Migraine

Heather Gilmour and Kathryn Wilkins

Abstract

Objectives
This article provides prevalence and incidence estimates of migraine among Canadians aged 12 or older. Associations with selected socio-demographic factors and health characteristics are also examined. Selected health indicators and medication use, as well as health care use and attitudes, are discussed, comparing migraineurs with non-migraineurs.

Data sources
The findings are based on the cross-sectional and longitudinal household components of the first three cycles (1994/95, 1996/97 and 1998/99) of Statistics Canada's National Population Health Survey. Information on hospital stays is from the 1997/98 Hospital Morbidity Database, maintained by the Canadian Institute for Health Information.

Analytical techniques
Cross-tabulations were used to estimate the prevalence and incidence of migraine. Associations of migraine with selected factors were examined using generalized logistic regression.

Main results
In 1998/99, migraine was most prevalent among women, 25- to 54-year-olds, Whites, and individuals in low-income households. The odds of being diagnosed with migraine were higher for women with pre-existing sinusitis, bronchitis or emphysema, compared with women without these conditions. The odds of this disorder for men were associated with previously diagnosed arthritis or rheumatism.

Key words
comorbidity, headache, longitudinal studies

Authors
Heather Gilmour (613-951-1679; gilmhea@statcan.ca) and Kathryn Wilkins (613-951-1769; wilkkat@statcan.ca) are with the Health Statistics Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

A substantial number of Canadians suffer from recurrent, potentially severe headaches known as "migraine" (see *What is migraine?*). According to the 1998/99 National Population Health Survey (NPHS), an estimated 8% of Canadians aged 12 or older—nearly 2 million people—have received a clinical diagnosis of migraine.

Previous studies indicate that migraine has a major impact on productivity and lifestyle.[1-7] It can result in days away from work, hinder job performance, restrict activities and disrupt relationships. In addition, the direct costs of doctor consultations, emergency room visits, and drug treatments for migraine are considerable. It has been estimated that migraine accounts for 7 million lost working days annually in Canada.[8] A recent US study estimated 112 million bedridden days a year for migraineurs, costing employers $13 billion (US) because of missed workdays and impaired work function, and $1 billion in direct costs for medical care.[6] (Direct costs include those associated with medical visits and medications.[6]) Although the impact of migraine is appreciable, little is known about the extent and burden of this health problem among Canadians.

<p style="text-align:center;">**Methods**</p>

Data sources

This analysis is based on data from Statistics Canada's National Population Health Survey (NPHS), weighted to represent the population of the 10 provinces. The NPHS, which began in 1994/95, collects information about the health of the Canadian population every two years. It covers household and institutional residents in all provinces and territories, except persons living on Indian reserves, on Canadian Forces bases, and in some remote areas. The NPHS has both a longitudinal and a cross-sectional component. Respondents who are part of the longitudinal component will be followed for up to 20 years.

Cross-sectional sample: The 1994/95 and 1996/97 (cycles 1 and 2) cross-sectional samples are made up of longitudinal respondents and other members of their households, as well as individuals who were selected as part of supplemental samples, or "buy-ins," in some provinces. In 1994/95, the large majority of interviews were conducted in person. Most of the 1996/97 interviews were conducted by telephone, and the additional respondents for the buy-ins were chosen using the random digit dialling technique. The 1998/99 (cycle 3) cross-sectional sample is made up mostly of longitudinal respondents and their cohabitants. Again, most of the interviews were conducted by telephone. Although no buy-ins were added to the cycle 3 sample, infants born in 1995 or later and immigrants who entered Canada after 1994 were randomly selected and added to keep the sample representative. As well, to replace the sample that was lost to attrition, individuals in households that were part of the original sampling frame, but whose members did not respond in 1994/95, were contacted and asked to participate.

NPHS data consisting of socio-demographic and some health information obtained for each member of participating households are found in the General file. In-depth health information, which was collected for one randomly selected household member, as well as the information in the General file pertaining to that individual, is found in the Health file.

In households belonging to the cross-sectional buy-in component, one knowledgeable person provided the socio-demographic and health information about all household members for the General file. As well, one household member, not necessarily the same person, was randomly selected to provide in-depth health information about himself or herself for the Health file.

Among individuals in the longitudinal component in 1996/97 and 1998/99, the person providing in-depth health information about himself or herself for the Health file was the randomly selected person for the household in cycle 1 (1994/95), and was usually the person who provided information on all household members for the General file in cycles 2 and 3. In households that were added to the 1998/99 cross-sectional sample (immigrants, infants and individuals in households that did not participate in cycle 1), the randomly selected respondent was also the person who provided information for the General file.

The 1994/95 provincial, non-institutional sample consisted of 27,263 households, of which 88.7% agreed to participate. After the application of a screening rule to maintain the representativeness of the sample, 20,725 households remained in scope. In 18,342 of these households, the selected person was aged 12 or older. Their response rate to the in-depth health questions was 96.1%, or 17,626 respondents.

In 1996/97, the overall response rate at the household level was 82.6%. The response rate for the randomly selected individuals aged 2 or older in these households was 95.6%. In 1998/99, the overall response rate was 88.2% at the household level. The response rate for the randomly selected respondents aged 0 or older in these households was 98.5%.

Longitudinal sample: Of the 17,626 randomly selected respondents in 1994/95, 14,786 were eligible members of the longitudinal panel, along with 468 persons for whom only general information was collected. An additional 2,022 of the 2,383 randomly selected respondents under age 12 were also eligible for the longitudinal panel. Thus, 17,276 respondents were eligible for re-interview in 1996/97, and 16,677 were still alive in 1998/99. A response rate of 93.6% was achieved for the longitudinal panel in 1996/97, and a response rate of 88.9%, based on the entire panel, was achieved in 1998/99. Of the 16,168 participants in 1996/97, full information (that is, general and in-depth health information for the first two cycles of the survey or an outcome of death or institutionalization) was available for 15,670. The corresponding number for 1998/99 was 14,619 respondents. More detailed descriptions of the NPHS design, sample, and interview procedures can be found in published reports.[9,10]

Hospital discharge data for migraine were obtained from the Hospital Morbidity Database for 1997/98, which is maintained by the Canadian Institute for Health Information. The information in this database comes from the separation form completed by Canadian hospitals at the end of each patient's stay.

Analytical techniques

Cross-tabulations, based on data from the cross-sectional Health files (all three cycles), were used to estimate the prevalence of migraine in the household population aged 12 or older. Data from the longitudinal Health file were used to estimate incidence. Incident cases of migraine were considered to occur in individuals who did not have reports of clinically diagnosed migraine in cycle 1 (1994/95), then had subsequent reports of migraine in cycle 2 and/or cycle 3 (1996/97 and/or 1998/99).

Women who lived in a household with a child younger than 1 were excluded from the analysis of overnight hospital stays, since they would likely have stayed in a hospital during childbirth.

Generalized logistic regression was used to model the relationship between incident cases of self-report of physician-diagnosed migraine and various socio-demographic and health factors. Individuals who indicated that they did not have diagnosed migraine in cycle 1 were identified as the population at risk of developing migraine. Chronic conditions that had been significantly more prevalent among migraineurs than non-migraineurs in any of the three cross-sectional cycles of the NPHS were included in the model. A variable to account for missing data on household income was included in the model for both sexes, but removed from the model for each sex because of small numbers. Education was not included in the model since individuals in the younger age groups would not yet have attained their highest level of education. (The relationships did not change when education was added to the model.)

All cross-sectional estimates based on NPHS data were weighted to represent the Canadian population at the date of each survey cycle. Longitudinal estimates were weighted to represent the 1994 Canadian population. To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.[11-13]

This article examines the prevalence of migraine in Canada using cross-sectional data from the 1998/99 National Population Health Survey (NPHS). In addition, longitudinal data from individuals followed from 1994/95 to 1998/99 offer a unique opportunity to estimate migraine incidence and identify associated factors. (See *Methods, Limitations,* and *Supplementary definitions* in the Appendix.)

One in twelve diagnosed

According to the 1998/99 NPHS, an estimated 2 million Canadians aged 12 or older had been diagnosed with migraine (Table 1). Earlier Canadian studies have reported a considerably higher figure of over 3 million.[8,14] The inconsistency likely arises from differences in the way migraine was defined (see *Defining migraine in the NPHS*). While the NPHS asked respondents if they had medically diagnosed migraine, the other studies defined migraine by asking questions about a specific set of symptoms identified by the International Headache Society.[15] For example, respondents were asked if headache pain occurred on one side of the head, had a pulsating quality, or was accompanied by nausea, vomiting, or sensitivity to light or sound. Because many migraineurs never actually receive a clinical diagnosis,[1,16-18] the NPHS likely underestimates prevalence.

More common among women

Estimates from the 1998/99 NPHS show that migraine is three times as common in females (11.7%) as in males (3.8%) (Table 1). The higher prevalence of migraine among women has been well documented in population-based studies in Canada,[8,14] the United States[2,16,19] and other countries.[5,17,20-25] Hormonal fluctuations that women experience related to menstruation, oral contraceptive use, pregnancy, menopause, and

Defining migraine in the NPHS

To establish the presence of chronic conditions, including *migraine*, National Population Health Survey (NPHS) respondents were asked if they had any "long-term conditions that have lasted or are expected to last six months or more and that have been diagnosed by a health professional" (see *Limitations*). In addition to migraine, chronic conditions relevant to this study are: food allergies, other allergies, asthma, arthritis or rheumatism, back problems excluding arthritis, high blood pressure, bronchitis or emphysema, sinusitis, stomach or intestinal ulcers, diabetes, epilepsy, heart disease, cancer, effects of a stroke, and urinary incontinence. Only those conditions that were significantly associated with migraine in bivariate analysis are shown in Tables 4, 6 and D.

Follow-up questions were asked in cycles 2 and 3 if the response to the question "Do you have migraine headaches?" was inconsistent with the response to the same question in the previous cycle. For example, if records showed "No" to "Do you have migraine headaches?" in cycle 1 and "Yes" to the same question in cycle 2, respondents were asked, "When were you diagnosed with this?". If the date given was before the previous interview, the respondent was asked, "So you had migraine headaches prior to our last interview?" Alternatively, if the respondent answered "Yes" in cycle 1 followed by "No" in cycle 2, the interviewer asked, "During our last interview it was reported that you had migraine headaches, but this time it was not. Has the condition disappeared since then?"

Respondents could confirm that their migraine headaches had disappeared, or that the cycle 1 response was an error and they had never had migraine. For the longitudinal analysis, responses to these follow-up questions were taken into account when determining the number of respondents who had migraine in cycles 1 and 2. Specifically, respondents who indicated that they did have migraine in the previous cycle even though the response was "No" at that time were counted as migraineurs. Likewise, respondents who had said "Yes" they had migraine in the previous cycle, but in a subsequent cycle indicated that they never had migraine were not counted as migraineurs.

A possible explanation for inconsistent replies between cycles is that a proxy reporter gave the information for the selected respondent in the first cycle, then the selected individual was interviewed directly in subsequent cycles.[26] It is also possible that respondents did not clearly understand the question in one of the cycles. Alternatively, undiagnosed individuals may have consulted a physician between survey cycles and received a diagnosis of migraine. As a result of the follow-up questions, more people indicated that they actually did have migraine in the previous cycle than indicated that they never had migraine. Thus, the net effect of adjusting responses based on the follow-up questions was to increase the number of prevalent cases in cycle 1 and thus reduce the number of incident cases.

hormone replacement therapy appear to influence migraine prevalence.[27] However, the ratio of female-to-male migraineurs remains high even in older age groups, suggesting the existence of additional, but as yet unidentified, reasons for the elevated prevalence among women (Chart 1).[16]

Table 1
Prevalence of migraine, by selected socio-demographic factors and health characteristics, household population aged 12 or older, Canada excluding territories, 1998/99

	Sample size	Estimated population	Prevalence
		'000	%
Total	**1,197**	**1,956**	**7.9**
Sex			
Male	268	469	3.8
Female	929	1,485	11.7**
Age group†			
12-24	149	290	5.6
25-39	449	679	9.9
40-54	382	657	9.9
55-69	153	244	6.5
70+	64	82	3.4
Race			
White	1,101	1,771	8.1*
Non-White	92	178	5.9
Education‡			
Secondary graduation or less	366	594	7.8
Some postsecondary or more	682	1,070	8.9
Household income			
Lowest	238	280	8.9
Lower-middle	312	485	7.9
Upper-middle	380	670	7.9
Highest	213	422	8.1
Ever a daily smoker			
Yes	650	1,016	8.5*
No	544	935	7.3
Type of drinker			
Regular	540	950	7.0
Occasional/ Former/Abstainer	654	1,000	8.9**
Major depressive episode			
Yes	145	220	20.4**
No	1,024	1,683	7.3

Data source: *National Population Health Survey, cross-sectional sample, Health file, 1998/99*
Note: *Detail may not add to totals because of missing values for some variables.*
† All pairwise comparisons (p ≤ 0.05, adjusted for multiple comparisons) are significant with the exception of the comparisons between 12 to 24 and 55 to 69, and 25 to 39 and 40 to 54.
‡ Population age 25 or older
* Significantly higher than value for other item in category (p ≤ 0.05)
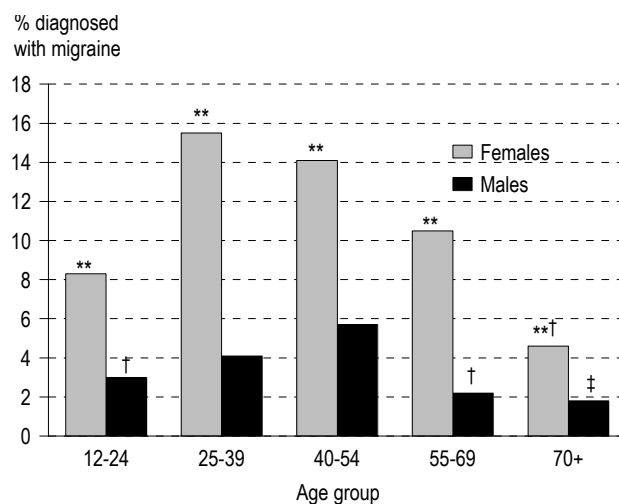*** Significantly higher than value for other item in category (p ≤ 0.01)*

In contrast to the majority of chronic conditions, which are more prevalent in old age, migraine most frequently affects people during early to middle adulthood (ages 25 to 54).

Heredity plays a role

Although migraine tends to run in families, a specific gene associated with the disorder has been found for only one rare type (familial hemiplegic).[28-30] Some research indicates that genetic factors may be partly responsible for a biochemical imbalance that makes some individuals more susceptible to migraine when they are exposed to certain triggers (see *What is migraine?*).[28,31]

NPHS data for 1998/99 show that a significantly higher proportion of Whites reported a diagnosis of migraine (8%) than did non-Whites (6%) (Table 1). Genetically based racial differences, rather than environmental or cultural factors, have been suggested as an explanation for the lower migraine prevalence found in African and Asian populations, since lower prevalence has also been noted in US residents of African and Asian descent.[32] However, the literature on the link between race and migraine

Chart 1
Prevalence of migraine, by sex and age group, household population aged 12 or older, Canada excluding territories, 1998/99

Data source: *National Population Health Survey, cross-sectional sample, Health file, 1998/99*
† Coefficient of variation between 16.6% and 25.0%
‡ Coefficient of variation between 25.1% and 33.3%
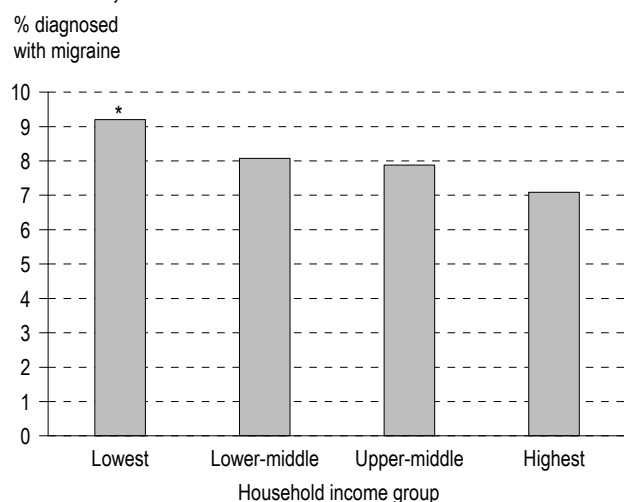*** Significantly higher than value for males (p ≤ 0.01)*

is not entirely consistent. Another US study found higher prevalence among Blacks than Whites.[33]

Income, education and migraine

The relationship of migraine to socio-economic status is also unclear in the literature. Studies in the United States have found higher migraine prevalence among individuals in lower income households.[2,16,19] However, this link to low income was absent in previous Canadian studies,[3,8,14] as well as in research from other countries.[24,25] And it did not emerge in the first or third NPHS cycles (1994/95 and 1998/99), perhaps because of insufficient statistical power resulting from smaller sample sizes, or perhaps because of reporting error (see *Limitations*). But in 1996/97, when the sample size was much larger, the data show a slightly higher prevalence of migraine among individuals in the lowest household income group, compared with those in the highest (Chart 2).

Some researchers have suggested that "reverse causality" might explain the higher prevalence of migraine among members of lower income households; that is, migraine sufferers lose income or employment because of the effect of their

Chart 2
Prevalence of migraine, by household income group, household population aged 12 or older, Canada excluding territories, 1996/97†

% diagnosed
with migraine

Data source: *National Population Health Survey, cross-sectional sample, Health file, 1996/97*
† *No significant differences emerged in 1998/99.*
* *Significantly higher than value for highest household income group (p ≤ 0.05, adjusted for multiple comparisons)*

What is migraine?

Migraine is a complex biochemical disorder causing recurrent headaches that are often characterized by throbbing pain on one side of the head. Such headaches may be accompanied by nausea, vomiting, sensitivity to light or sound, or visual disturbances, and may be exacerbated by movement or physical activity.[34] A migraine attack can last from several hours to several days, and the pain and associated symptoms can be disabling. The frequency of attacks can vary, from two to three per year to two or more per week.[4,14]

Current research suggests that migraine originates in the brain, either in the brainstem or the occipital cortex. Impulses from these areas appear to stimulate nerve endings in the blood vessels of the meninges, causing these vessels to become dilated and inflamed, thus generating migraine pain. Some researchers believe that migraine and tension-type headaches are separate disorders; others believe they are on opposite ends of a continuum of the same disorder, differing only in severity.[35]

Migraine can occur with or without aura, even in the same individual.[36] Aura refers to neurologic symptoms that can occur 20 minutes to one hour before the headache actually begins. These symptoms may include visual or sensory disturbances such as blurred vision, numbness and tingling. In some cases, these symptoms may also accompany the headache; in others, a headache does not follow the aura. Migraine without aura is characterized by the sudden onset of a headache, without any warning signals. (The NPHS does not differentiate between the sub-types of migraine.)

The exact cause of migraine is unknown, but certain factors are believed to provoke such headaches in some people. These "triggers" include alcohol, aged cheeses, flavour enhancers or food preservatives, irregular sleep patterns, hormonal changes (often related to menstruation), stress and anxiety, and environmental factors.[34]

Medications used to treat migraine include over-the-counter and prescription analgesics, serotonin agonists to abort migraine, and drugs typically used to treat other medical conditions (antidepressants, beta-blockers, or hormone replacement therapy, for example).[34,37] As well, several non-drug therapies such as biofeedback, relaxation therapy, acupuncture and physiotherapy can be used to treat migraine.[38] Although the NPHS asks respondents about medication use and alternative/complementary therapies in general, it is not known if migraine was the reason for use of these medications and therapies. In a separate question, migraineurs are asked if they received any treatment or medication for their headaches; however, the response categories (drug, diet, exercise/physiotherapy, other) do not permit the identification of specific medications or therapies (see *Limitations*).

condition.[7,16,35,39,40] To explore this possibility, data on changes in income were examined using the NPHS longitudinal file. Among people aged 16 or older who lived in households where employment was the main source of income, the proportions of migraineurs and non-migraineurs who experienced a decline in household income between cycles 1 and 3 did not differ significantly. However, the time period for comparison is brief and data on personal income were not available, which may explain the lack of an association between a decline in income and a diagnosis of migraine.

Previous Canadian studies have found that migraineurs tend to have a higher level of education than non-migraineurs.[3,8] NPHS data relating education to migraine are partially consistent with this earlier research. Although the differences were not statistically significant in 1998/99, data from cycles 1 and 2 reveal a higher prevalence of diagnosed migraine among people with at least some postsecondary education, compared with those who had attained only secondary graduation or less (Appendix Table A). This finding is curious, considering the inverse relationship between income and migraine prevalence noted above. In the United States, migraine prevalence (based both on symptoms and self-reported diagnosis) has been found to be inversely related to educational level.[33]

Links to smoking, depression

According to the 1998/99 NPHS, the prevalence of migraine was higher among current or former daily smokers, compared with occasional or former occasional smokers, or individuals who had never smoked (Table 1). This is consistent with previous research showing smoking to be associated with migraine.[33,41]

Migraine prevalence in 1998/99 was slightly lower among individuals who reported having one alcoholic drink at least once per month than among those who drank less frequently, or who were former drinkers or abstainers. It may be that migraine sufferers tend to avoid alcohol because it can trigger an episode. Some research indicates no association between migraine and alcohol use or abuse,[33,42]

although in one study, people suffering from migraine with aura had increased odds of either alcohol dependence or abuse, or illicit drug dependence or abuse.[41]

The prevalence of migraine was nearly three times as high among people who reported suffering from depression at some point during the 12 months before the interview as among those who did not: 20% compared with 7%. Other studies, too, have reported associations between migraine and depression, mood and anxiety disorders.[41-44]

Fair, poor health ratings

Reflecting increases in the prevalence of chronic diseases and other disorders that accompany aging, the level of self-rated health tends to decline with age in the general population.[45] Despite the relatively young age of migraineurs, however, higher proportions rated their health as fair or poor when compared with non-migraineurs in 1998/99 (Chart 3). Conversely, non-migraineurs were significantly more likely to rate their health as good, very good, or excellent.

Chart 3
Self-rated health of migraineurs and non-migraineurs, household population aged 12 or older, Canada excluding territories, 1998/99
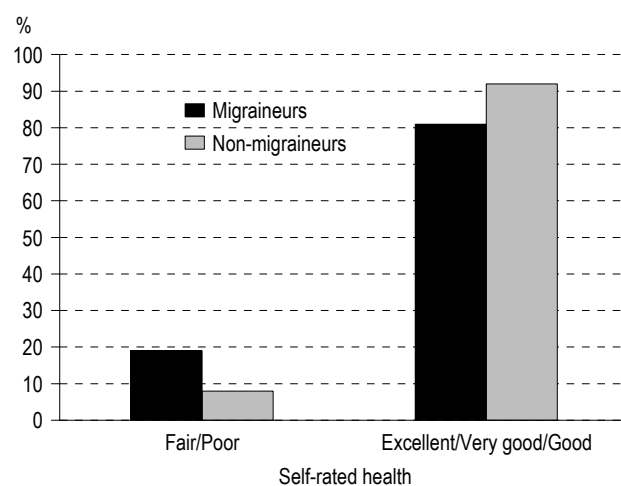
Data source: *National Population Health Survey, cross-sectional sample, Health file, 1998/99*
Notes: *Chi-squared test used 500 bootstrap weights and included the Rao-Scott second-order correction[46] to account for the complex survey design. Chi-squared = 48.21, df = 1, p ≤ 0.001.*

Many migraineurs do not receive treatment

Although migraine is not curable, episodes can usually be managed with medication and/or non-drug therapies (see *What is migraine?*). However, previous studies have shown that many migraine sufferers do not seek medical care.[1,5,15] NPHS data indicate that a growing proportion of migraine sufferers reported receiving treatment. In 1998/99, 56% of diagnosed migraineurs received treatment—

a statistically significant increase from 48% in 1996/97 (p ≤ 0.001; data not shown). Greater awareness of the disorder and recent advancements in medications may account for this rise.

NPHS data suggest that treatment for migraine is somewhat sporadic. Among respondents who reported migraine in both 1996/97 (cycle 2) and 1998/99 (cycle 3), one-third (33%) of those not receiving treatment in cycle 2 reported receiving it in cycle 3—principally medications. In contrast, one-

Limitations

National Population Health Survey (NPHS) data are self- or proxy-reported, and the degree to which they are inaccurate because of reporting error is unknown. There was no independent source to confirm diagnosis of migraine or other health problems. Determination of migraine for the NPHS is based on a self-report of clinical diagnosis (see *Defining migraine in the NPHS*), not on questions about symptoms of migraine, as contained in the International Headache Society criteria used in most recent analytical studies.[47] Because many migraineurs do not seek medical attention,[1,15,22] and many of those who do remain undiagnosed,[12,15] it is likely that the NPHS underestimates migraine prevalence. Thus, caution is advised when comparing estimates of migraine prevalence based on NPHS data with those from other population surveys.

Characteristics of diagnosed migraineurs (as in the NPHS) may differ from those of non-diagnosed migraineurs. For example, a US study showed that female migraineurs and migraineurs in higher income households were more likely than male or low-income migraineurs to have obtained a medical diagnosis.[18] If this relationship also exists in Canada, the NPHS data would underestimate migraine prevalence in lower income households relative to higher income households, and for men relative to women.

The NPHS is a general health survey; it was not designed to collect detailed information about migraine sufferers. For example, respondents are not asked to identify sub-types of migraine (with or without aura), or to report the frequency or duration of attacks. As well, an individual's migraine history before the first survey cycle is unknown; therefore, it was assumed that those who did not report diagnosed migraine in 1994/95 did not have migraine before then. It is also not known if respondents with migraine are indicating whether they have ever had migraine, or whether they have recently experienced it. Finally, because the NPHS questions on migraine cover only individuals aged 12 or older, the prevalence and incidence of migraine among children cannot be determined.

Although the NPHS collects self-reported data on overnight hospital stays and consultations with medical professionals, the reasons for these contacts with the health care system are not known. Data on outpatient treatment and visits to emergency departments are not available.

A period of longer than four years would be preferable to examine incidence rates and the temporal relationship between risk factors and the subsequent onset of migraine. This will be possible with future cycles of longitudinal data.

Information on individual income is not available for all three cycles, thus household income was used to investigate the relationship between migraine prevalence and income. It is not possible to determine what proportion of income migraineurs who live with others contribute to the total household income.

In cycles 2 and 3, respondents who indicated that they had received a clinical diagnosis of migraine were asked if they received any treatment or medication for it, and whether the treatment consisted of drugs, diet, exercise/physiotherapy (cycle 3 only), or other. It is not known how respondents interpreted the word "treatment." It could be understood to mean only treatment prescribed or recommended by a physician, or it could be interpreted as including self-treatment such as non-prescription drugs or alternate therapies. Respondents are also asked about specific medications they are taking. Migraine medications per se are not included in the list, although some medications that can be used to treat migraine (pain killers and codeine, for example) are included.

Although there is evidence for associations of migraine with epilepsy,[48,49] and head trauma,[50] the numbers of people reporting epilepsy or head injury in the NPHS sample were too small to produce reliable estimates. Consequently, these disorders were not included in the multivariate model. A separate multivariate analysis was run including oral contraceptive use among women aged 12 to 49; however, no significant association was found.

quarter (25%) of migraineurs who received treatment in cycle 2 did not in cycle 3. These findings may reflect the intermittent pattern of migraine episodes, or perhaps the inadequacy, undesirable side effects, or expense of treatment.

Health status and medication use

Reports of activity restriction, pain, and use of medications were more common among individuals with diagnosed migraine than those without (Table 2; Appendix Table B). However, it is not possible to determine if these differences were actually caused by migraine. In 1998/99, migraineurs were more likely than non-migraineurs to report activity restrictions (26% versus 13%), although only a small proportion of people with activity limitation (0.5%; data not shown) indicated that the primary reason for their activity restrictions was migraine. Higher proportions of migraineurs reported that, during the two weeks before their NPHS interview, they had stayed in bed or cut down on their activities because of illness or injury. Migraine sufferers also reported a higher average number of disability days (1.8) for that two-week period than did individuals without migraine (0.8).

Although most people reported that they were usually free of pain or discomfort, this was the case for a substantially smaller percentage of migraineurs

than non-migraineurs. In the month before their NPHS interview, migraineurs were also more likely than non-migraineurs to have used pain relievers, codeine, Demerol® or morphine, and antidepressants.

Heavy users of health care

Although migraineurs appear to receive treatment for migraine only sporadically, they are relatively heavy users of health care (Table 3; Appendix Table C). In 1998/99, they were more likely than non-migraineurs to have had seven or more consultations with a health care professional in the 12 months before their NPHS interview. The same pattern was observed in the two previous survey cycles. Yet in 1998/99, a significantly higher proportion of migraineurs (26%) than non-migraineurs (22%) indicated a preference for self-care over reliance on physicians.

A higher percentage of migraineurs than non-migraineurs spent at least one night in hospital during the 12 months before their interview. Although migraine does not generally require hospitalization, severe episodes can result in a hospital stay. (The reason for hospitalization is not available from the NPHS.) According to hospital records for 1997/98, close to 10,000 (9,895) hospital

Table 2
Selected health indicators and medication use, migraineurs and non-migraineurs, household population aged 12 or older, Canada excluding territories, 1998/99

	Migraineurs	Non-migraineurs
Activity restriction (%)	25.5**	12.9
Usually free of pain or discomfort (%)	72.6**	87.4
In last two weeks:		
Cut down on activities (%)	22.8**	10.5
Stayed in bed (%)	13.9**	5.6
Mean number of disability days	1.8**	0.8
In last month, used:		
Pain relievers (%)	83.8**	63.2
Codeine/Demerol®/morphine (%)	15.8**	3.9
Antidepressants (%)	10.3**	3.6

Data source: National Population Health Survey, cross-sectional sample, Health file, 1998/99
** Significantly different from value for non-migraineurs (p ≤ 0.01)

Table 3
Health care use and attitudes of migraineurs and non-migraineurs, household population aged 12 or older, Canada excluding territories, 1998/99

	Migraineurs	Non-migraineurs
	%	%
Seven or more consultations with health care professionals in previous 12 months	32.9**	15.6
Hospital stay in previous 12 months†	9.7**	6.1
Needed, but did not receive, care for physical problem in previous 12 months	10.5**	4.0
Prefer self-care over reliance on doctor‡	25.6**	21.8

Data source: National Population Health Survey, cross-sectional sample, Health file, 1998/99
† Excludes women with a child younger than 1, as these women would likely have stayed overnight in a hospital.
‡ Population aged 18 or older
** Significantly higher than value for non-migraineurs (p ≤ 0.01)

discharge summaries for a stay of one or more days included a diagnosis of migraine.

Although they consult medical professionals and are hospitalized more frequently than non-migraineurs, a higher proportion of migraineurs reported that they felt they needed, but did not receive, medical care for a physical problem in the previous 12 months (10% compared with 4%).

Other chronic conditions

The heavy use of health care by migraine sufferers may partly reflect the presence of additional illnesses (Table 4; Appendix Table D). Nearly 3 of every 10 female migraineurs and 2 of every 10 of their male counterparts reported that they had other chronic conditions. The prevalence of food allergies, other allergies, arthritis or rheumatism, back problems other than arthritis, sinusitis, and stomach or intestinal ulcers was significantly higher among both male and female migraineurs than among non-migraineurs. It is possible that respondents may confuse avoidance of certain foods that trigger migraine episodes with actual food allergies. As well, it is possible that pain medications, if taken frequently by migraineurs, could contribute to the higher prevalence of stomach ulcers among migraineurs. In women, the prevalence of asthma and chronic bronchitis or emphysema was significantly higher among migraineurs compared with non-migraineurs. Consistent with these findings, the 1990 Ontario Health Survey showed significantly higher rates of hay fever/other allergies, arthritis/rheumatism, skin allergies/skin diseases, and back pain in migraineurs.[3] Finally, the prevalence of a major depressive episode was higher among migraineurs of both sexes. This finding corroborates earlier studies showing a higher risk of major depression in people with migraine.[41-44,51]

Given that migraineurs may have other chronic conditions that could require frequent medical consultations, it is possible that they would have more opportunity to mention their headaches, and to be diagnosed as having migraine.

Is migraine becoming more common?

Reports from other countries suggest an increase in the prevalence and incidence of migraine.[52-55] In

Table 4
Selected health problems of migraineurs and non-migraineurs, by sex, household population aged 12 or older, Canada excluding territories, 1998/99

	Migraineurs	Non-migraineurs
	%	%
Chronic conditions		
Food allergies		
Females	15.1**	7.2
Males	10.4†*	5.2
Other allergies		
Females	42.7**	25.4
Males	28.4*	20.2
Asthma		
Females	16.5**	7.9
Males	9.4†	7.2
Arthritis or rheumatism		
Females	22.7‡*	18.7†
Males	16.5*	11.0
Back problems excluding arthritis		
Females	25.2**	13.2
Males	25.9**	12.5
High blood pressure		
Females	10.5	13.0
Males	10.9†	9.0
Chronic bronchitis or emphysema		
Females	5.1**	2.6
Males	--	2.1
Sinusitis		
Females	12.6**	5.7
Males	10.8†**	3.6
Stomach or intestinal ulcers		
Females	6.5**	2.6
Males	6.0‡*	2.5
Three or more chronic conditions (other than migraine)		
Females	26.7**	13.7
Males	18.7**	8.5
Major depressive episdoe		
Females	13.0**	4.9
Males	6.8†*	2.9

Data source: *National Population Health Survey, cross-sectional sample, Health file, 1998/99*
† Coefficient of variation between 16.6% and 25.0%
‡ Coefficient of variation between 25.1% and 33.3%
-- Coefficient of variation greater than 33.3%
* Significantly higher than value for non-migraineurs (p ≤ 0.05)
** Significantly higher than value for non-migraineurs (p ≤ 0.01)

Canada, a comparison of migraine prevalence in 1978/79 with that in 1998/99 indicates a significant rise in the disorder among women aged 45 to 64.[45]

Over a much shorter period, NPHS cross-sectional data from 1994/95 (cycle 1) and 1998/99 (cycle 3) indicate that the estimated prevalence of diagnosed migraine among women aged 25 to 54—the peak age for this disorder—rose from 13% to 15% (Table 5). In contrast, among younger males

Table 5
Prevalence of migraine, household population aged 12 or older, by sex and age group, Canada excluding territories, 1994/95 and 1998/99

	1994/95	1998/99
	%	%
Females		
12-24	7.4	8.3
25-54	12.8	14.8**
55+	6.6	8.1
All ages	10.1	11.7**
Males		
12-24	5.3	3.0[†]**
25-54	4.5	4.9
55+	2.8	2.1[†]
All ages	4.3	3.8

Data source: *National Population Health Survey, cross-sectional samples, Health file, 1994/95 and 1998/99*
† Coefficient of variation between 16.6% and 25.5%
*** Statistically different from value for 1994/95 (p ≤ 0.01)*

(aged 12 to 24), migraine prevalence fell from 5% to 3% between the first and third cycles.

Greater awareness among both patients and doctors could be partly responsible for the increase in diagnosed migraine. It is also possible that the availability and awareness of new medication and treatment options may have prompted some individuals who were previously undiagnosed to consult physicians. While increases in diagnosed migraine among women may also reflect a true increase of the disorder, the decrease among 12- to 24-year-old males remains unexplained.

Higher incidence among females
According to NPHS longitudinal data for 1994/95 through 1998/99, the estimated four-year cumulative incidence of newly diagnosed migraine among people aged 12 or older was 3.8 cases per 100 individuals. The incidence rate for women was significantly higher than that for men: 5.7 per 100, compared with 1.9 (data not shown).

These findings strongly suggest that females are at higher risk of migraine than males. However, as the NPHS questions on migraine cover only individuals aged 12 or older, the data may slightly underestimate the incidence in males. A population-based survey of adolescents and young adults in the

United States found that migraine incidence for males peaked before age 12, compared with 12 or older for females.[56] Similarly, another study found the age of migraine diagnosis peaked at 10 to 14 for males, compared with 20 to 24 for females.[53]

Who is at risk?
To gain a better understanding of who is at risk of developing migraine, it is useful to compare the baseline morbidity and socio-demographic characteristics of people who reported a new diagnosis of migraine in 1996/97 or 1998/99 with those of individuals who did not. Chronic conditions that were associated with migraine in the bivariate analysis and factors reported in the literature were included in the multivariate analyses. Previously reported chronic conditions included food allergies[57] and depression.[41-44,51]

To control for the possibility that people who see a physician frequently have greater opportunity to have their migraine diagnosed, the variables representing the number of medical consultations and general health status were included in the model. Smoking status and alcohol consumption were also included.

As expected from the patterns of migraine prevalence and incidence, females had higher odds of developing migraine than males, as did individuals in the age groups 12 to 24 and 25 to 54 (Table 6). Even when controlling for the effects of general level of health, frequency of medical consultations, and selected factors related to migraine, the odds of being diagnosed with migraine were higher for women with previously diagnosed chronic bronchitis/emphysema, compared with women without these conditions. The higher odds for new migraine among people with chronic bronchitis or emphysema remain significant even when accounting for smoking. Migraine has been previously associated with respiratory diseases such as bronchitis and asthma,[58-61] suggesting a biological link or shared risk factors.

The odds of a new diagnosis of migraine were also higher among women with sinusitis. Since sinusitis can cause headaches, it is possible that these higher odds among women who had already been

Table 6
Adjusted odds ratios for migraine in 1996/97 or 1998/99, by selected characteristics in 1994/95, household population aged 12 or older,† Canada excluding territories

Characteristics in 1994/95	Females		Males		Both sexes	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Sex						
Female	...	...	...	...	3.0**	2.1, 4.1
Male	...	...	...	...	1.0	...
Age group						
12-24	5.0**	2.5, 10.2	2.3	0.8, 6.8	4.5**	2.5, 8.2
25-54	2.9**	1.6, 5.5	2.8*	1.2, 6.7	3.1**	1.8, 5.2
55+‡	1.0	...	1.0	...	1.0	...
Race						
White‡	1.0	...	1.0	...	1.0	...
Non-White	0.7	0.3, 1.6	1.3	0.4, 3.7	0.8	0.5, 1.5
Household income group						
Low	1.3	0.9, 2.0	1.6	0.8, 3.5	1.4	1.0, 2.0
High‡	1.0	...	1.0	...	1.0	...
Major depressive episode						
Yes	1.5	0.8, 2.7	1.7	0.6, 4.5	1.5	0.9, 2.4
No‡	1.0	...	1.0	...	1.0	...
Food allergies						
Yes	0.9	0.4, 2.1	1.5	0.2, 14.9	1.0	0.5, 2.0
No‡	1.0	...	1.0	...	1.0	...
Other allergies						
Yes	0.9	0.5, 1.5	0.5	0.3, 1.2	0.8	0.5, 1.2
No‡	1.0	...	1.0	...	1.0	...
Asthma						
Yes	0.9	0.3, 2.3	--	--	0.8	0.3, 1.7
No‡	1.0	...	1.0	...	1.0	...
Arthritis or rheumatism						
Yes	0.9	0.5, 1.5	2.7*	1.2, 6.1	1.2	0.7, 1.9
No‡	1.0	...	1.0	...	1.0	...
Back problems, excluding arthritis						
Yes	1.6	1.0, 2.7	1.4	0.6, 3.2	1.6*	1.0, 2.4
No‡	1.0	...	1.0	...	1.0	...
Bronchitis or emphysema						
Yes	2.4*	1.1, 5.1	--	--	2.2*	1.1, 4.3
No‡	1.0	...	1.0	...	1.0	...
Sinusitis						
Yes	2.2*	1.1, 4.2	--	--	1.9*	1.0, 3.5
No‡	1.0	...	1.0	...	1.0	...
Stomach or intestinal ulcers						
Yes	1.2	0.5, 2.6	2.6	0.7, 9.6	1.5	0.8, 2.8
No‡	1.0	...	1.0	...	1.0	...
Seven or more medical consultations						
Yes	1.1	0.6, 1.7	0.8	0.3, 1.9	1.0	0.7, 1.6
No‡	1.0	...	1.0	...	1.0	...
Self-rated health						
Excellent, very good or good	0.6	0.4, 1.0	0.8	0.3, 1.9	0.6*	0.4, 1.0
Fair or poor‡	1.0	...	1.0	...	1.0	...
Ever a daily smoker						
Yes	1.1	0.7, 1.6	1.2	0.6, 2.5	1.2	0.8, 1.6
No‡	1.0	...	1.0	...	1.0	...
Type of drinker						
Regular	0.8	0.5, 1.1	0.9	0.4, 1.9	0.8	0.6, 1.1
Occasional, former or abstainer‡	1.0	...	1.0	...	1.0	...

Data source: *National Population Health Survey, longitudinal sample, Health file, 1998/99*
Note: *Because of rounding, some confidence intervals with 1.0 as the lower or upper limit were significant.*
† Individuals without reports of migraine in 1994/95
‡ Reference category, for which odds ratio is always 1.0
* p ≤ 0.05
** p ≤ 0.01
··· Not applicable
-- Excluded from the multivariate analysis because the sample count was too low and caused instability in the regression model.

diagnosed with sinusitis could reflect the difficulty in initially distinguishing the two conditions.

Among males, incident migraine was associated with previously diagnosed arthritis or rheumatism. For both sexes combined, non-arthritic back problems were significantly associated with subsequent migraine.

The possibility of a common origin of migraine and osteoarthritis, both disorders that involve inflammation, has been investigated.[62] However, the genetic factor studied did not support the theory that the comorbid association among the disorders was caused by shared pathophysiology. Another study found that migraineurs were two to four times as likely as non-migraineurs to report joint, back, stomach or neck pain, and perhaps had a higher propensity to report pain, or had a lower pain threshold.[63] One theory, based on the possible role of neurogenic inflammation in several disorders including migraine, asthma, rhinitis, rheumatoid arthritis and fibromyalgia, hypothesizes that they can be exacerbated by exposure to environmental chemicals.[64]

Associations between oral contraceptive use and migraine use have also been noted.[65] A separate multivariate model, which added a variable for oral contraceptive use, was run for women aged 12 to 49, but it showed that oral contraceptive use was not significantly associated with incident cases of migraine (data not shown). It is possible that onset of migraine preceded the use of oral contraceptives for some women. One might also expect that women with migraine avoid the use of oral contraceptives because they could increase the frequency or intensity of their headaches.

Concluding remarks

This analysis has used the first population-based Canadian longitudinal health survey, the National Population Health Survey, to estimate the incidence of migraine and to examine associated risk factors. Migraine is a relatively common disorder: nearly 2 million Canadians were suffering from clinically diagnosed migraine in 1998/99.

Despite their stated preference for self-care, migraineurs made more use of health care services than did non-migraineurs. Results also suggest that migraine sufferers perceive more difficulty in obtaining the health care they believe they need. This may be partly because migraine is difficult to treat, or it could be that migraineurs tend to have more chronic conditions than other people. The proportion of migraineurs receiving treatment remains low, perhaps indicating a need for more awareness of treatment options.

This analysis adds to the evidence that migraine prevalence has been increasing among 25- to 54-year-old women in recent years. The prevalence of migraine was found to be higher among individuals from low-income households, Whites, and individuals with certain other chronic conditions.

As expected, the odds of developing migraine were higher for females and for both sexes under age 55. Even after accounting for the number of medical consultations sought, several chronic conditions remained significantly associated with developing migraine, including musculoskeletal, inflammatory and respiratory conditions.

Specific factors associated with developing migraine are difficult to pinpoint, however, and may be due to interactions between genetic and socio-demographic factors and environmental conditions. Nonetheless, longitudinal analysis can contribute to the understanding of potential risk factors, which may ultimately lead to an understanding of the causes and means of controlling, or even preventing, migraine. ●

References

1 Edmeads J, Findlay H, Tugwell P, et al. Impact of migraine and tension-type headache on life-style, consulting behaviour, and medication use: A Canadian population survey. *Canadian Journal of Neurological Sciences* 1993; 20: 131-7.

2 Kryst S, Scherl E. A population-based survey of the social and personal impact of headache. *Headache* 1994; 34: 344-50.

3 To T, Wu K. Health care utilization and disability of migraine: The Ontario Health Survey. *Canadian Journal of Public Health* 1995; 86(3): 195-9.

4 Stewart WF, Lipton RB, Simon D. Work-related disability: results from the American Migraine Study. *Cephalalgia* 1996; 16: 231-8.

5 Sakai F, Igarashi H. Prevalence of migraine in Japan: a nationwide survey. *Cephalalgia* 1997; 17: 15-22.

6 Hu XH, Markson LE, Lipton RB, et al. Burden of migraine in the United States: Disability and economic costs. *Archives of Internal Medicine* 1999; 159: 813-8.

7 Stang P, Von Korff M, Galer BS. Reduced labor force participation among primary care patients with headache. *Journal of General Internal Medicine* 1998; 13: 296-302.

8 Pryse-Phillips WEM, Findlay H, Tugwell P, et al. A Canadian population survey on the clinical, epidemiologic and societal impact of migraine and tension-type headache. *Canadian Journal of Neurological Sciences* 1992; 19: 333-9.

9 Tambay J-L, Catlin G. Sample design of the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 1995; 7(1): 29-38.

10 Swain L, Catlin G, Beaudet MP. The National Population Health Survey—its longitudinal nature. *Health Reports* (Statistics Canada, Catalogue 82-003) 1999; 10(4): 69-82.

11 Rao JNK, Wu CFJ, Yue K. Some recent work on resampling methods for complex surveys. *Survey Methodology* (Statistics Canada, Catalogue 12-001) 1992; 18(2): 209-17.

12 Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. *Statistical Methods in Medical Research* 1996; 5: 281-310.

13 Yeo D, Mantel H, Liu TP. Bootstrap variance estimation for the National Population Health Survey. *American Statistical Association: Proceedings of the Survey Research Methods Section*. Baltimore: August 1999.

14 O'Brien B, Goeree R, Streiner D. Prevalence of migraine headache in Canada: a population-based survey. *International Journal of Epidemiology* 1994; 23(5): 1020-6.

15 Lipton RB, Stewart WF, Simon D. Medical consultation for migraine: results from the American Migraine Study. *Headache* 1998; 38: 87-96.

16 Stewart WF, Lipton RB, Celentano DD, et al. Prevalence of migraine headache in the United States: relation to age, income, and other sociodemographic factors. *Journal of the American Medical Association* 1992; 267(1): 64-9.

17 Russell MB, Rasmussen BK, Thorvaldsen P, et al. Prevalence and sex-ratio of the subtypes of migraine. *International Journal of Epidemiology* 1995; 24(3): 612-8.

18 Lipton RB, Stewart WF, Celentano DD, et al. Undiagnosed migraine headaches: a comparison of symptom-based and reported physician diagnosis. *Archives of Internal Medicine* 1992; 152: 1273-8.

19 Stang PE, Osterhaus JT. Impact of migraine in the United States: data from the National Health Interview Survey. *Headache* 1993; 33: 29-35.

20 Henry P, Michel P, Brochet B, et al. A nationwide survey of migraine in France: prevalence and clinical features in adults. *Cephalalgia* 1992; 12(4): 229-37.

21 Haimanot RT, Seraw B, Forsgren L, et al. Migraine, chronic tension-type headache, and cluster headache in an Ethiopian rural community. *Cephalalgia* 1995; 15(6): 482-8.

22 Rasmussen BK. Epidemiology of migraine. *Biomedicine and Pharmacotherapy* 1995; 49: 452-5.

23 Wong TW, Wong KS, Yu TS, et al. Prevalence of migraine and other headaches in Hong Kong. *Neuroepidemiology* 1995; 14(2): 82-91.

24 Lavados PM, Tenhamm E. Epidemiology of migraine headache in Santiago, Chile: a prevalence study. *Cephalalgia* 1997; 17(7): 770-7.

25 Launer LJ, Terwindt GM, Ferrari MD. The prevalence and characteristics of migraine in a population-based cohort: The GEM study. *Neurology* 1999; 53: 537-42.

26 Shields M. Proxy reporting in the National Population Health Survey. *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 12(1): 21-39.

27 Silberstein SD. Menstrual migraine. *Journal of Women's Health & Gender-based Medicine* 1999; 8(7): 919-31.

28 Gawel M. Unlocking the mystery of migraine. *Headlines* 1998; 7(4): 1-4.

29 Larkin M. The Genetics of Migraine (JAMA Migraine Information Center). Available at: http://www.ama-assn.org/special/migraine/newsline/briefing/genetics.html. Accessed December 3, 1999.

30 Gervil M, Ulrich V, Kaprio J, et al. The relative role of genetic and environmental factors in migraine without aura. *Neurology* 1999; 53: 995-9.

31 Hamel E. Current concepts of migraine pathophysiology. *Canadian Journal of Clinical Pharmacology* 1999; 6 (Suppl A): 9A-14A.

32 Stewart WF, Lipton RB, Liberman J. Variation in migraine prevalence by race. *Neurology* 1996; 47: 52-9.

33 Stang P, Sternfeld B, Sidney S. Migraine headache in a prepaid health plan: ascertainment, demographics, physiological, and behavioral factors. *Headache* 1996; 36: 69-76.

34 American Medical Association. Type of headache (JAMA Migraine Information Centre). Available at: http://www.ama-assn.org/special/migraine/support/educate/types.html. Accessed December 1, 1999.

35 Lipton RB, Stewart WF. Prevalence and impact of migraine. *Neurologic Clinics* 1997; 15(1): 1-13.

36 Rasmussen BK, Olesen J. Migraine with aura and migraine without aura: an epidemiological study. *Cephalalgia* 1992; 12: 221-8.

37 Fettes I. Migraine in the menopause. *Neurology* 1999; 53 (Suppl 1): S29-S33.

38 Pryse-Phillips WEM, Dodick DW, Edmeads JG, et al. Guidelines for the nonpharmacologic management of migraine in clinical practice. *Canadian Medical Association Journal* 1998; 159: 47-54.

39 Silbertstein SD, Lipton RB. Headache epidemiology: emphasis on migraine. *Neurologic Clinics* 1996; 14(2): 421-34.

40 Lipton RB, Stewart WF. Migraine headaches: epidemiology and comorbidity. *Clinical Neuroscience* 1998; 5: 2-9.

41 Breslau N. Psychiatric comorbidity in migraine. *Cephalalgia* 1998; 18 (Suppl 22): 56-61.

42 Guillem E, Pelissolo A, Lepine JP. Troubles mentaux et migraine : données épidémilogiques. *L'Encéphale* 1999; XXV: 436-42.

43 Breslau N, Davis GC, Schultz LR, et al. Joint 1994 Wolff Award Presentation. Migraine and major depression: a longitudinal study. *Headache* 1994; 34: 387-93.

44 Breslau N, Merikangas K, Bowden CL. Comorbidity of migraine and major affective disorders. *Neurology* 1994; 44 (Suppl 7): S17-S22.

45 Statistics Canada. Health in mid-life. *Health Reports* (Statistics Canada, Catalogue 82-003) 2000; 11(3): 35-46.

46 Rao JNK, Thomas DR. Chi-squared tests for contingency tables. In: Skinner CJ, Holt D, Smith TMF, eds. *Analysis of Complex Surveys*. New York: Wiley, 1989: 89-114.

47 Headache Classification Committee of the International Headache Society. Classification and diagnostic criteria for headache disorders, cranial neuralgias, and facial pain. *Cephalalgia* 1988; 8 (Suppl 7): 1-96.

48 Lipton RB, Ottman R, Ehrenberg BL, et al. Comorbidity of migraine: the connection between migraine and epilepsy. *Neurology* 1994; 44 (Suppl 7): S28-S32.

49 Ottman R, Lipton RB. Comorbidity of migraine and epilepsy. *Neurology* 1994; 44: 2105-10.

50 Speed WG. Headache following injury. *Headache, Newsletter of the American Council for Headache Education* 1993; 4(3). Available at: http://www.achenet.org/_articles/INJURY1.HTM. Accessed January 5, 2000.

51 Bott AD. The comorbidity of migraine and the mood and anxiety disorder: implications for treatment (CME reviews). Available at: http://www.cme-reviews.com. Accessed December 23, 1999.

52 Prevalence of chronic migraine headaches—United States, 1980-1989. *Morbidity and Mortality Weekly Report* 1991; 40(20): 331, 337-8.

53 Stang PE, Yanagihara T, Swanson JW, et al. Incidence of migraine headache: a population-based study in Olmsted County, Minnesota. *Neurology* 1992; 42: 1657-62.

54 Sillanpää M, Anttila P. Increasing prevalence of headache in 7-year-old schoolchildren. *Headache* 1996; 36: 466-70.

55 Rozen TD, Swanson JW, Stang PE, et al. Increasing incidence of medically recognized migraine headache in a United States population. *Neurology* 1999; 53: 1468-73.

56 Stewart WF, Linet MS, Celentano DD, et al. Age- and sex-specific incidence rates of migraine with and without visual aura. *American Journal of Epidemiology* 1991; 134: 111-20.

57 Mansfield LE. The role of food allergy in migraine: a review. *Annals of Allergy* 1987; 58: 313-18.

58 Gurkan F, Ece A, Haspolat K, et al. Parental history of migraine and bronchial asthma in children. *Allergologia et immunopathologia* 2000; 28(1): 15-17.

59 Merikangas KL. Comorbidity of migraine and other conditions in the general population of adults in the United States (abstract). *Cephalalgia* 1991: 11 (Suppl 11): 108-9.

60 Strachan DP, Butland BK, Anderson HR. Incidence and prognosis of asthma and wheezing illness from early childhood to age 33 in a national British cohort. *British Medical Journal* 1996; 312(7040): 1195-9.

61 Peckham C, Butler N. A national study of asthma in childhood. *Journal of Epidemiology and Community Health* 1978; 32(2): 79-85.

62 Peroutka SJ, Price SC, Jones KW. The comorbid association of migraine with osteoarthritis and hypertension: complement C3F and Berkson's bias. *Cephalalgia* 1997; 17: 23-6.

63 Sternfeld B, Stang P, Sydney S. Relationship of migraine headaches to experience of chest pain and subsequent risk for myocardial infarction. *Neurology* 1995; 45: 2135-42.

64 Meggs WJ. Neurogenic inflammation and sensitivity to environmental chemicals. *Environmental Health Perspectives* 1993; 101(3): 234-8.

65 Becker WJ. Use of oral contraceptives in patients with migraine. *Neurology* 1999; 53 (Suppl 1): S19-S25.

66 Kessler RC, McGonagle KA, Zhao S, et al. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from the National Comorbidity Survey. *Archives of General Psychiatry* 1994; 51(1): 8-19.

67 American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 3rd rev. ed. Washington, DC: American Psychiatric Association, 1987.

68 Healthwise Evaluation Project. Final grant report, Healthwise Communities Project, Oregon Health Sciences University, Portland, Oregon, 1999.

Appendix

Supplementary definitions

Five *age groups* were formed for this analysis: 12 to 24, 25 to 39, 40 to 54, 55 to 69, and 70 or older. However, due to sample size constraints, for multivariate analysis and comparison of migraine prevalence by sex between cycles 1 and 3, age was collapsed into three age groups: 12 to 24, 25 to 54, and 55 or older.

Race was determined by asking, "How would you best describe your race or colour?".

For univariate analysis, four *household income groups* were established, based on the number of people in the household and total household income from all sources in the 12 months before the interview:

Household income group	People in household	Total household income
Lowest	1 or 2	Less than $15,000
	3 or 4	Less than $20,000
	5 or more	Less than $30,000
Lower-middle	1 or 2	$15,000 to $29,999
	3 or 4	$20,000 to $39,999
	5 or more	$30,000 to $59,999
Upper-middle	1 or 2	$30,000 to $59,999
	3 or 4	$40,000 to $79,999
	5 or more	$60,000 to $79,999
Highest	1 or 2	$60,000 or more
	3 or more	$80,000 or more

For multivariate analysis, *household income groups* were combined into two groups:

Household income group	People in household	Total household income
Lowest	1 or 2	Less than $15,000
	3 or 4	Less than $20,000
	5 or more	Less than $30,000
Middle or high	1 or 2	$15,000 or more
	3 or 4	$20,000 or more
	5 or more	$30,000 or more

Education was examined for the population aged 25 or older and was collapsed into two categories: high school graduation or less, and any postsecondary.

Two groups were used to classify *type of smoker:* those who had ever smoked daily, and those who had not. Type of smoker was derived from responses to the following questions: "At the present time, do you smoke cigarettes daily, occasionally or not at all?" , "Have you ever smoked cigarettes at all?" and "Have you ever smoked cigarettes daily?"

Due to sample size constraints, *type of drinker* was collapsed into two categories: regular drinker (at least one drink per month) and occasional or former drinker, or abstainer.

Using the methodology of Kessler et al,[66] the NPHS measures the probability of a major depressive episode (MDE) with a subset of questions from the Composite International Diagnostic Interview. These questions cover a cluster of symptoms for depressive disorder, which are listed in the *Diagnostic and Statistical Manual of Mental Disorders (DSM III-R).*[67] Responses to these questions were scored and transformed into a probability estimate of a diagnosis of MDE. If this estimate was 0.9 or more (that is, 90% or higher certainty of a positive diagnosis), the respondent was considered to have experienced depression in the previous 12 months.

Self-rated health was assessed with the question, "In general, would you say your health is: excellent? very good? good? fair? poor?"

A respondent who answered "Yes" to the question, "In the past 12 months, have you been a patient overnight in a hospital, nursing home or convalescent home?" was considered to have had a *hospital stay*. Women who lived in a household with a child under age 1 were excluded, as they would likely have stayed in a hospital during childbirth.

The *number of consultations with health care professionals* was determined from responses to the question, "Not counting when you were an overnight patient, in the past 12 months, how many times have you seen or talked on the telephone with a family doctor or general practitioner, eye specialist or other medical doctor about your physical, emotional or mental health?" Responses were categorized as: 0 to 6 visits, and 7 or more visits.

Respondents were asked if, during the past 12 months, there was a time they felt they needed, but did not receive, health care for a physical problem.

In cycle 3 (1998/99), the NPHS used the method of The Community Health Survey from the Kaiser Permanente Center for Health Research,[68] to determine attitudes toward *self-care*. Respondents aged 18 or older were asked to rank their responses to the following five statements using a five-point scale ranging from "strongly agree" (score 1) to "strongly disagree" (score 5):
 • I prefer doctors who give me choices or options and let me decide for myself what to do (reverse scored).
 • Patients should never challenge the authority of the doctor.
 • I prefer that the doctor assume all of the responsibility for my medical care.
 • Except for serious illness, it is generally better to take care of your own health than go to a doctor (reverse scored).
 • It is almost always better to go to a doctor than to try to treat yourself.

The values were recoded to 0 to 4 and reverse coding was done where noted. Then values were summed to an index score of between 0 and 20, with 0 indicating a preference to rely on a doctor; 20, a preference for self-care. Respondents with an index score of 15 or higher (22.1%) were considered to prefer self-care.

Oral contraceptive use was determined by asking females aged 12 to 49, "In the past month, did you take birth control pills?".

Respondents were considered to have an *activity restriction* if they indicated that, because of a long-term physical or mental condition or health problem, they were limited in the kind or amount of activity that they could do at home, school, or work, or in other activities such as transportation to or from work or school or leisure-time activities. "Long-term" refers to conditions/problems that have lasted or are expected to last six months or more.

Disability days refers to the number of days during the two-week period before their NPHS interview when respondents stayed in bed or cut down activities because of illness or injury.

Respondents were asked if they were usually *free of pain or discomfort*. They were also asked about prescription or over-the-counter medications that they had taken during the last year (although the reason for medication use is unknown). Pain relievers, including acetylsalicylic acid, acetaminophen, codeine, Demerol® and morphine, and antidepressants were relevant to this analysis.

Table A

Prevalence of migraine, by selected socio-demographic factors and health characteristics, household population aged 12 or older, Canada excluding territories, 1994/95 and 1996/97

	1994/95				1996/97		
	Sample size	Estimated population	Prevalence of migraine		Sample size	Estimated population	Prevalence of migraine
		'000	%			'000	%
Total	**1,366**	**1,737**	**7.3**		**5,804**	**1,915**	**7.8**
Sex							
Male	346	510	4.3		1,414	515	4.3
Female	1,020	1,226	10.1**		4,390	1,400	11.2**
Age group							
12-24	230	322	6.3		838	296	5.8
25-39	487	594	8.1		2,176	695	9.6
40-54	388	538	9.3		1,753	619	9.9
55-69	175	200	5.6		754	232	6.3
70+	86	80	3.7		283	71	3.2
Race							
White	1,279	1,594	7.4		5,392	1,752	8.0*
Non-White	84	131	5.8		386	156	6.3
Education							
Secondary graduation or less	446	529	6.6		1,916	597	7.4
Some postsecondary or more	687	882	8.2**		3,017	1,013	9.0**
Household income							
Lowest	366	327	8.0		1,068	297	9.2†
Lower-middle	390	491	7.2		1,322	500	8.1
Upper-middle	426	609	7.5		1,695	627	7.9
Highest	139	241	6.6		636	220	7.1
Ever a daily smoker							
Yes	790	944	8.1**		3,082	1,009	8.8**
No	575	791	6.5		2,707	902	6.9
Type of drinker							
Regular	632	867	6.6		2,695	942	7.3
Occasional/ Former/Abstainer	732	868	8.0**		3,064	962	8.5**
Major depressive episode							
Yes	214	249	19.9**		639	190	19.1**
No	1,103	1,397	6.6		4,948	1,634	7.2

Data source: *National Population Health Survey, cross-sectional samples, Health files, 1994/95 and 1996/97*
Note: *Detail may not add to totals because of missing values for some variables. All pairwise comparisons are significant except for those between 12-24 and 55-69, and 25-39 and 40-54 in 1994/95 and 1996/97, and between 12-24 and 25-39, and 55-69 and 70+ in 1994/95, p < 0.01 adjusted for multiple comparisons.*
† Significantly higher than value for highest household income group (p ≤ 0.05) adjusted for multiple comparisons
* Significantly higher than value for other item in category (p ≤ 0.05)
** Significantly higher than value for other item in category (p ≤ 0.01)

Table B

Selected health indicators and medication use, migraineurs and non-migraineurs, household population aged 12 or older, Canada excluding territories, 1994/95 and 1996/97

	1994/95		1996/97	
	Migraineurs	**Non-migraineurs**	**Migraineurs**	**Non-migraineurs**
Activity restriction (%)	34.1**	15.0	24.5**	12.0
Usually free of pain or discomfort (%)	66.9**	84.4	73.1**	88.0
In last two weeks:				
Cut down on activities (%)	26.4**	11.1	18.8**	9.3
Stayed in bed (%)	15.4**	6.2	12.7**	5.3
Mean number of disability days	2.1**	0.8	1.6**	0.8
In last month, used:				
Pain relievers (%)	87.5**	59.3	85.5**	62.3
Codeine/Demerol®/morphine (%)	15.2**	3.4	15.3**	3.7
Antidepressants (%)	7.5**	2.4	9.5**	3.0

Data source: *National Population Health Survey, cross-sectional samples, Health file, 1994/95 and 1996/97*
** Significantly different from value for non-migraineurs (p ≤ 0.01)

Table C

Health care use and attitudes of migraineurs and non-migraineurs, household population aged 12 or older, Canada excluding territories, 1994/95 and 1996/97

	1994/95		1996/97	
	Migraineurs	**Non-migraineurs**	**Migraineurs**	**Non-migraineurs**
		%		
Seven or more consultations with health care professionals in previous 12 months	34.5**	17.2	31.7**	14.6
Hospital stay in previous 12 months†	11.0**	7.6	9.9**	6.8
Needed, but did not receive, care for physical problem in previous 12 months	6.5**	2.6	9.1**	3.6
Prefer self-care over reliance on doctor‡	..	..	..	..

Data source: *National Population Health Survey, cross-sectional samples, Health file, 1994/95 and 1998/99*
† Excludes women with a child younger than 1, as these women would likely have stayed overnight in a hospital
‡ Population aged 18 or older
** Significantly higher than value for non-migraineurs (p ≤ 0.01)
·· Figures not available

Table D
Selected health characteristics of migraineurs and non-migraineurs, by sex, household population aged 12 or older, Canada excluding territories, 1994/95 and 1996/97

	1994/95		1996/97	
	Migraineurs	Non-migraineurs	**Migraineurs**	Non-migraineurs
	%	%	%	%
Chronic conditions				
Food allergies				
Females	14.2**	5.8	15.9**	7.6
Males	9.8†**	4.1	14.5†**	4.6
Other allergies				
Females	35.2**	17.4	39.6**	24.3
Males	18.5	16.0	25.4**	18.3
Asthma				
Females	13.6**	6.0	14.1**	7.7
Males	5.6†	6.2	8.9*	5.9
Arthritis or rheumatism				
Females	21.0**	15.2	23.7**	17.1
Males	17.0**	9.2	14.3**	9.5
Back problems excluding arthritis				
Females	30.9**	12.1	27.1**	13.4
Males	32.6**	13.1	23.9**	12.9
High blood pressure				
Females	11.7	9.8	11.0	11.4
Males	9.7†	7.2	11.5	8.6
Chronic bronchitis or emphysema				
Females	8.3**	3.3	6.6**	2.9
Males	5.7†*	2.3	4.3†*	2.2
Sinusitis				
Females	14.8**	4.2	12.8**	4.8
Males	13.4†**	2.7	8.1†**	3.2
Stomach or intestinal ulcers				
Females	8.5**	2.9	5.6**	2.5
Males	9.4†**	2.9	4.5**	2.5
Three or more chronic conditions (other than migraine)				
Females	26.7**	10.4	27.2**	12.8
Males	18.6**	7.1	16.4**	7.3
Major depressive episode				
Females	17.2**	6.3	11.7**	4.8
Males	9.8†**	3.4	6.8†**	2.7

Data source: *National Population Health Survey, cross-sectional samples, Health files, 1994/95 and 1996/97*
† Coefficient of variation between 16.6% and 25.0%
* Significantly higher than value for non-migraineurs (p ≤ 0.05)
** Significantly higher than value for non-migraineurs (p ≤ 0.01)