rating scale. Depression can either be assessed via self-report or via clinician ratings; the latter is generally regarded as more objective and often forms the gold standard against which self-reports are compared. Furthermore, the diagnosis distinguished minor from major depression. Many prevalence studies include only major depression, although minor depression in older people is clinically significant; it causes distress for those who suffer it, leads to avoidance of social relations, increased medical and service use,[27] and leads to poorer outcomes than normally seen in older people. In addition to assessing depression, detailed cognitive testing was undertaken. Depression and dementia frequently coexist, making the assessment of each more difficult. Unlike many other studies, we have information about the prevalence of depression among people with dementia.

This study also has some limitations. Although the overall CSHA included over 10,000 people, we only had depression data on those who attended the clinical exam (n = 2,341, with complete data on depression status). Our analyses are cross-

sectional, limiting inferences that may be drawn about the causal direction of some of the observed relationships. Many people with *severe* dementia were missing data on depression; this is likely because their cognitive difficulties (or the depression itself) made them unable or unwilling to answer questions. To the extent that those with missing depression data are more likely to be depressed than those with such data available, our estimates may be somewhat lower than the actual prevalences. This limitation is not unique to our study, but is inherent in the study of depression among older people.

Policy implications

Due to its public health importance, data on depression are important to clinicians as well as national, provincial and local policy makers. Data on elderly Canadians are particularly important as declining birth rates and rising longevity increase the proportion of the Canadian population aged 65 and over.

These analyses show that depression is a significant mental health problem among the elderly, particularly for women, for men in the oldest age group and for elderly people of both sexes in institutions and with significant physical limitations. Depression can have important negative consequences for elderly people, including loss of pleasure in life, reduced participation in social activities, and increased disability and use of health care services. Yet, depression often remains undetected and untreated. More attention should be paid to the detection and treatment of depression, particularly among the elderly who are most at risk.

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APPENDIX 1
DSM-III-R symptoms and the clinician rating scale for depression used in the CSHA

Depression symptoms (DSM-III-R)	Items (CSHA: Clinical examination)
Non somatic	
Decreased concentration	Feel a decreased ability to concentrate
Depressed mood, sad	Feel sad, blue or depressed
Loss of interest	Lose interest in things that are pleasurable
Worthlessness, guilt	Feel worthless, sinful or guilty
Thoughts of death or suicide	Want to die or are considering suicide
Somatic	
Appetite or weight loss	Lose appetite Lose weight without trying to
Sleep disturbance	Have difficulty falling asleep Experience early awakening in the morning Have a tendency to sleep all day
Decreased energy	Feel tired all the time
Psychomotor agitation	Have to be moving all the time

Measurement issues related to the evaluation and monitoring of major depression prevalence in Canada

Scott B Patten, Jian Li Wang, Cynthia A Beck and Colleen J Maxwell

Abstract

Monitoring major depression prevalence is important because of the substantial impact of this condition on population health. Local or regional surveys using cost-efficient methods (e.g. data collection by telephone interview) may provide useful epidemiological data, as may the inclusion of brief diagnostic modules for major depression in general health surveys. In Canada, the Composite International Diagnostic Interview Short Form for Major Depression (CIDI-SFMD) has been widely employed for both purposes. The recent Canadian Community Health Survey 1.2 (2002), which employed a more detailed diagnostic interview (the World Mental Health 2000 CIDI), provides a standard against which to evaluate the performance of the CIDI-SFMD. A tendency to at times overestimate prevalence appears to be a characteristic of the CIDI-SFMD, and it has produced a broad range of prevalence estimates, suggesting a greater vulnerability to study-specific or contextual factors. However, the pattern of association of major depression with potential demographic determinants is not consistent with the classical "dilution" effect expected to occur with non-differential misclassification bias.

Key words: *bias, depressive diagnostic interviews, disorder, health surveillance, major depression, population*

Introduction

Interpretation of epidemiological data about depression is complicated by the use of different instruments in various studies. Several recent Canadian studies have used a brief predictive instrument to detect depressive episodes. In this paper, these results are reviewed and compared to the findings of a national survey that used a fully detailed diagnostic instrument. It is hoped that these comparisons will assist with the interpretation of estimates from past and future epidemiological studies.

Some Canadian surveys have evaluated depression in the population using symptom-rating instruments. These include the 1978/79 Canada Health Survey,[1] the 1988 Campbell Survey on Well-Being in Canada[2] and the ongoing Canadian Multicentre Osteoporosis Study (CaMos).[3] The Diagnostic and Statistical Manual of Mental Disorders[4] adheres to an alternative approach, providing categorical definitions for a set of depressive disorders.

Prior to the mid-1990s, epidemiological data about major depression in Canada was available only from individual epidemiological studies conducted in single cities or provinces/territories.[5,6] However, since the modernization of Canada's health information systems, due in part to the Canadian Institute of Health Information's Roadmap Initiative,[7] a wealth of national epidemiological data is now available.

Still, most Canadian studies evaluating major depression use a short-form diagnostic instrument, the Composite International Diagnostic Interview Short Form for Major Depression (CIDI-SFMD).[8] Beaudet has described the CIDI-SFMD results from the early cycle National Population Health Surveys.[9,10] Since the CIDI-SFMD is a brief predictive instrument, data from studies using the CIDI-SFMD may be vulnerable to misclassification bias. However, up until now, this possibility has been difficult to assess in the absence of comparable results from studies using more elaborate diagnostic instruments.

The Canadian Community Health Survey (CCHS) 1.2 (2002) is a cross-sectional study of a nationally representative sample of household residents (N = 36,984), with the proviso that some remote areas, First Nations' reserves and members of the armed forces were excluded from the sampling frame. (Similar exclusions applied to earlier iterations of the CCHS and the National Population Health Survey [NPHS]). Unlike the NPHS, the CCHS 1.2 used the full World Mental Health 2000 CIDI (WMH-CIDI), a much more lengthy and detailed instrument than the CIDI-SFMD. The CCHS 1.2 has made available, for the first time in Canada, nationally representative prevalence estimates deriving from a "state-of-the-art" fully structured diagnostic interview.

While the WMH-CIDI is a more sophisticated instrument than the CIDI-SFMD, the CCHS 1.2 does not necessarily render all data derived from the CIDI-SFMD obsolete. For example, the National Population Health Survey is the only ongoing source of longitudinal major depression data in Canada. As

Author References

Scott B Patten, Departments of Community Health Sciences and Psychiatry, University of Calgary
Jian Li Wang, Department of Psychiatry, University of Calgary
Cynthia A Beck, Colleen J Maxwell, Department of Community Health Sciences, University of Calgary
Correspondence: Scott B Patten, Departments of Community Health Sciences and Psychiatry, University of Calgary, 3330 Hospital Drive NW, Calgary, Alberta, Canada T2N 4N1; fax: (403) 270-7307; e-mail: patten@ucalgary.ca

well, the large general health surveys (N ~ 130,000), which form an important part of the CCHS initiative, have included the CIDI-SFMD as optional content, and they provide the only available region-specific Canadian prevalence estimates. Inclusion of the WMH-CIDI would not have been practical in general health surveys because of time constraints. Several smaller-scale Canadian studies have also used the CIDI-SFMD (see below) where it may not have been practical to incorporate the full CIDI. In the future, it will continue to be necessary to use small-scale telephone surveys and data from large-scale general health surveys to monitor major depression epidemiology. Therefore, the performance of brief predictive diagnostic instruments, such as the CIDI-SFMD, will continue to be of relevance.

Prevalence data from the CCHS 1.2 provide a standard against which the performance of recent applications of the CIDI-SFMD can be evaluated. In this paper, we explore the prevalence and distribution of major depressive episode and major depressive disorder in the CCHS 1.2 and compare the results to those of Canadian studies using the CIDI-SFMD, and to other recent international surveys that have used the WMH-CIDI.

Methods

Some of the estimates presented in this papr derive from independent epidemiological surveys conducted in Alberta[11,12] and Saskatchewan.[13] In these instances, the estimates in the Tables 1–4 derive directly from published results and incorporate sample weights accounting for the telephone sampling procedures employed. They used random digit dialed methodologies. Estimates from the CCHS 1.2 used its most recently updated version of the Statistics Canada master file. The CCHS 1.2 interviews were conducted by Statistics Canada interviewers using the WMH-CIDI.[14] Estimates from the CCHS 1.1[15] and the first three cycles of the NPHS[15] used a sampling frame based on that of Statistics Canada's Labour Force Survey. The sampling procedures were complex and require the use of sampling weights, calculated by Statistics Canada. Confidence intervals for estimates from the CCHS 1.2 were calculated using a bootstrap methodology

TABLE 1
Annual prevalence (percentage) of major depression in the Canadian Community Health Survey (CCHS), Cycle 1.2 (2002), by demographic variables

	Major depressive episode		Major depressive disorder*	
	12–month (95% CI**)	Lifetime (95% CI**)	12–month (95% CI**)	Lifetime (95% CI**)
Overall	4.8 (4.5–5.1)	12.2 (11.7–12.7)	4.0 (3.7–4.2)	10.8 (10.3–11.3)
Sex				
Male	3.7 (3.3–4.1)	9.2 (8.5–9.8)	2.9 (2.6–3.3)	7.9 (7.3–8.6)
Female	5.9 (5.4–6.4)	15.1 (14.3–15.9)	5.0 (4.5–5.4)	13.5 (12.8–14.3)
Age				
15–25	6.2 (5.4–7.0)	10.4 (9.4–11.4)	5.0 (4.2–5.7)	8.8 (7.9–9.7)
26–45	5.6 (5.0–6.1)	13.9 (13.1–14.8)	4.5 (4.0–5.0)	12.2 (11.3–13.0)
46–65	4.4 (3.8–5.0)	13.9 (12.9–14.9)	3.7 (3.1–4.2)	12.4 (11.5–13.3)
> 65	2.0 (1.5–2.4)	6.6 (5.8–7.4)	1.9 (1.5–2.4)	6.4 (5.7–7.2)
Marital status				
Wid./Sep./Div.	7.9 (7.0–8.8)	19.3 (17.8–20.7)	6.5 (5.7–7.3)	16.7 (15.4–18.0)
Married***	3.4 (3.0–3.7)	10.7 (10.1–11.4)	2.8 (2.5–3.2)	9.8 (9.2–10.4)
Single	6.8 (6.1–7.6)	12.2 (11.3–13.1)	5.3 (4.6–6.0)	10.2 (9.4–11.1)
Income				
Lowest	11.6 (9.4–13.7)	20.2 (17.3–23.1)	8.5 (6.6–10.3)	16.1 (13.4–17.8)
Lower middle	7.2 (6.0–8.5)	15.1 (12.6–17.6)	5.3 (4.3–6.3)	12.3 (9.9–14.8)
Middle	5.2 (4.5–5.8)	12.2 (11.2–13.3)	4.2 (3.6–4.8)	10.7 (9.8–11.7)
Upper middle	4.4 (3.9–5.0)	12.4 (11.5–13.2)	3.7 (3.2–4.2)	11.0 (10.1–11.8)
Highest	3.6 (3.0–4.1)	11.2 (10.3–12.1)	3.2 (2.7–3.7)	10.3 (9.5–11.2)
Education				
> High school	4.8 (4.4–5.3)	13.3 (12.6–14.0)	4.0 (3.6–4.4)	11.8 (11.2–12.5)
≤ High school	4.8 (4.3–5.2)	10.7 (10.0–11.4)	3.9 (3.5–4.3)	9.4 (8.7–10.0)
Urban/Rural				
Rural	4.1 (3.4–4.7)	10.6 (9.7–11.6)	3.3 (2.7–4.0)	9.5 (8.6–10.4)
Urban	5.0 (4.6–5.4)	12.5 (12.0–13.1)	4.1 (3.8–4.4)	11.1 (10.5–11.6)
Employed				
Yes in past year	4.1 (3.7–4.5)	11.9 (11.1–12.6)	3.5 (3.1–3.9)	10.7 (10.0–11.4)
Not in past year	5.9 (5.4–6.4)	13.3 (12.5–14.0)	4.6 (4.2–5.1)	11.5 (10.8–12.2)
Chronic condition†				
No	2.1 (1.7–2.4)	6.7 (6.0–7.5)	1.9 (1.6–2.3)	6.4 (5.7–7.2)
Yes	6.0 (5.6–6.4)	14.6 (14.0–15.2)	4.9 (4.5–5.2)	12.7 (12.1–13.3)

* lifetime episodes of major depression without lifetime manic episodes
** bootstrapped
*** includes common-law
† denotes one or more non-psychiatric chronic conditions

which also accounts for design effects, including unequal selection probabilities and multistage clustered sampling. The prevalence estimates from the NPHS and CCHS 1.1 used the Public Use Microdata Files (PUMF). Confidence intervals and/or significance tests are not presented for analyses using these files. All estimates were sufficiently precise to meet data release guidelines.

Results

Table 1 presents the 12–month and lifetime prevalence data of the CCHS 1.2 for major depressive episodes and major depressive disorder. An expected pattern emerges when prevalence is cross-tabulated with demographic variables: The prevalence of major depression was found to be higher in women than in men; higher in younger age categories for 12–month prevalence (lifetime prevalence peaks occur at a later age); higher in subjects who were unmarried and in those with chronic medical conditions. Prevalence was also slightly higher in subjects living in urban as opposed to rural areas and in subjects who were unemployed. There was no evidence that a higher prevalence of major depression was related to lower levels of education. It should be emphasized that these prevalence estimates derive from cross-sectional data and do not imply causality. For example, the prevalence of major depression in those who are unmarried may be explained by a plurality of factors, including an effect of marital status on major depression incidence, prognosis or mortality, or an effect of major depression on marital status.

Table 2 presents 12–month prevalence estimates for major depressive episode from three NPHS cycles and the CCHS 1.1—all of which used the CIDI-SFMD. The CCHS 1.2 estimates are reproduced in the left-hand column of the table for ease of reference. The prevalence values from the NPHS and their pattern of distribution across demographic groups were strikingly similar to those of the CCHS 1.2. Taken alone, this would suggest that the CIDI-SFMD provides comparable results to the much more lengthy and detailed WMH-CIDI. However, the results from the CCHS 1.1, which used the CIDI-SFMD, suggest higher prevalence values and show a

TABLE 2
Annual prevalence (percentage) of major depressive episode by demographic variables in five Canadian surveys

	CCHS 1.2 (WMH-CIDI)	NPHS (CIDI-SFMD)			CCHS 1.1 (CIDI-SFMD)
	2002 (95% CI)	1994	1996	1998	2000–2001
Overall	4.8 (4.5–5.1)	5.7	4.2	4.6	7.4
Sex					
Male	3.7 (3.3–4.1)	3.7	2.8	3.1	5.2
Female	5.9 (5.4–6.4)	7.6	5.5	6.0	9.5
Age					
15–25	6.2 (5.4–7.0)	8.8	5.4	5.8	8.9
26–45	5.6 (5.0–6.1)	6.1	5.1	5.3	8.7
46–65	4.4 (3.8–5.0)	5.0	3.8	3.9	6.8
> 65	2.0 (1.5–2.4)	2.5	1.6	2.4	3.3
Marital status					
Wid./Sep./Div.	7.9 (7.0–8.8)	8.7	7.9	7.7	11.1
Married**	3.4 (3.0–3.7)	4.1	3.2	3.4	5.6
Single	6.8 (6.1–7.6)	8.3	4.8	5.6	9.8
Income					
Lowest	11.6 (9.4–13.7)	8.0	8.9	9.1	14.2
Lower middle	7.2 (6.0–8.5)	8.5	6.9	7.7	11.3
Middle	5.2 (4.5–5.8)	5.7	4.3	4.1	8.2
Upper middle	4.4 (3.9–5.0)	4.8	3.7	4.1	7.2
Highest	3.6 (3.0–4.1)	5.2	3.4	3.5	5.7
Education					
> High school	4.8 (4.4–5.3)	5.7	4.1	5.0	7.7
≤ High school	4.8 (4.3–5.2)	5.9	4.4	3.9	7.2
Urban/Rural					
Rural	4.1 (3.4–4.7)	4.8	3.6	3.9	–
Urban	5.0 (4.6–5.4)	5.9	5.1	4.9	–
Employment					
Yes in past year	4.1 (3.7–4.5)	5.4	4.3	4.3	7.7
Not in past year	5.9 (5.4–6.4)	6.4	4.8	6.1	8.5
Chronic condition†					
No	2.1 (1.7–2.4)	4.0	2.7	2.4	4.1
Yes	6.0 (5.6–6.4)	7.1	5.4	6.0	9.2

CCHS = Canadian Community Health Survey
NPHS = National Population Health Survey
† denotes one or more non-psychiatric chronic conditions

very similar pattern of association with all demographic variables.

Table 3 presents a similar set of estimates for the two other recent surveys using the WMH-CIDI, the ESEMeD study from Europe16,17 and the National Comorbidity Study Replication (NCS-R) in the United States.18 The Canadian and pan-European prevalence and pattern of distribution were comparable, relative to demographic variables. In the American study, an association with education was observed and the overall prevalence was higher than in Canada or Europe.

While the divergence in prevalence reported by the NPHS and CCHS 1.1 suggests some source of variability affecting the performance of the CIDI-SFMD, even more divergent findings have been reported in smaller-scale telephone surveys. Results from three such studies conducted in Western Canada and which incorporate the CIDI-SFMD are summarized in Table 4. There is one notable feature of these sets of estimates: The majority of the studies found an association between major depression and a lower level of education.

Discussion

These results suggest two characteristics of the performance of the CIDI-SFMD. First, most—but not all—studies using this instrument have reported higher 12–month prevalence estimates than those generally reported by studies using the WMH-CIDI and its predecessors. The most notable exception is the NPHS, whose estimates were comparable to those of the CCHS 1.2. Second, estimates deriving from the CIDI-SFMD have been quite variable across studies.

The two Albertan studies using the CIDI-SFMD (Headwaters Health Authority and Epidemiology of "Depressive Syndrome" in Calgary) yielded high prevalence estimates and thus exemplify this CIDI-SFMD tendency. And when one considers the international literature, their results prove to be not atypical. In the Midlife Development in the United States (MIDUS) study, which used a random digit dialed sample of 3,032 community

TABLE 3
Annual prevalence (percentage or odds ratio) of major depression in three WMH-CIDI studies: Canada (CCHS 1.2), Europe (ESEMeD) and USA (NCS-R)

	CCHS 1.2 (Canada)	ESEMeD* (Europe)	NCS-R (USA)†
Overall	4.8	4.2	6.6
Sex			
Male	3.7	2.8	$OR_{♀} = 1.4$
Female	5.9	5.6	
Age			
15–25	6.2	6.1	$OR_{18–29} = 3.0$
26–45	5.6	4.0 – 4.5	$OR_{30–44} = 1.8$
46–65	4.4		$OR_{45–59} = 1.2$
> 65	2.0	3.2	–
Marital status			
Wid./Sep./Div.	7.9	6.5	OR = 1.4
Married**	3.4	3.5	–
Single	6.8	5.3	OR = 2.3
Income			
Lowest	11.6	–	$OR_{poverty} = 3.8$
Lower middle	7.2	–	$OR_{1–3x\ pov} = 1.8$
Middle	5.2	–	$OR_{3–6x\ pov} = 1.2$
Upper middle	4.4	–	
Highest	3.6	–	–
Education			
> High school	4.8	3.4	–
≤ High school	4.8	3.5 – 5.5§	OR = 1.9
Urban/Rural			
Rural	4.1	3.5	–
Urban	5.0	4.6	$OR_{urban} = 1.2$
Employment			
Yes***	4.0	3.4	7.7
No	5.9	3.2 – 17.9	OR = 1.5
Chronic condition****			
No	2.1	–	–
Yes	6.0	–	–

* any mood disorder, age categories 18–24, 25–34, 35–49, 50–64, >65
** includes common-law
*** CCHS 1.2: Employed in the past 12 months; ESEMeD: Current employment
**** denotes one or more non-psychiatric chronic conditions
§ 3.5–3.6 percent in those with more than four years of education
† The NCS-R sampled household residents 18 years of age and older. OR for unemployment excludes students, homemakers and retired.

residents aged 25 to 74, the use of the CIDI-SFMD resulted in an estimated 12–month prevalence of 14.1 percent.[19] In the Finnish Health Care Survey, the CIDI-SFMD produced an annual prevalence of 9.3 percent.[20] One population-based American study, the Household Survey of Healthcare for Communities, reported a 9.1 percent 12–month major depression prevalence.[21] It should be emphasized that these comparisons do not provide a straightforward perspective on the performance of the CIDI-SFMD as a measurement instrument because the actual prevalence may vary across populations; Alberta did have the highest provincial prevalence of major depression in the CCHS 1.2.

Another study using the CIDI-SFMD in the United States is the Health and Retirement Survey, which reported an overall prevalence of 9.4 percent in women.[22] Although the estimate was restricted to women, it nevertheless seems to us quite high when one considers that the study cohort consisted of individuals from the general population between the ages of 51 and 61 at the time of recruitment, an age at which prevalence is usually found to be comparatively lower.

The CIDI-SFMD was developed using a receiver-operator analysis of data collected in the National Comorbidity Survey (which employed a version of the full CIDI)[23] and the estimated positive predictive value of its scale was 90 percent, using the five symptom cut point. A subsequent comparison to the full CIDI placed its positive predictive value (for CIDI major depression) at approximately 75 percent.[24] The only study that has evaluated the performance of the CIDI-SFMD against an instrument that could be regarded as a diagnostic gold standard—the Schedules for Clinical Assessment in Neuropsychiatry (SCAN)—was carried out in Finland by Aalto-Setäla et al.[25] In a sample of 20 to 24 year olds, many of whom had screened positive on nonspecific measures of mental ill-health, these authors reported a 73 percent sensitivity and 82 percent specificity for the CIDI-SFMD versus a SCAN consensus diagnosis of major depression. These estimates became 71 percent and 90 percent, respectively, when any mood disorder was used as the reference standard. These results

TABLE 4
Annual major depression prevalence (percentage) from three regional and provincial Canadian telephone surveys using the CIDI-SFMD*

	Headwaters Health Authority %	Saskatchewan Population Health and Dynamics Survey %	Epidemiology of "Depressive Syndrome" in Calgary %
Overall	10.4	7.1	15.6
Sex			
Male	7.4	5.1	11.8
Female	13.2	8.7	19.4
Age			
15–25	12.1	Declines with age	Declines with age
26–45			
46–65	8.5		
> 65			
Marital status		**Ranking:**	**Ranking:**
Wid./Sep./Div.	14.6	Sep./Div. > Never Married > Married	Sep./Div./Wid. > Never married > Married
Married**	8.0		
Single	15.8		
Income			
Lowest	–	Higher prevalence with inadequate income in men and women	42.0
Lower middle	–		30.0
Middle	–		18.3
Upper middle	–		15.0
Highest	–		8.9
Education			
> High school	7.8–11.1	♀: 7.0–9.8 ♂: 5.0–5.8	9.2–16.3
≤ High school	16.2	♀: 7.4 ♂: 4.5	33.7
Urban/Rural			
Rural	Adjacent urban area had a higher prevalence (25)	♀: 8.1 ♂: 4.3	Adjacent rural health region had lower prevalence (5)
Urban		♀: 8.9 ♂: 5.6	
Employment			
Yes	10.3	♀: 10.0 ♂: 4.7	Higher prevalence for unemployed
No	11.3	♀: 4.2 – 10.4 ♂: 2.5 – 10.1	
Chronic condition***			
No	–	♀: 5.0 ♂: 2.6	12% versus 15% (weighted prevalence ratio 1.44)
Yes	6.0	♀: 12.8 ♂: 8.4	

* annual prevalence, ranges indicate multiple reported estimates within a stratum
** includes common-law
*** denotes one or more non-psychiatric chronic conditions

underscore the CIDI-SFMD's tendency to overestimate major depression prevalence; a specificity of 82 percent could suggest that 18 percent of the population without a major depressive episode in the past year would provide false positive ratings. On the other hand, given an annual period prevalence of 6 percent, a sensitivity of 73 percent predicts that approximately 4 percent of the population would appear as true positives. These values lead to an anticipated positive predictive value much lower than that reported from studies comparing the CIDI-SFMD to the full CIDI, at least partially due to the fact that the Finnish data was collected from subjects of whom many had screened positive on other instruments. The CIDI-SFMD is probably more specific than these results would suggest when it is applied in the general population. Finally, it should be acknowledged that even the full CIDI and SCAN do not show close agreement.[18,26]

The idea that the CIDI-SFMD may be somewhat non-specific is consistent with the nature of the instrument, since it contains no organic exclusion items and no detailed items probing the clinical significance (distress or functional impairment) of the reported symptoms. Yet both types of items are contained in the full versions of the CIDI. There is also no bereavement exclusion in the CIDI-SFMD. The lack of organic exclusions in the short form may have been one determinant of the generally high prevalence estimates reported by studies conducted in subjects with chronic medical conditions.[27,28] On the other hand, the comparability of the NPHS estimates with those of the CCHS 1.2 indicates that the CIDI-SFMD is not always non-specific.[27,28] Low sensitivity does not provide an adequate explanation for prevalence estimates in the range of 5 percent in some studies if the instrument is appreciably non-specific. In these cases, the false positive rate associated with 95 percent specificity could account for nearly all of the positive results.

The findings reported by Aalto-Setäla et al.[25] may also help to explain the apparently inconsistent behaviour of the CIDI-SFMD. These authors reported that the insensitivity of the CIDI-SFMD could often be attributed to its reliance on two key items: depressed mood and anhedonia. Subjects answering "no" to these two items are then "skipped" out of the CIDI-SFMD. As such, it is possible that subtle factors such as the rapport between the interviewers and their subjects, the positioning of the questions within a questionnaire and the mode of data collection could lead to considerable changes in prevalence estimates. For example, two "no" responses motivated by discomfort with the interview situation could skip a respondent with major depression out of the CIDI-SFMD module.

While the literature points to problems both with the sensitivity and specificity of the CIDI-SFMD, we can also observe that the pattern of association between various demographic factors and major depression (as defined by the CIDI-SFMD) is quite similar to that produced by presumably more valid instruments, such as the WMH-CIDI. Classical epidemiological theory would predict that misclassification bias would often cause a dilution of such associations towards the null [29]. On the contrary, certain associations, such as those between low income and low education, appear to be at least as strong in those CIDI-SFMD studies reporting very high prevalence. One possible explanation is that the misclassification is not random—many of the false positives represent people with adjustment disorders, normal bereavement or other forms of situational depressive syndromes that may also be associated with similar determinants.

When associations with potential determinants or prognostic factors are the focus of investigation, it is difficult to evaluate the performance of the CIDI-SFMD by comparing studies from different populations since potential determinants may be component (rather than sufficient) causes of depression.[30] The frequency of other component causes combining with an index variable which is also a component cause, to thereby create a sufficient cause, could well explain the occurrence of an association in one population, but not in another. For example, the observation that some CIDI-SFMD studies have found an association of major depression with education, though the CCHS 1.2 did not, may indicate that low education can increase the risk of major depression only in those regions where the estimates were made (in this case, Alberta).[30]

What are the possible solutions to these problems? It seems plausible that an expansion of the CIDI-SFMD to include several additional items asking about depressed mood and anhedonia, perhaps using different terminology, may render the instrument more sensitive; respondents would be less likely to be skipped out of the module. The problem of specificity is more difficult, but it is possible that combining an instrument like the CIDI-SFMD with other brief scales evaluating distress and dysfunction might allow the differentiation of major depressive episodes from milder depressive syndromes. However, if this approach were to be pursued, it may be preferable to use an instrument such as the Mini Neuropsychiatric Interview,[31] which measures current prevalence, in order to be consistent with the fact that most instruments providing ratings of distress or functional impairment refer to recent weeks and not the past year. Another option would be to add organic exclusion probes to the CIDI-SFMD.

The CIDI-SFMD may provide a useful categorization, but the depressive syndrome that it identifies should not be interpreted exactly as major depression. Rather, a somewhat broader syndrome may be captured in some applications. Comparisons across different studies using this instrument must be made with caution since the estimates contained in the literature suggest that the CIDI-SFMD is subject to a large degree of variability, perhaps due to such factors as mode of interview, its place within a larger interview script and perhaps intangible factors such as the context of the interview or attitude of the interviewers.

The variability in results across different studies has implications for the interpretation of CIDI-SFMD data. When data from the CIDI-SFMD are to be used for evaluative or planning purposes, it may be prudent to focus on within-study comparisons and not use comparisons across different studies.

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A descriptive analysis of Canadian youth treated in emergency departments for work-related injuries

Tammy Lipskie and F Curtis Breslin

Abstract

Because labour laws and regulations protect minors by preventing them from working, this population is often excluded from labour data. However, work is common among Canadian youth. Young teens, and especially pre-teens, have informal employment arrangements such as odd jobs, yard work, babysitting and deliveries. Work injuries occurring in these informal employment arrangements are surprisingly frequent and not usually captured by traditional occupational health and safety data sources (e.g. workers' compensation claims). We analyzed data from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) and found 999 youths (5 to 17 years) who had suffered a work-related injury between 1995 and 1998. They were concentrated in two main areas: clerical/service and manual labour. Work-related injuries increased with age. Approximately one third of the youth experienced open wounds and 5.5 percent had animal bites. Collisions with someone or something were common, as were falls. Others or animals were frequently involved. For the majority of cases, the direct cause of injury corresponds to one of ten categories. Injuries and circumstances varied by occupation. Even informal work arrangements (e.g. delivering newspapers) contained hazards and these varied by workplace. The injuries of young workers have implications for future research, prevention efforts, health services policy and legislative and regulatory efforts.

Key words: *adolescent, Canada, child, injury prevention and control, injury surveillance, work-related injury*

Introduction

Entry into the labour force brings both potential benefits and risks for health. Initial job experiences provide opportunities for new social contacts, to learn generic job skills (e.g. organizing time) and to explore possible career options.[1] Work plays a large role in the lives of many Canadian youth. Canadians often enter the labour market in their teens. Twenty-six percent of 15 year olds worked for pay during 1996 and that proportion progressively increased with each year of age to attain 55 percent of 17 year olds.[2] Adolescents often juggle both school and work. In 1998, 32 percent of 15 to 19 year olds were working part-time and going to school full-time.[3] They worked an average of 14 hours per week and about one in five worked more than 20 hours per week.[3]

Adolescent workers are concentrated in certain types of jobs. According to Statistics Canada's Labour Force Survey, service industries (e.g. retail trade and food services) employ about 80 percent of young workers.[3] The remaining teens are employed primarily in the goods sector, which includes manufacturing and construction. The types of jobs held by teenage boys and girls differ. Whereas almost half of 15- to 19-year-old boys were working as semi-skilled or unskilled labourers, less than one in five girls in that age group held similar jobs. Girls at that age were more likely to work in sales or clerical positions.[2]

Work injuries among youth are surprisingly frequent. Compared to adults, Canadian youth have elevated rates of self-reported work injuries and lost-time claims.[4,5] Among working U.S. teenagers, 7 to 16 percent have been injured on the job seriously enough to require medical attention.[6,7] In 1996, 15- to 17-year-old workers in the U.S. were injured at a rate almost twice that of all workers (4.9 versus 2.8/100 full-time equivalents).[8,9] For 1993, the direct and indirect costs of adolescent work injuries in the U.S. were estimated to be at least five billion dollars.[10]

In Canada, minimum age restrictions on work are primarily regulated by each province and territory.[11,12] In Ontario, regulations set 14 years as the minimum age for employment in offices or stores, 15 for factory work, 16 for logging and 18 for underground mining. In British Columbia, paid employment is restricted for those under age 15 and very hazardous jobs are prohibited (e.g. use of chemical toxins, explosives) between the ages of 15 and 17.

Studies of child labour in the U.S. suggest that informal work arrangements (e.g. newspaper delivery) are not uncommon among youth less than 15 years of age.[13] In addition, some children in the U.S. are working non-agricultural jobs in violation of minimum age restrictions.[14,15]

Currently, there is no formal information registry capturing the number of Canadian children under the age of 15 who are working and their work-related injuries. An initial

Author References

Tammy Lipskie, Health Canada, Ottawa, Ontario, Canada
F Curtis Breslin, Institute for Work & Health, Toronto, Ontario, Canada
Correspondence: Tammy Lipskie, Health Canada, AL 1917A, Ottawa, Ontario, Canada K1A 0K9; fax: (613) 948-2110; e-mail: tammy.lipskie@hc-sc.gc.ca

description of work-related injuries has been presented for cases under 20 years of age using the first years of emergency department surveillance data.[16,17] We analyzed work-related injuries of younger youth (under age 18) in a larger, more recent sample, given that minors are protected in many Canadian jurisdictions by labour laws and regulations and are consequently excluded from labour data sources (e.g. Labour Force Survey, National Work Injuries Statistics Program of the Association of Workers' Compensation Boards of Canada).

Methods

Injury data were retrieved from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) database. CHIRPP is a program of the Health Surveillance and Epidemiology Division of the Public Health Agency of Canada. It is an emergency-department-based injury and poisoning surveillance system that collects data from ten pediatric and five general hospitals located in seven provinces and two territories.[18] Its data are collected and coded separately from the hospital discharge data. More than 730 values are available to describe the circumstances of the injury or poisoning event. In addition, the data provide details of the patient, the nature of the injuries and the treatment received in the emergency department. The surveillance system and its data assist in the identification of hazards, aid in developing interventions and policies, and support the evaluation of these injury control efforts.[18] Current data collection procedures ensure that 90 to 95 percent of injury and poisoning emergency department presentations are captured.

During the four-year study period (1995–98), the CHIRPP emergency departments treated a total of 465,637 patients (243,261 aged 5 to 17 years). We included all cases aged 5 to 17 years who had suffered a work-related injury; this is defined by CHIRPP as an injury reported by a patient and occurring while working for income. Since intentional injuries were rare (three events: 0.6 percent), they were retained in the injury data and were not analyzed separately.

TABLE 1
Job categories of injured workers
(Ages 5–17, 1995–98 CHIRPP database)

Clerical and service	Manual labour work
Food Preparation	**Construction/Repair**
food preparation	carpenter
cook	cabinet maker
kitchen hand	painter
baker	roofer
food trade	tiler/floor covering
meat trade	**Stocks/Stores**
Clerical/Sales	stock/purchasing clerk
sales assistant	**Vehicle/Mechanical/Factory**
teller	vehicle driver
cashier	plant machine operator
mail/filing clerk	mechanical worker
receptionist	electrical worker
street vendor	metal worker
Other service	factory worker
teacher/instructor	working on a vehicle
counsellor	working in a garage
waiter	assembler/packing machine
bartender	**Agriculture/Forestry**
cleaner/housekeeper	farm worker
child care provider	agricultural worker
companion/aide	forestry worker
performer	gardener/grounds worker
nurse	
guard/security	

CHIRPP = Canadian Hospitals Injury Reporting and Prevention Program

Occupation classifications

In the CHIRPP database, 282 occupation codes are grouped into nine major categories, based on the type and level of skill needed to successfully complete the work. The occupations of the injured youth in the study sample are in Table 1. We collapsed the major CHIRPP categories to reflect the fact that youth were concentrated in certain occupations. Nine job groupings in two main areas (clerical/service and manual labour) were used for our analyses.

Nature and circumstances of injury

Frequency distributions were used to describe who was being injured on the job, and the nature and circumstances of their injuries. Where appropriate, comparisons were made with non-work injuries in these age groups.

Results

We identified 999 youth aged 5 to 17 (Table 2) with work-related injuries. This represented 0.4 percent (999/243,261) of all CHIRPP records for these ages. CHIRPP emergency departments treated an average of 261 work-related cases annually (1995–98) in this age range. The number and proportion of work-related records increased with age. Injuries attributed to work accounted for 0.8/10,000 cases for the youngest age group and rose to 315.5/10,000 cases for the oldest age group. Older youth (14 to 17 years) were over-represented in work-related injuries compared to all other injury events (87.2 vs. 24.5 percent;

TABLE 2
Age, sex and jobs distribution for injured workers (Ages 5–17, 1995–98 CHIRPP database)

Job group	Age group (years) 5–9 N	%	10–13 N	%	14–15 N	%	16–17 N	%	Total 5–17 years N	%	Male (%)
Clerical/Sales	0		1	0.8	15	6.6	45	7.0	61	6.1	32.8
Delivery	7	87.5	80	66.7	49	21.5	18	2.8	154	15.4	70.8
Food preparation	0		0		30	13.2	148	23.0	178	17.8	62.4
Other service	1	12.5	17	14.2	34	14.9	92	14.3	144	14.4	43.1
Clerical/Service subtotal	**8**	**100.0**	**98**	**81.7**	**128**	**56.1**	**303**	**47.1**	**537**	**53.8**	**56.2**
Construction/Repair	0		0		7	3.1	29	4.5	36	3.6	91.7
Stocks/Stores	0		0		4	1.8	33	5.1	37	3.7	67.6
Vehicle/Mechanical/Factory	0		2	1.7	6	2.6	24	3.7	32	3.2	87.5
Agriculture/Forestry	0		5	4.2	14	6.1	13	2.0	32	3.2	87.5
Other manual labour	0		7	5.8	37	16.2	148	23.0	192	19.2	78.1
Manual labour subtotal	**0**		**14**	**11.7**	**68**	**29.8**	**247**	**38.4**	**329**	**32.9**	**80.2**
Unknown	0		8	6.7	32	14.0	93	14.5	133	13.3	63.2
Total	**8**		**120**		**228**		**643**		**999**		**65.1**

CHIRPP = Canadian Hospitals Injury Reporting and Prevention Program

$p < 0.0001$). Males accounted for 65.1 percent (650/999) work injuries overall, which was similar to the rest of the database (60.2 percent) for these ages.

Temporal characteristics

About two in five work injury events occurred during the summer months (June to August). This was 1.5 times higher than the proportion of all other injury events for youth aged 5 to 17 years (41.7 vs. 26.9 percent, $p < 0.0001$). Approximately one third (34.6 percent; 346/999) of the work injury events happened on the weekend (Saturday and Sunday) and one third (35.1 percent; 351/999) occurred on weekdays between the hours of 15:00 and 21:00. These distributions were similar to other injury events for this age group (28.2 and 32.4 percent respectively).

Job characteristics

Occupation varied with age and sex (Table 2). Clerical/service jobs (delivery in particular) were most common for the 5 to 9 and 10 to 13 year olds. The older injured youth were equally likely to be manual labour workers (56.2 percent of 14 to 15 year olds; 47.1 percent of 16 to 17 year olds) as clerical/ service workers.

The sex distribution varied by type of job. Young males comprised 80.2 percent (264/329) of those injured at manual labour jobs and 56.2 percent (302/537) of those injured in clerical/service jobs.

Nature and circumstances of injury

Injured youth suffered upper extremity injuries (55.6 percent; 549/988) and open wounds of the fingers and hands in particular (23.3 percent; 230/988). One in eight (130/988) sustained an injury to the head, face or neck.

The injury patterns varied by occupation (Table 3). Open wounds accounted for approximately one third of the injured in the areas of clerical/service and manual labour (35.7 and 32.5 percent respectively). Animal bites accounted for 9.1 percent (49/537) of all those injured in clerical/service jobs but 29.2 percent (45/154) of the injured youth working in delivery.

The circumstances of the work injuries also varied by occupation (Table 4). Overall, collisions with someone or something were common (15.0 percent; 150/999). However, for the injured delivery workers, falls (33.1 percent, 51/154) and acts by others or animals (29.2 percent; 45/154) were frequent circumstances of injury. Objects or people in inappropriate or unexpected locations (e.g. kneeling in a cupboard when a co-worker stepped on their foot) were also common circumstances (17.6 percent; 58/329).

The direct cause of injury for the majority of young workers fell into one of ten categories (Table 5). One in three (63/178) youths involved in food preparation had been injured by a knife or scissors. Part of a structure or the natural environment was responsible for 55.8 percent (86/154) of delivery injuries, while animals accounted for an additional 36.4 percent (56/154). Self or others were the leading causes of injury in the other clerical/service jobs (e.g. being bitten by a child). For manual labourers, other people and parts of structures caused approximately one quarter (88/329) of injuries.

TABLE 3
Nature of work injuries [a] by job group
(Ages 5-17, 1995-98 CHIRPP database)

	Contusion/ crushing		Open wound		Fracture		Strain/ sprain		Amputation		Burn/ corrosive		Bite		Other muscular or skeletal		Other and unknown	
Job group	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Clerical/Sales	14	23.0	16	26.2	4	6.6	15	24.6	0		6	9.8	0		0		6	9.8
Delivery[b]	38	24.7	20	13.0	23	14.9	18	11.7	0		0		45	29.2	0		9	5.8
Food preparation[b]	21	11.8	99	55.6	4	2.3	11	6.2	4	2.3	27	15.2	0		0		10	5.7
Other service	35	24.3	26	18.1	19	13.2	31	21.5	0		11	7.6	4	2.8	2	1.4	16	11.1
Construction/Repair	7	19.4	15	41.7	3	8.3	2	5.6	0		1	2.8	0		0		8	22.2
Stocks/Stores	8	21.6	23	62.2	0		3	8.1	0		0		0		0		3	8.1
Vehicle/Mechanical/Factory	5	15.6	11	34.4	1	3.1	2	6.3	2	6.3	0		1	3.1	0		10	31.3
Agriculture/Forestry	7	21.9	6	18.8	12	37.5	1	3.1	2	6.3	0		0		0		4	12.5
Other manual labour[b]	55	28.7	54	28.1	15	7.8	32	16.7	2	1.0	13	6.8	1	0.5	3	1.6	16	8.3
Unknown	21	15.8	53	39.9	10	7.5	16	12.0	1	0.8	14	10.5	4	3.0	1	0.8	13	9.8
NOI Total[c]	**211**	**21.1**	**323**	**32.3**	**91**	**9.1**	**131**	**13.1**	**11**	**1.1**	**72**	**7.2**	**55**	**5.1**	**6**	**0.6**	**95**	**9.5**

[a] Up to three injuries can be recorded for each patient in the CHIRPP database. Only the first, most serious injury is included in the table; 66 (6.6%) had suffered two injuries and 23 (2.3%) had suffered three injuries.

[b] In two youths working in food preparation, one messenger and one manual labourer, there were no injuries detected.

[c] Total includes injuries where the occupation was unknown. (#, % of sample).

CHIRPP = Canadian Hospitals Injury Reporting and Prevention Program

TABLE 4
Initiator of event sequence by job group (Ages 5-17 years, 1995-98 CHIRPP database)

Event initiator	Job group											
	Clerical/ Service (N=205)		Delivery (N=154)		Food preparation (N=178)		Manual labour workers (N=329)		Unknown job (N=133)		Total (% of total) (N=999)	
	N	%	N	%	N	%	N	%	N	%	N	%
Loss of control of objects or movements	42	20.5	20	13.0	81	45.5	68	20.7	34	25.6	245	24.5
Falls	44	21.5	51	33.1	15	8.4	43	13.1	27	20.3	180	18.0
Object or person in inappropriate location	10	4.9	11	7.1	17	9.6	58	17.6	12	9.0	108	10.8
Collision	37	18.1	10	6.5	25	14.0	55	16.7	23	17.3	150	15.0
Acts by others or animals	6	2.9	45	29.2	0		1	0.3	3	2.3	55	5.5
Object dropped or fell on patient	14	6.8	2	1.3	7	3.9	30	9.1	5	3.8	58	5.8
Body part or clothing caught or snagged	9	4.4	1	0.7	8	4.5	28	8.5	11	8.3	57	5.7
Object knocked over or spilled	12	5.9	0		10	5.6	3	0.9	5	3.8	30	3.0
Other events	26	12.7	10	6.5	9	5.1	29	8.8	6	4.5	80	8.0
Unknown	5	2.4	4	2.6	6	3.4	14	4.3	7	5.3	36	3.6

CHIRPP = Canadian Hospitals Injury Reporting and Prevention Program

Medical treatment

Patients in the study age group of 5 to 17 years were admitted to hospital as a result of work injuries half as often as they were for other injury events (2.8 versus 6.3 percent, $p < 0.0001$). There were variations by occupation. The rate of admission ranged from 1.9 percent (10/537) for the entire clerical/service job group to 15.6 percent (5/32) of youth injured in agricultural/forestry jobs. The hospital admission rate was 4.3 percent (14/329) for the entire manual labour job group. Additionally, 39.3 percent (393/999) of youth sustained injuries requiring a return visit to a medical practitioner. One in three (43/154) injured on delivery and 41.5 percent (159/383) in the other clerical/service jobs required medical follow-up.

Discussion

This study provides rarely documented details of the circumstances of work injury for Canadian children and adolescents. Consequently, they are useful in identifying areas that may warrant further investigation or intervention. We found that the work of injured youth could be classified as either clerical/service or manual/unskilled labour. Six specific job groupings within these areas (Table 1) were found: delivery, food preparation, clerical/sales, construction/repair, stocks/stores, vehicle/mechanical/factory and agriculture/forestry. Our findings are very similar to those from the Queensland Injury Surveillance Unit (Australia), which found food retailing, accommodation, restuarants and agriculture to be the industries with the largest number of youth work-related injuries.[19] As in earlier Canadian studies[16,17], a large proportion of youth delivering flyers, catalogues and newspapers from the CHIRPP data were bitten by animals and suffered contusion/crushing injuries and fractures; this is evidence that even informal work arrangements contain work hazards that have persisted throughout the past decade.

We also found that those in other clerical/service jobs (food preparation in particular) suffered cuts and burns from the equipment they were using. Manual labour workers experienced contusion/crushing injuries and cuts from falls, collisions and other hazards of their workplace. The time of injury suggests that those working part-time (i.e. summer, weeknight and weekend) may be at greater risk. However, this also may be a reflection of the hours most often worked by youth in Canada or times of relaxed supervision when staff with more experience or seniority (including management) are likely not working.

Our findings support continued recommendations for prevention.[17,19] The types of injuries that young workers sustain have implications for prevention efforts and health services policy. Efforts are needed to increase hazards awareness and appropriate interventions for working youth, their supervisors and employers. For example, youth could be educated through the school system and their on-the-job traning. *Passport to Safety* exemplifies efforts in this regard.[23]

Legislative and regulatory efforts could be expanded to included employees and employers not presently covered (e.g. working youth under the age of 15 and agricultural workers). A fairly recent example of progress is the establishment of the North American

TABLE 5
Leading direct cause(s) of injury by job group (Ages 5–17, 1995–98 CHIRPP database)

Direct cause of Injury[a]	Job group									
	Clerical/ Service (N=205)		Delivery (N=154)		Food preparation (N=178)		Manual labour workers (N=329)		Unknown occupations (N=133)	
	N	%	N	%	N	%	N	%	N	%
Part of structure (e.g. wall, floor, stairs)	38	18.5	62	40.3	16	9.0	57	17.3	17	10.5
Self or other person	48	23.4	11	7.1	13	7.3	31	9.4	16	12.0
Knife, scissors	15	7.3	0		63	35.4	33	10.0	17	12.8
Food, beverage	11	5.4	0		18	10.1	8	2.4	9	6.8
Hand or cleaning tools	5	2.4	0		2	1.1	30	9.1	4	3.0
Natural environment, weather	26	12.7	24	15.6	1	0.6	28	8.5	4	3.0
Small appliance (e.g. toaster, fry pan)	4	1.9	0		26	14.6	14	4.3	5	3.8
Parts of vehicles	5	2.4	6	3.9	0		17	5.2	5	3.8
Large equipment (e.g. lawn mower, farm equipment)	2	0.9	0		0		31	9.4	5	3.8
Animal	5	2.4	56	36.4	0		8	2.4	4	3.0
10 listed leading causes implicated in % of injured		77.6		103.2		78.1		78.4		56.4

[a] Up to 2 factors can be coded as the direct cause of injury on each record, depending on the amount of information provided. Therefore, the row and column totals may exceed 100%.

CHIRPP = Canadian Hospitals Injury Reporting and Prevention Program

Guidelines for Children's Agricultural Tasks.[21]

There are limitations to these surveillance data. They may underestimate the prevalence of work injuries among children. Not all work-related injuries lead to an emergency department visit. Some strains and sprains may not warrant medical attention but may still be serious enough to limit normal activities. Further, estimates of the proportion of youth seeking treatment at CHIRPP hospitals are not available. The bulk of CHIRPP data comes from pediatric hospitals in major cities; therefore, injuries and poisonings suffered by older teens and adults seen at general hospitals are absent. Aboriginal people and people who live in rural areas are under-represented. Fatalities are also under-represented because emergency department data do not capture people who died before they could be taken to hospital or those who died after being admitted.

Another limitation is that observed differences may reflect differences in the proportion of youth working. In the workforce, there are many more 15 to 17 year olds than children under 15. Identifying who is working can be difficult.[22] Young workers are often engaged in informal work arrangements such as newspaper or catalogue delivery. In addition, young workers often work at family businesses and farms, making it difficult to distinguish chores from work.[22] These atypical and informal work arrangements are common among youth and can lead to some injuries not being attributed to work. Without these denominators (who is working and where they seek treatment), incidence rates could not be calculated.

Work-related incidents among youth are often acute.[16,17] Improved surveillance and documenting the potential health care needs of injured young workers is an important step towards ensuring service provision activities in this area.[23] Given the limitations of current surveillance data for youth, relevant federal and provincial agencies should further develop the monitoring of work- related and other injuries. There may be further information on young work-related fatalities provided by the National Coroners and Medical Examiners database, currently being coordinated by the Health Statistics Division of Statistics Canada. Health care services could be targeted to reduce the duration and severity of disabilities associated with work injuries; medical and behavioural interventions occurring soon after the injury may prevent serious consequences and/or chronic health conditions.

The findings are exploratory, but there are a limited number of previous studies examining work injuries among Canadian youth, particularly at unregulated ages. Pickett and his colleagues do provide evidence that CHIRPP data are representative of youth injury in Canada.[23] Future research could attempt to establish estimates of the above-mentioned denominators. While our study sample was younger than previous studies, the injuries and their circumstances were similar. The proportion of work-related records for this age group rose 30 percent in the years following the study period (0.44 to 0.57 percent; 261-367 records), suggesting

further investigation is warranted to explore these patterns of occupational injury in the CHIRPP database. The CHIRPP surveillance data could also be used as a sampling frame for a follow-up study to examine the length of time on the job and the training received by these young injured workers.

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Acceptability of micronutrient sprinkles: A new food-based approach for delivering iron to First Nations and Inuit children in Northern Canada

Anna Christofides, Claudia Schauer, Waseem Sharieff and Stanley H Zlotkin

Abstract

Iron deficiency anemia (IDA) is a significant public health problem among Canadian Aboriginal children. The objectives of this study were to determine the acceptability and safety of microencapsulated-iron sprinkles, a new powdered form of iron packaged in a single-serving sachet for prevention of IDA. A total of 102 non-anemic children aged 4 to 18 months from three communities were randomized to receive sprinkles containing 30 mg Fe/day (N = 49) or placebo (N = 53) for six months. To assess acceptability, adherence and side effects were monitored bi-weekly. To assess safety, serum ferritin (SF) concentration and anthropometry were measured at baseline and end. Mean adherence was 59.6 ± 27.7 percent. There were no differences in adherence, SF, anthropometric status or side effects between groups. Although there were no differences in hemoglobin (Hb) concentration and anemia prevalence from baseline to end and between groups, the Hb curve shifted to the right (increased) for the sprinkles group and to the left (decreased) for the placebo group. Sprinkles may provide a safe and acceptable option to the current standard of care (i.e. ferrous sulphate drops) for the provision of iron in Canadian Aboriginal populations.

Key words: *First Nations, Inuit, iron deficiency anemia, iron supplement, sprinkles*

Introduction

Iron deficiency anemia (IDA) is the most common preventable nutritional deficiency in the world today.[1] In children, IDA has a significant impact on motor, cognitive and socio-emotional development.[2,3,4,5] Studies have shown the prevalence of IDA to be very high in Canadian Aboriginal populations, varying from 14 to 50 percent, as compared to only 3.5 to 10.5 percent of infants among the general population.[6,7,8,9,10,11]

Current strategies to control IDA in Canadian Aboriginal communities include treatment with ferrous sulphate drops and recommendations that encourage healthy feeding practices for prevention.[12] Iron drops, however, are not well accepted because of significant side effects such as a metallic unpleasant taste, teeth staining and abdominal discomfort.[13,14] Current programs using iron drops have not been successful in controlling these problems.[15] In an attempt to provide a more acceptable iron source that can be used in the treatment or prevention of IDA, our research group developed a new form and delivery system for iron and other micronutrients, known as "sprinkles". Sprinkles are single serving sachets containing micro-encapsulated iron and other micronutrients in a powder form that can be mixed into any complementary (weaning) food in the home. The lipid encapsulate masks the unpleasant taste of the iron and prevents gastrointestinal discomfort and interactions with food. The single-serving package obviates the need for exact measurement. We have demonstrated that sprinkles are as efficacious as iron drops in treating IDA.[16] However, the acceptance of sprinkles may vary among populations because of perceived or real side effects or other factors, which may influence adherence. For example, high doses from iron supplements have been associated with gastrointestinal effects.[17] Dewey, et al. showed that among children with initial hemoglobin (Hb) levels > 100 g/L, supplementation with iron had a significant negative impact on linear growth from four to six months of age.[18] Whether excessive iron intake alone can lead to secondary iron overload is unknown.[19] However, studies have linked iron overload in children to possible oxidative stress. For example, in children with thalassemia, antioxidant levels were lower in those with iron overload due to frequent blood transfusions.[20] It is therefore important to demonstrate that iron supplementation has no adverse impact on non-anemic children. Thus, the objectives of this study were to determine the acceptability and safety of sprinkles as a strategy for delivering iron to infants and young children in Aboriginal communities.

Methods

Study area, subjects and recruitment

The study was conducted in three Aboriginal Canadian communities from December 2001 to June 2003. These included two Cree communities on the west side of James Bay, Ontario (populations 441 and 1,293) and one Inuit community in Nunavut Territory

Author References

Anna Christofides, *Claudia Schauer*, *Waseem Sharieff* and *Stanley H Zlotkin*, Research Institute, The Hospital for Sick Children, Toronto, Ontario, Canada
Correspondence: Dr Stanley Zlotkin, Division of Gastroenterology and Nutrition, The Hospital for Sick Children, 555 University Avenue, Toronto, Ontario, Canada M5G 1X8; fax: (416) 813 4972; e-mail: stanley.zlotkin@sickkids.ca

(population 1,286).[21] These communities are very small and isolated, with road access limited to the winter months. Because of the remoteness of these communities, some traditional feeding practices still exist. These include prolonged breastfeeding and the pre-chewing of hunted meats such as caribou and seal, which are then passed on to the infant.

James Bay General Hospital, as well as the local health centre in the Inuit community, coordinated the local field work. Field workers were community health workers, trained by researchers from The Hospital for Sick Children in Toronto, Ontario, and were supervised by nurses at the hospitals/health center. Lists of all infants between 4 and 18 months of age were compiled from health care records. These were checked for completeness by a select number of caregivers in the community, adding infants that did not use these facilities to ensure that all eligible infants were included. All infants consuming complementary foods and who would be remaining in the three study areas for the following six months were eligible to participate.

Ethics approval and consent

Ethics approval was obtained from The Hospital for Sick Children, Health Canada and the Nunavut Research Institute. Consent from First Nations communities was obtained from hospital boards and the chief and councils. Community and individual informed consent were obtained.

Study design

A double-blind randomized controlled trial design was used to measure the acceptability and safety of sprinkles. Infants with Hb ≥ 100 g/L (N = 102) were randomly allocated to receive a placebo sprinkles sachet (N = 36) or sprinkles containing 30 mg iron daily (N = 49) for a period of six months. A cutoff of 100 g/L was used to define anemia, as it is below this level that functional consequences of IDA such as cognitive impairment become apparent and the use of a placebo group in anemic infants would be unethical.[2] Randomization was obtained using poker chips pulled from an opaque bag. All infants with baseline Hb < 100 g/L were excluded from the study and treated for three months with either sprinkles (60 mg iron/day) or ferrous sulfate drops (40 mg iron/day). Sprinkles sachets contained 30 mg of iron (as micro-encapsulated ferrous fumarate), 150 µg folic acid, 50 mg L-ascorbic acid and 200 IU vitamin D3 (cholecalciferol). The placebo contained no nutrients; an equal proportion of sterile ground purple rice made it appear identical to sprinkles. A two-week supply of sachets was packaged in child-proof containers. Caregivers were instructed to mix the contents of one sachet into the child's food each day.

At baseline and six months, caregivers and their participating children were instructed to go to the health center/hospital. Anthropometric measurements, including length and weight, were taken.[16] Trained nurses collected finger-prick blood samples using standardized techniques. Hb was determined from a drop of blood using a portable HEMOCUE B-Hemoglobin photometer (HemoCue®, Angelholm, Sweden).[22] The remaining blood sample (500 uL) was centrifuged for 10 minutes at 12,000 Xg and serum was separated before storage at –40° C. Serum ferritin (SF), soluble serum transferrin receptor (sTfR) and C-Reactive Protein (CRP) were analyzed using standardized techniques after being transported to the Hospital for Sick Children (Ramco Laboratories, Houston, TX).

Field workers visited participants every two weeks to monitor adherence and side effects (diarrhea, vomiting and darkening of stool). Questions on side effects involved asking caregivers whether any episodes of diarrhea, vomiting or darkening of the stool occurred in the previous seven days. At each visit, parents were provided with verbal educational support to maximize adherence to the intervention and the number of sachets consumed/used was determined. A new child-proof container containing sprinkles or placebo was distributed at each visit and the old container was collected. Adherence was expressed as percentages of sachets used.

Sample size and power

The sample size was based on our primary outcome, adherence, which we estimated to have a standard deviation of 12.5 percent.[16] Assuming a minimal correlation within communities (intra-community coefficient = 0.05) and the number of children per community (m) to be 50, the adjusted SD was 24 percent:

$$\text{SD}_{\text{cluster-adjusted}} = [\sqrt{SD^2 \times [1 + (m-1)\rho}\,]$$

To determine the adherence in the sprinkles group with a precision of 10 percent, an SD of 24 percent and a Type I error of 0.05, a sample size of 22 was required. Assuming an additional 20 percent for non-response and dropouts, we estimated a sample size of 26 per group.

TABLE 1
Characteristics of study population (N=62)

	Sprinkles (N=26)		Placebo (N=36)	
Characteristics	**N**	**%**	**N**	**%**
Boys	13	50	15	42
Girls	13	50	21	58
CRP Positive (> 8 mg/L)	8	33.3[a]	9	25.0
	Mean	**SD**	**Mean**	**SD**
Age (months)	11.76	5.1	11.44	4.3
Age of weaning (months)	4.54	2.8	4.97	1.93
Weight (kg)	10.2	2.2	10.7	2.44
Height (cm)	73.1	6.6	74.1	5.7

[a] N=24 samples in total in the Sprinkles group for CRP

Data processing and analysis

Data were double-entered using Access 2000 software (Microsoft Inc.) and were checked for range and consistency with customized data entry and processing programs as previously described.[15] Data were analyzed using SAS, version 8.0 (SAS Institute, Carey, NC). Analyses of SF and sTfR values were conducted on log-transformed data because of the skewed distribution. Iron deficiency (ID) was defined as sTfR > 8.5 mg/L.[23,24] Serum ferritin concentrations above 300 µg/L may indicate elevated iron stores.[25] Values above 300 µg/L were therefore used to define elevated iron stores. CRP values above 8 mg/L were considered elevated.[26] Adherence and side-effect data were determined by first calculating a score for each individual based on the mean outcome (e.g. number of vomiting episodes) over 12 monitoring visits, and then calculating the overall mean percentage in the study population. Because side-effect data were highly skewed (many cases with no side effects) and could not be normalized with any transformation, dichotomous variables for the presence or absence of adverse effects were then created, and groups were compared using logistic regression, as was used in the study by Dewey, et al.[18] Anthropometric data were analyzed as Z-scores (CDC growth reference values, 2000).[27] Paired t-tests were used to analyze the changes in blood indices between baseline and endline within groups. Differences between groups were measured using General Linear Modeling (GLM). Differences in the prevalence of anemia, ID and side effects were detected using chi-square tests. Differences were considered significant at $p < 0.05$.

Results

Recruitment and baseline assessment

As the communities were small, we included all eligible children from all three communities. A total of 170 children 4 to 18 months of age were screened for eligibility (Figure 1). Of these, 68 percent (115/170) participated in baseline assessment (mean age, 11.5 months). Of those who underwent baseline assessment, 89 percent (102/115) were eligible, based on our Hb cutoff (Hb ≥ 100 g/L), and were enrolled in the study. 61 percent (62/102) completed the study. Baseline characteristics are presented in Table 1. SF is an acute-phase reactant, with falsely high levels associated with inflammation and infection.[26,28] SF was therefore not used to define iron deficiency (ID), due to the large

FIGURE 1
Follow-up of population studied in three First Nations communities (Infants 4 to 18 months of age)

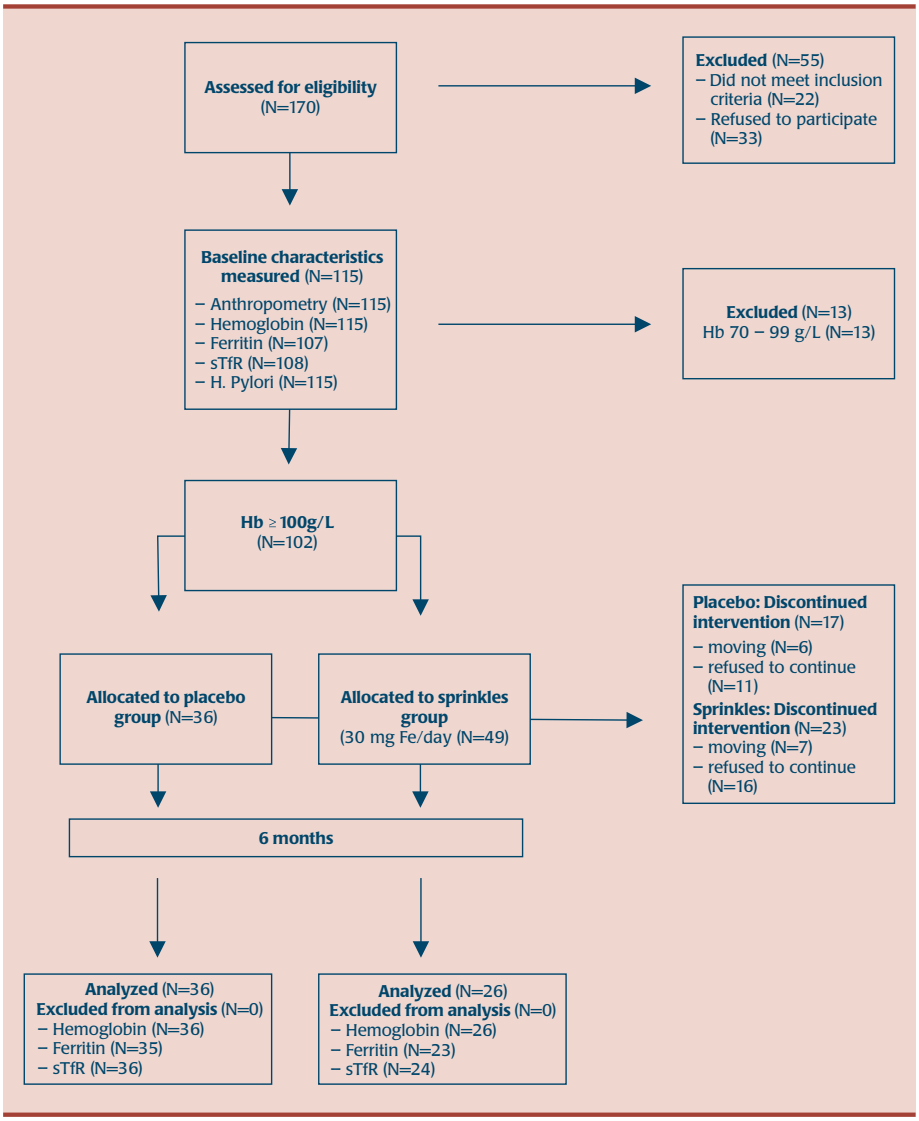


TABLE 2
Reported side effects among users of sprinkles or placebo (N=62)

	Sprinkles (N=26)[a]		Placebo (N=36)[a]		Relative risk	
Side effect	N	%	N	%	RR	95% CI
Diarrhea	14	53.9	18	50.0	1.09	0.61–1.97
Vomiting	4	15.4	11	30.6	0.57	0.23–1.39
Darker stools	21	80.8	25	69.4	1.46	0.66–3.23

[a] Subjects reporting at least one episode in a six-month period

number of subjects that tested positive for infections (as shown by the high prevalence of CRP > 8 mg/L). It was used, however, to screen for high storage iron levels and potential iron overload.

Acceptability

On average, adherence was 59.6 ± 27.7 percent. Over the six-month period, three percent of subjects were compliant 100 percent of the time, 40 percent were compliant 75 percent of the time and 65 percent were compliant 50 percent of the time. There were no differences in adherence between sprinkles (60.8 ± 28.2 percent) and placebo (58.7 ± 27.6 percent) groups. In both groups, adherence increased over time ($p = 0.0005$). There was no difference in occurrence of side effects in the sprinkles versus placebo groups (Table 2). In total, side effects were reported in 76.9 percent and 69.4 percent of individuals in the sprinkles and placebo groups respectively (no difference). There were no differences between those who dropped out of the study (N = 40) and those who completed the study (N = 62) in reported side effects (data not shown).

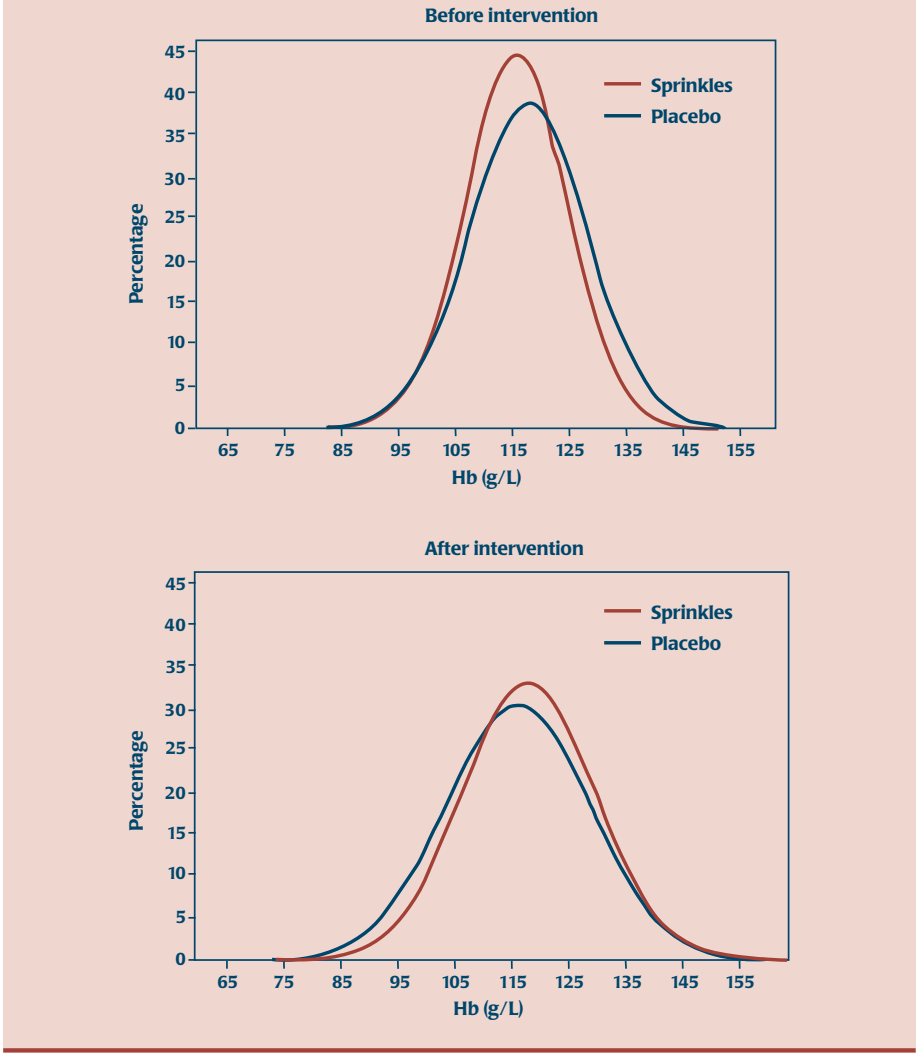
Safety

There were no children with elevated iron stores (SF level > 300 µg/L). Growth was not impaired by the use of iron sprinkles since there were no differences between placebo and active sprinkles in height-for-age, weight-for-height or weight-for-age Z-scores between groups (Table 3). There was no accidental or inadvertent use or abuse of sprinkles.

Indicators of iron status

At the end of the intervention, there were no significant differences in Hb, SF, sTfR and ID within and between groups (Table 4). There was a shift to the right in the Hb curve after six months in the sprinkles group and a shift to the left in the placebo group (Figure 2). Of those children that were anemic and excluded at baseline, all were successfully treated with drops or sprinkles after three months of treatment (13/13). One child in the sprinkles group and two children in the placebo group became anemic (Hb < 100 g/L) after six months of intervention.

FIGURE 2
Hemoglobin curve before and after intervention with sprinkles or placebo (N=62)



Discussion

The objective of this study was to determine the adherence and safety of sprinkles, a new form and delivery system for iron and other micronutrients, in Canadian Aboriginal children. Over a six-month period, participants adhered on average approximately 60 percent of the time to the recommended use of sprinkles; approximately 65 percent of participants adhered more than 50 percent of the time. Adherence to medical interventions generally tends to be low in Canadian Aboriginal communities (personal communications, Melanie Phelps, director of patient care at James Bay General Hospital, Attawapiskat Wing, 2004).

A previous study in Ghana using sprinkles showed that 88 percent of infants and children consumed sprinkles more than four days per week.[16] While long-term adherence to an iron intervention is important, optimal adherence to a daily dose is not generally critical to overall efficacy. For example, in a randomized controlled trial in Bangladesh among anemic and non-anemic infants, we demonstrated that the use of one sprinkles sachet per week significantly increased Hb levels.[29] Therefore, although adherence could only be rated as fair in the current study, taking sprinkles 50 percent of the time would likely be efficacious in the prevention of IDA.

TABLE 3
Z-scores and changes in baseline anthropometric measures of placebo and sprinkles groups (N=62)

Factor	Sprinkles N=26		Placebo N=36		*p*-value
	Mean	SD	Mean	SD	
Weight-for-age Z-score					
Baseline	0.7	2.1	0.8	1.7	0.8
Final	0.6	1.7	1.1	1.4	0.2
p-value for change	0.72		0.27		0.4[a]
Weight-for-height Z-score					
Baseline	1.2	3.5	1.3	1.5	0.9
Final	1.3	1.4	1.4	1.3	0.7
p-value for change	0.75		0.34		0.8[a]
Height-for-age Z-score					
Baseline	0.05	2.7	0.1	1.7	0.9
Final	-0.1	2.0	0.5	1.9	0.3
p-value for change	0.62		0.13		0.2[a]

SD = standard deviation

[a] Adjusted for baseline values

In terms of acceptability, three information sessions were conducted with the mothers of children in the study to discuss issues around the use of sprinkles. Responses from these sessions suggested that sprinkles did not create any appreciable change in color, taste or appearance of the complementary food. Caregivers stated that sprinkles were easy to use, although they did have trouble remembering to give them daily. Participants agreed that if sprinkles were ever to become a commercially marketed product, they should be made available in their communities as an alternative to iron syrup.

No significant adverse effects or safety issues were identified. Among children taking sprinkles, there was no evidence of elevated iron stores (i.e. no subject had a serum ferritin value above 300 µg/L) and there was no effect of the sprinkles intervention on anthropometric status when compared to the placebo group. These results suggest that sprinkles would be a safe intervention if used in other and similar Aboriginal communities. Although this study did not have the statistical power to detect a significant difference in hematologic status between sprinkles and placebo in the prevention of anemia, there was a shift in the Hb distribution curve to the right in those given sprinkles for six months and to the left in those given placebo, suggesting a positive impact of sprinkles on hematologic status. The one child who became anemic in the sprinkles group had a low compliance (28 percent) and had a high CRP level (CRP > 8 mg/L), which may indicate that the anemia was due to infection, possibly with *H. Pylori*.[11]

The current WHO/UNICEF recommendation for the prevention of IDA is to provide iron supplements to all 6- to 24-month-old children without screening when the prevalence of anemia (Hb < 110 g/L) in the population is more than 40 percent.[30,31] In the three communities included in the current study, the overall prevalence (36 percent) was just below the 40 percent cutoff level. Given the significant health consequences of anemia in infants and children, from a public health policy perspective, it is important to decide which approach is more appropriate: blanket supplementation to prevent IDA (i.e. prevention through intervention among all infants), or universal screening and treatment of all anemic/iron-deficient infants. The Canadian Task Force on the Periodic Health Examination recommends that all high-risk infants should be screened at nine months of age.[32] However, screening is not routinely performed in all communities; a significant number of infants with IDA remain unrecognized and thus untreated.

The Canadian Prenatal Nutrition Program (CPNP) is a Health Canada initiative to prevent anemia. It advocates exclusive breastfeeding until six months of age, followed by the use of iron-fortified cereals and formulas.[12] Clearly, given the high prevalence of anemia in Aboriginal communities, existing prevention programs to control IDA are not effective and alternative strategies should be investigated by researchers. Sawchuk, et. al. examined the impact of an infant nutrition program in a First Nations community in British Columbia in which subsidized iron-fortified formula was provided to families.[33] They found that after the program had been operational for a year, the prevalence of IDA had decreased from 52 percent to four percent. Normally, iron-fortified infant products are prohibitively expensive within Aboriginal communities and less expensive substitutes, such as evaporated milk, are commonly fed to infants. Sprinkles may be a viable addition to programs such as the CPNP as they offer a number of advantages over iron-fortified infant formulas, iron drops or syrups. Sprinkles can be added to complementary foods, do not compete with breastfeeding, are low in cost, have minimal side effects and have been shown to be acceptable by these communities.

In addition to iron, sprinkles are a source of other micronutrients. These additional minerals and vitamins may be beneficial in Aboriginal communities where low intakes of vitamin D, calcium and folate have been reported.[34] Adherence to drops or syrups is often very poor because of their strong metallic taste, difficulty of measurement and ability to stain teeth if they are not administered directly into the back of the child's mouth.[13,14] At the very least, there is a need for health promotion and education to increase understanding of the impact of

TABLE 4
Comparison of haematologic factors after sprinkles or placebo interventions (N=62)

	Sprinkles N=26		Placebo N=36		*p*-value across groups
	Mean	SD	Mean	SD	
Hemoglobin (g/L)					
Baseline	115.6	8.9	117.6	10.3	0.6
End of supplementation	115.6	11.5	113.5	12.5	0.6 [a]
p-value for change	1.0		0.12		
	Sprinkles N=23		**Placebo N=35**		
	Geometric mean	Range	Geometric mean	Range	
Ferritin (ug/L)					
Baseline	26.0	3.9-228.2	13.4	2.6-59.6	0.04
End of supplementation	21.4	7.0-83.0	16.6	3.8-63.9	0.1[a]
p-value for change	0.2		0.3		
	Sprinkles N=24		**Placebo N=36**		
	Mean	SD	Mean	SD	
sTfR (mg/L)					
Baseline	6.5	1.9	6.8	2.6	0.6
End of supplementation	5.6	1.6	6.9	2.4	0.05[a]
p-value for change	0.09		0.7		
	N	%	N	%	
Prevelance of iron deficiency sTfR > 8.5 mg/L					
Baseline	4	17.4	9	25.0	0.4
End of supplementation	3	11.5	7	19.4	0.5[a]
p-value for change	0.7		0.5		

SD = standard deviation

[a] Adjusted for baseline values

anemia on the health and development of children in the community.

Our study has several potential limitations. Firstly, due to the small sample size, comparisons between sprinkles and placebo groups may have insufficient power to detect differences or equivalencies. For example, the power to detect the difference between groups of 2 g/L in Hb is very low. Unfortunately, the high costs and logistic difficulties associated with the great distances between communities restricted our study to three communities in total. However, since all eligible children from these communities participated, we believe that our results are generalizable to other Aboriginal communities. In addition, it is possible that since these children were non-anemic at the beginning of the study, they were protected from developing anemia by other factors, which were unknown to us.

A second limitation was the large number of dropouts (N = 40). A high dropout and low response rate is common in Aboriginal communities, due in part to the high mobility rate of these populations, often moving to nearby communities (13/40 of the dropouts in our study). In addition, a greater percentage of children completed the study in the placebo (67.9 percent) versus the sprinkles group (53.1 percent). However, this difference was not significant. Although the number of dropouts was large within the study population, there were no differences found in the reporting of side effects between those who dropped out and those who completed the study.

In conclusion, our results suggest that sprinkles were well accepted with minimal side effects. Sprinkles may therefore be a safe and acceptable addition to current strategies for the prevention and treatment of IDA in Canadian Aboriginal children.

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Seasonality of SIDS in Canada between 1985-1989 and 1994-1998

Dear Editor,

Rusen et al. report an elimination of a seasonal pattern for SIDS deaths in Canada after the recommendation in the early 1990s to place infants to sleep supine instead of prone (CDIC;Vol 25, No 1).[1] A re-analysis of the reported Canadian SIDS postneonatal infant mortality data shows that the seasonality of SIDS did not change.

The authors reported percentages of SIDS during four seasons, defined as January–March, April-June, July-September and October–December 1985–1989 and 1994–1998, and which spanned the period when the recommended infant sleeping position changed from prone to supine.[2] Dr. Shiliang Liu, a co-author, provided the SIDS and non-SIDS data that were the basis for the conclusion of "elimination of a seasonal pattern for SIDS deaths" following the change in recommended sleep position. This conclusion was based on the change of a chi-square test of independence between SIDS and non-SIDS in the same season, and which was interpreted as a test for change of seasonality of SIDS as shown below.

Table 1 shows the data and chi-square test results reported.[1] The authors performed their tests for the two time periods using a technique to determine a change in the independence of the seasonal distributions of SIDS and non-SIDS. In fact, this is not a test of whether there was any seasonal variation of SIDS between the two time periods because the non-SIDS seasonal distribution may have changed while the SIDS seasonal distribution remained unchanged.

To test for independence, the expected value (E) within each cell was the product of the row total (R) and column total (C) divided by the overall sample size (N). For example, in Winter 1985-1989 there were 331 SIDS observed (O). For R = 921, C = 1125 and N = 3,349, E = RC/N = 309.38, giving a partial chi-square of 1.51. Repeating this computation for the other seven cells gives a total chi-square of 7.845 with 3 d.f., which, at $p = 0.0493$, narrowly meets the statistical criterion for independence of $p < 0.05$ (n.b. not at $p = 0.002$, as published). Because the 1994-1998 comparison test gave a value of $p = 0.408$, which did not meet the statistical criterion for independence, the authors

TABLE 1
Post-neonatal SIDS and non-SIDS deaths obtained from unlinked birth and death certificates, Canada (excluding Newfoundland and Labrador, and Ontario), 1985-1989 and 1994-1998[1]

Period Test of data	1985–1989 SIDS vs non-SIDS		1994–1998 SIDS vs non-SIDS		1985–1989 vs 1994–1998 SIDS vs SIDS	
Season	**SIDS**	**non-SIDS**	**SIDS**	**non-SIDS**	**SIDS 85-89**	**SIDS 94-98**
Winter (Jan-Mar)	331	590	173	352	331	173
Spring (Apr-Jun)	283	510	169	371	283	169
Summer (Jul-Sep)	229	502	139	330	229	139
Autumn (Oct-Dec)	282	622	155	390	282	155
Total number	**1,125**	**2,224**	**636**	**1,443**	**1,125**	**636**
Chi-square (3 df)	7.845		2.893		1.534	
p value	$p = 0.0493$*		$p = 0.408$		$p = 0.674$	
Conclusion	Independent		Not independent		Not independent	

* Inadvertently reported as $p = 0.002$ in the article on page 3.[1]

TABLE 2
Sinusoidal seasonal model of Hawaiian SIDS (Equation 1) applied to the Canadian postneonatal SIDS data of Table 1[1,3]

Canadian data	1985–1989		1994–1998	
Season	**Observed SIDS**	**Expected SIDS Hawaii model**	**Observed SIDS**	**Expected SIDS Hawaii model**
Winter (Jan-Mar)	331	333.41	173	188.49
Spring (Apr-Jun)	283	266.13	169	150.45
Summer (Jul-Sep)	229	226.86	139	128.25
Autumn (Oct-Dec)	282	298.60	155	168.81
Total SIDS (Nt)	**1,125**	**1,125**	**636**	**636**
Yates chi-square*	1.90		5.22	
Yates p value	$p = 0.593$		$p = 0.156$	

* With three degrees of freedom because Equation 1 parameters A, B and ϕ are predetermined.

concluded that the seasonality of SIDS had changed.

However, by directly testing whether the seasonal distribution of SIDS in 1985-1989 is independent of the seasonal distribution of SIDS in 1994-1998, the results in Table 1 show that they are not independent (chi-square = 1.53 with 3 d.f., $p = 0.674$). Consequently, the seasonality of SIDS does not appear to have changed as a result of the recommended change from prone to supine sleep position.

A model of sinusoidal variation of daily SIDS data [S(t)] as a function of calendar day of the year (t) is Equation 1. It is applied to the total SIDS data (Nt) in each period with parameters A = 0.002111 Nt; B = 0.000628 Nt; $\phi = 30$, which were predetermined from a Hawaiian SIDS study.[3]

EQUATION 1 $S(t) = A + B\,(1 + \cos[2\pi\,(t - \phi)/365.2])$

Table 2 shows the same sinusoidal distribution is not rejected as a fit for both data sets, also indicating that the seasonality of SIDS in Canada did not change with the change in recommended infant sleep position. The fit of the Hawaiian data to the Canadian data indicates that a pattern of seasonal respiratory infection, rather than seasonal temperature, may be responsible for the consistency of the seasonality of SIDS in Canada.

David T. Mage
Temple University
Department of Public Health
Philadelphia, PA 19122 USA
dmage@temple.edu

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Dear Editor,

We thank Dr. Mage for his interest in our article examining trends in rates and risk factors for sudden infant death syndrome in Canada.[1] The main objective of our research was to examine the post-neonatal mortality rates due to SIDS in relation to public health recommendations to avoid the prone sleep position. A secondary objective was to examine, in a multivariate model, any changes in established risk factors before and after the public health campaign. Finally, we conducted a simple analysis on seasonal patterns of SIDS deaths using methods that have been previously applied elsewhere.[2]

Dr. Mage raises concerns with our statistical interpretation of changes in seasonal patterns of SIDS deaths and also proposes an alternative method for this analysis. We utilized a basic chi-square test to examine differences in the proportion of post-neonatal SIDS deaths that occurred in each season in the time periods before and after the public health campaign. There was evidence of a winter predominance in the first period ($p = .049$) but not during the second period ($p = .408$) (the p value for the first period was initially incorrectly reported as .002, but subsequently corrected in a written communication to CDIC). Dr. Mage suggests a Yates correction is required in our analysis. Although the Yates correction leads to a minor change in the p value in this situation, it should be noted that this correction has been criticized for being overly conservative[3] and applies to a chi-square for a 2 x 2 table (1 degree of freedom)[4], which was not the scenario for our analysis. Therefore, we believe that the observed significant finding in our basic examination of seasonality of SIDS deaths is valid.

We appreciate that more sophisticated and detailed approaches are available to further explore the issue of seasonality and SIDS, though this was not the focus of our research effort. We look forward to future work by Dr. Mage and others to better understand this important and poorly understood area of SIDS research.

I.D. Rusen for all study authors

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Status Report

Child maltreatment in different populations: Investigated cases and Canadian street youth

Richard De Marco, Michelle Wesley, Cara Bowman, Susanne Shields and Tom Wong

Implementing effective policies to combat child maltreatment is greatly facilitated when information from different sources, and representing different populations, is complementary. For example, national data on child maltreatment provide important information often not available from smaller studies. As with other areas of health and social policy, decision makers require timely information so that they can allocate prevention and intervention resources most effectively. The Public Health Agency of Canada contributes to the child maltreatment evidence base in two important ways: the *Canadian Incidence Study of Reported Child Abuse and Neglect* (CIS) and the *Enhanced Surveillance of Canadian Street Youth* (ESCSY). Undertaken at five-year intervals, the CIS is based on a representative sample of child maltreatment investigations from child welfare agencies across Canada. It describes the immediate context of maltreatment, including the type of abuse that children experience and their family environment. The ESCSY is a study of street youth from seven major urban centres across Canada. Its main focus is to investigate sexually transmitted infections and health-risking behaviours among youth and young adults who currently live on the street. However, it also gathers information on many different aspects of respondents' lives (Table 1), including history of maltreatment, which many experienced while they were living at home. Thus, it provides insight into how maltreatment earlier in life may affect later decisions that put youth in risky situations.

TABLE 1
CIS (1998) and ESCSY (1999) methods

	Canadian Incidence Study of Reported Child Abuse and Neglect (N = 7,672)	Enhanced Surveillance of Canadian Street Youth (N = 1,733)
Population	Children and youth aged 0 to 15 years	Youth aged 15 to 24 years
Sampling	Nationally representative sample (13 provinces/ territories, stratified sampling)	Convenience sample from seven large urban centres across Canada (Vancouver, Edmonton, Saskatoon, Winnipeg, Toronto, Ottawa and Halifax)
Data collection	Random sample of new child maltreatment investigations by child welfare authorities (not including investigations by others such as police and medical services)	Nurse-administered questionnaire collecting self-reported information regarding abuse from street youth attending 'drop-in' centres. Snowball sampling (i.e. recruiting peers)
Types of abuse	Included measures for physical, sexual and emotional abuse, and neglect	Included measures for physical, sexual and emotional abuse
Types of measurements	Measures include maltreatment correlates (child, family and perpetrator characteristics) and outcomes of child maltreatment (such as physical and emotional harm)	Measures include socio-demographic information, family characteristics and living situation, abuse, interactions with social support and legal systems, sexual practices and history (including STI), substance use and emotional well-being
Frequency	Repeated at 5-year intervals	Repeated at regular intervals

Author References

Richard De Marco, *Michelle Wesley*, Injury and Child Maltreatment Section, Health Surveillance and Epidemiology Division, Centre for Healthy Human Development, Public Health Agency of Canada

Cara Bowman, *Susanne Shields*, *Tom Wong*, Sexual Health and Sexually Transmitted Infections, Community Acquired Infections Division, Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada

Correspondence : Richard De Marco, Centre for Healthy Human Development, Public Health Agency of Canada, PL: 1910D, Ottawa, Ontario, Canada K1A 0K9; fax: (613) 941-9927; e-mail: richard.de.marco@phac-aspc.gc.ca

The current study of child maltreatment benefits from examining different populations and is not limited to investigated cases. Street youth are of particular interest because they experience a multitude of life stressors, and by virtue of living on the street, may have difficulty accessing important health and social services.

What is child maltreatment?

Child maltreatment involves actions or behaviours, whether through commission or omission, that cause harm to a child or place a child at substantial risk of harm. The dimensions of harm include physical, emotional, cognitive and behavioural. Child maltreatment is commonly defined as physical abuse, sexual abuse, neglect and emotional maltreatment. Subcategories of the term have also been described by researchers.

The definition of "child", in terms of the provision of child welfare services, varies between Canadian provinces/territories. As a result, analyses of CIS data are restricted to children between 0 and 15 years of age, despite the fact that some provinces, such as British Columbia in 1998, provided services to youth up to the age of 19.

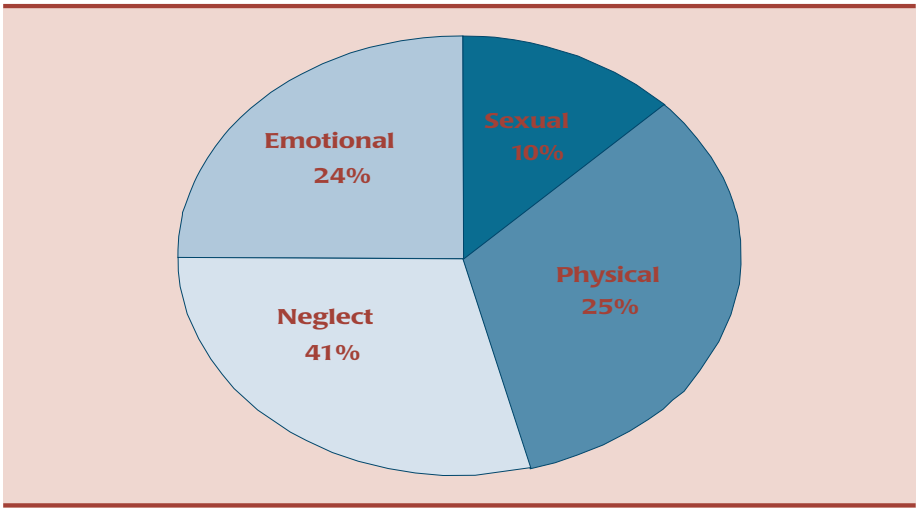
Methods of CIS and ESCSY

Table 1 compares the different characteristics of the CIS and ESCSY studies.

Incidence findings

Both studies present a national perspective on child and youth health. CIS data provide a snapshot of the incidence of child maltreatment in investigated cases and indicate that a total of 135,573 maltreatment investigations occurred in Canada in 1998 (21.2 per 1000 children). Of these investigations, 29,668 (22 percent of total sample) included sufficient evidence for the maltreatment to be substantiated.[1] The substantiated cases were categorized by the primary form of maltreatment. Forty-one percent involved neglect, 25 percent physical abuse, 24 percent emotional maltreatment and 10 percent involved sexual abuse.

FIGURE 1
Cases of substantiated maltreatment, CIS, 1998

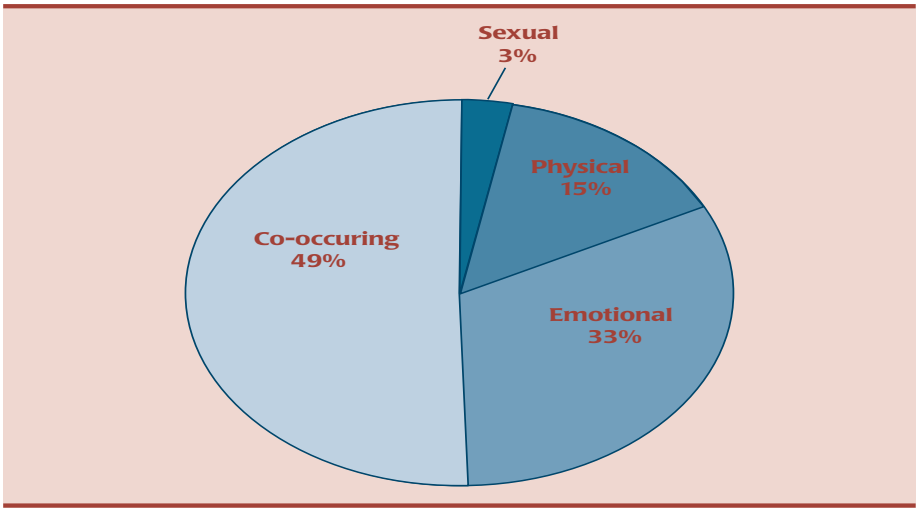


In addition, 24 percent of street youth sampled in the ESCSY of 1999 indicated that maltreatment was one of multiple reasons for leaving home, while 8.4 percent of respondants reported that physical, sexual and/or emotional abuse was the main reason that they left home. Among the youth who left home because of abuse, emotional abuse was the most commonly reported (33 percent), followed by physical (15 percent) and sexual (3 percent) abuse; almost half (49 percent) reported more than one type of abuse.

Consequences of maltreatment are both immediate and long term

The CIS provides information on the immediate effects of child maltreatment, while the ESCSY provides current risk behaviour information for street youth, many of whom were maltreated before living on the street. In the CIS, physical injury or harm was reported in 18 percent of all substantiated cases, with four percent requiring medical attention. The most common form of injury was

FIGURE 2
Types of abuse as reason for leaving home, ESCSY, 1999



bruises, cuts and scrapes (12 percent of all substantiated cases).[2] Emotional harm was more common, occurring in 34 percent of substantiated CIS cases, with symptoms severe enough to require treatment, observed in 21 percent of substantiated cases.

Analysis of the ESCSY data showed that having experienced abuse (emotional, physical or sexual) was associated with several risk behaviours identified in the questionnaire. Compared to those non-abused, a higher number of abused youth have been told they had an STI (percentages of 28 vs. 18), reported a significantly higher number of average lifetime sexual partners (percentages of 34 vs. 16), and have traded sex at some point in their lives (percentages of 34 vs. 18). Finally, more abused than non-abused youth have injected drugs (26 vs. 18 percent).

Discussion

These findings contribute to knowledge about child maltreatment in the following ways:

- They indicate that child maltreatment is an important problem that can have significant short and long-term consequences.
- They alert service providers to the possible long-term outcomes of abuse.
- They highlight the opportunity for early intervention to minimize long-term negative effects of child maltreatment.
- The large proportion of street youth who reported past emotional abuse as a problem supports the argument that it is widespread and has lasting effects. Emotional abuse was identified as an important form of child maltreatment in both of these studies.
- Finally, this research points to a need for continued services for homeless children and youth, particularly for those who have experienced sexual abuse. The challenges they face while living on the street may make it difficult to access the services that they need.

Conclusion

Both studies provide a unique perspective on child maltreatment in Canada. The ESCSY will continue to be an important source of data to assist in understanding the health, social and behavioural risks experienced by street youth, while the CIS will continue to provide important information on current child maltreatment. Further cycles of these two complementary studies of children and youth in Canada will provide valuable information to guide development of social welfare policy and programming. The report of the latest cycle of the CIS was released in October, 2005 and the data is available to researchers in government, academia and other areas. Further information on the availability of the study is available in a previous Chronic Diseases in Canada status report.[3] Likewise, a compendium of reports from the ESCSY data was released in the fall of 2005. These reports contain data from 1999 to 2003. The intended audience is the principle investigators and other researchers in each of the sentinel sites, other site-specific community service stakeholders, and provincial/territorial stakeholders.

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Ottawa

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Edmonton

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Status Report

Situational analysis of chronic disease surveillance in Canada: Results of a stakeholder interview

Bernard CK Choi, Elizabeth Wright, Ulrick Auguste and the Chronic non-communicable disease surveillance infostructure sub-group, Health surveillance working group

Introduction

The Network for Health Surveillance in Canada, a pan-Canadian partnership of health practitioners aiming to improve health surveillance capacity in Canada, was established in 1999. The Network was guided by the Federal/Provincial/Territorial Health Surveillance Working Group (HSWG).

The HSWG's Chronic Non-Communicable Disease Surveillance Infostructure Sub-Group (Chronic Sub-Group) was directed to develop a strategy for enhancing chronic disease surveillance capacity, beginning with a review of current capacity in Canada. Accordingly, a situational analysis was initiated in 2002 as a joint effort of the Centre for Chronic Disease Prevention and Control and the Centre for Surveillance Coordination of the former Population and Public Health Branch, Health Canada (now the Public Health Agency of Canada). The project was intended to provide baseline information on chronic disease surveillance activities in Canada and to produce a critical analysis of current capacity.

A key aspect of the project was a series of stakeholder interviews, conducted to gather information on the strengths and weaknesses in chronic disease surveillance capacity and to elicit recommendations for improvement.

Several working definitions were employed in the project. "Surveillance" was defined as "tracking and forecasting any health event or health determinant through the ongoing collection of data, the integration, analysis and interpretation of that data into surveillance products and the dissemination of that resultant surveillance product to those who need to know".[1] "Chronic disease" was defined as "disease that has a prolonged course, that does not resolve spontaneously and for which a complete cure is rarely achieved".[2]

Methods

Stakeholders and experts in Canada in the chronic disease surveillance area were identified through consultations within and outside of Health Canada. A list of potential interviewees was developed using the following criteria: experience and expertise in chronic disease surveillance; approximately equal numbers of information providers and information users; a reasonable distribution by sector (local, regional, provincial/territorial and federal governments, universities, public health agencies and consultants); no more than three interviewees per province or territory; and a balance of interviewees between urban and rural centres.

Stakeholders were asked to participate in a 45-minute telephone interview and were provided with background information consisting of an interview guide, definitions and selected questions in advance. The interview guide was based on a set of questions developed for the 2001 Summit on Non-communicable Disease Surveillance in the Americas.[3] All materials and supporting documentation were available in both official languages and interviews were conducted in the preferred official language of the interviewee. For interviews conducted in French, independent back translation of the document was used to ensure exact text translation.

The questionnaire began with open-ended questions on the importance of chronic disease surveillance in Canada; examples of surveillance initiatives (including systems and networks) of which the interviewees were aware; major problems or barriers affecting chronic disease surveillance in Canada; recommendations for improvement; perceived importance of achieving data comparability across various regions in Canada; and the best model, process or approach for conducting chronic disease surveillance in Canada.

The second part of the questionnaire repeated some of these questions, but in a closed format with multiple choice, "check all that apply" type options for the interviewees: important objectives for chronic disease surveillance in Canada; problems or barriers for chronic disease surveillance in Canada; and requirements for achieving comparability across various regions in Canada. The final question solicited the interviewees' thoughts on how to improve chronic disease surveillance in Canada.

Results

Twenty-seven of the 32 stakeholders were interviewed, representing data providers and users from national agencies, provincial and territorial health ministries and academic centres.

Author References

Bernard CK Choi, Ulrick Auguste, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada
Elizabeth Wright, Regional Offices, Atlantic Region, Public Health Agency of Canada
The Chronic Non-Communicable Disease Surveillance Infostructure Sub-Group, Health Surveillance Working Group
Correspondence: Bernard CK Choi, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, PL: 6701A, 120 Colonnade Road, Ottawa, Ontario, Canada K1A 0K9; fax: (613) 941-2633; e-mail: Bernard_Choi@phac-aspc.gc.ca.

General objectives of surveillance

There was agreement on the objectives of surveillance, centring on five themes: monitoring, decision-making, evaluation, research, and forecasting needs.

Monitoring trends, estimating prevalence, calculating burden of diseases, and tracking changes were cited as important objectives for chronic disease surveillance, although sometimes difficult to achieve.

Stakeholders also agreed on the importance of objectives relating to the ability to make health decisions, and provided a number of examples of the use of surveillance information: for long-term planning and for targeting of resources; to assist in the development of programs (including public education), health promotion interventions and clinical interventions; and to contribute to informed policy making for prevention and control.

Program evaluation was identified as a key objective, with surveillance information cited as a critical component of evaluation. This information is used for the objective assessment of the impact and effectiveness of actions such as screening programs, disease prevention and health promotion efforts; targeted interventions; and justification of resource allocations.

The link between research and surveillance was underscored as stakeholders identified surveillance as an integral part of the development of health research hypotheses, the investigation of disease aetiology, the identification of populations at risk and the examination of relationships between diseases.

Finally, the respondents noted the importance of surveillance in economic forecasting related to health care, and in the ability to systematically detect emerging problems and health issues.

Current state of chronic disease surveillance in Canada

Interviewees noted that while there are a variety of chronic disease surveillance initiatives producing useful information, there are few true surveillance systems that operate from data collection through to dissemination. The state of national-level chronic disease surveillance was characterized as uneven, ranging from the well-established Canadian Cancer Registry (CCR), to the more recent National Diabetes Surveillance System (NDSS), to a variety of databases and short-term initiatives. It was noted that numerous sources are used to provide the required data on determinants, risk factors, diagnoses, interventions and outcomes, with varying degrees of success, and often with duplication of effort.

Problems and barriers affecting chronic disease surveillance in Canada

The importance of strong leadership was stressed by the stakeholders. Some stakeholders felt the need for more knowledgeable leaders in chronic disease surveillance, and for action from those possessing the vision to drive the political agenda and garner the necessary support.

Stakeholders voiced the need for establishing a commitment to chronic disease surveillance, while noting that securing funding remains a challenge. Several explanations for this were presented: that there is sometimes insufficient appreciation of the true impact of chronic diseases, particularly in terms of the economic burden and the ageing population; and that there is a widely held perception that chronic conditions do not present threats to public health.

Those interviewed noted that the available human resources require strengthening, both in terms of numbers and expertise. Several stakeholders stressed that although there are content experts in the various chronic diseases, the existing level of expertise in surveillance methodologies for chronic disease is worth enhancing.

Many stakeholders felt an urgent need to reposition ways to conduct surveillance; to shift the focus from mortality to a more comprehensive view, encompassing determinants through to outcomes.

All stakeholders identified a need to achieve comparability in data collection across regions, to allow for development of a national perspective on chronic disease surveillance. This in turn raised the issue of the need for progress on creation of data standards, data dictionaries and common definitions in order to achieve comparability of information across regions. Stakeholders also identified the need for more work in the development of the data collection instruments to facilitate analysis, comparability, data linkage and coding.

Other needs identified included improvements to existing data sources for chronic disease surveillance in terms of quality, integration, timeliness and access.

Dissemination was also identified as an issue–the need to ensure a return of useful information on collected and submitted data, and to ensure the appropriate tailoring of surveillance information into meaningful information for varied audiences.

Several stakeholders referred to the electronic health record (EHR) as a solution, albeit a distant one. The point was made that although a reasonable amount of data will not be available within the next few years, the development of the EHR must be supported, as it will become a primary source of surveillance information.

Lastly, fragmentation or stove-piping of chronic diseases surveillance was identified as a major problem, resulting in duplication of efforts. Most stakeholders called for some sort of nationally integrated chronic disease surveillance network to cover all chronic diseases.

Discussion

Limitations of this study include a small sample size, a lack of objective "measures of opinion" items and a lack of objective methods to validate the answers given. Nevertheless, results of the stakeholder interview provide important information for the continued development of a national chronic disease surveillance strategy in Canada.

Although surveillance objectives were clearly identified, the findings related to the problems and barriers to chronic disease surveillance indicate that these objectives are not consistently being met. The identified

problems and barriers include lack of leadership; insufficient funding; human resource issues; and operational shortcomings of surveillance related to data collection and integration, data analysis and interpretation, and surveillance products and dissemination.

The problems identified are not new, and have been identified in previous work and consultations.[1,4-9] However, the results of these interviews indicate a consensus, at least amongst this group, that there are some fundamental steps that can be taken now to improve the situation: clear, informed leadership, directed efforts towards co-ordination, enhancement of data collection methods, facilitated access to data, development of standards and improvements to human resource capacity.

Recent developments at the federal, provincial and territorial level reflect a response to these identified needs. For example, in October 2005, the federal government launched the Integrated Strategy on Healthy Living and Chronic Disease, which includes activities to enhance surveillance for chronic diseases. Chronic disease surveillance is also a priority item for the new federal, provincial and territorial Advisory Committee on Population Health and Health Security, and focussed work is underway to improve capacity for surveillance of chronic disease risk factors.

Conclusion

Chronic disease surveillance capacity, from determinants to outcomes, must be enhanced in order to produce timely, high quality and useful surveillance information on population health. This permits improved understanding of individuals' health within a population, contributes to chronic disease prevention and control, facilitates the evaluation of interventions and services, and assists in the accountability process.

Chronic disease surveillance stakeholders identified existing gaps and possible solutions that focus on several themes: the need for leadership and coordination of efforts; data quality and access issues; the need for methodological improvements; and requirements for enhanced human resource capacity.

The capacity for chronic disease surveillance in Canada should be constantly monitored and evaluated to assess progress in eliminating the barriers and problems identified in this analysis. A stakeholder interview is recommended on a regular basis as an efficient way to obtain comments and suggestions.

Acknowledgements

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Calendar of Events

3–4 February 2006 **Toronto, Ontario, Canada**	The Ontario Thoracic Society Better Breathing 2006: A Lifetime of Lung Health	e-mail: ots@on.lung.ca < http://www.on.lung.ca >
16–18 February 2006 **St. Gallen, Switzerland**	Cancer Prevention 2006	< http://www.oncoconferences.ch/2006/index.htm >
28 February – 4 March 2006 **Mérida, Yucatán, México**	XIII International Congress on Metabolism and Nutrition in Renal Disease	< http://www.isrnm-merida2006.org/standinformation .htm >
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30 March – 1 April 2006 **Paris, France**	1st International Conference on Hypertension, Lipids, Diabetes and Stroke Prevention	e-mail: strokeprevention@kenes.com < http://www.kenes.com/strokeprevention/index.asp >
17–20 April 2006 **Atlanta, Georgia, USA**	US Centers for Disease Control and Prevention – Physical Activity and Health Branch International Congress on Physical Activity and Public Health	e-mail: ICPAPH2006@cdc.gov < http://www.cdc.gov/nccdphp/dnpa/ICPAPH/index.htm >
21–22 April 2006 **Halifax, Nova Scotia, Canada**	11th Annual Atlantic Canada Cardiovascular Congress	e-mail: mary.ann.robinson@dal.ca
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16–19 May 2006 **Denver, Colorado, USA**	Centers for Chronic Disease Control and Prevention 2006 CDC Diabetes and Obesity Conference	< http://www.cdc.gov/diabetes/conferences/ >
28–31 May 2006 **Vancouver, British Columbia, Canada**	Canadian Public Health Association 97th Annual Conference	e-mail: conference@cpha.ca < http://www.cpha.ca/english/conf/conf97/97conf-e.htm >
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