Factors associated with chronic noncancer pain in the Canadian population

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S Rashiq, BD Dick. Factors associated with chronic noncancer pain in the Canadian population. Pain Res Manage 2009;14(6):454-460.

Chronic noncancer pain (CNCP) is a prevalent health problem with pervasive negative effects on the individual's quality of life. Previous epidemiological studies of CNCP have suggested a number of individual biological, psychological and societal correlates of CNCP, but it has rarely been possible to simultaneously compare the relative strengths of many such correlates in a Canadian population sample. With data provided by the 1996/1997 Canadian National Population Health Survey, ordinal logistic regression was used to examine the extent to which a number of population variables are associated with CNCP in a large (n=69,365) dataset. The analysis revealed cross-sectional correlations of varying strengths between CNCP and 27 factors. Increasing age, low income, low educational achievement, daily cigarette smoking, physical inactivity and abstention from alcohol were among the factors found to increase CNCP risk. The considerable impact of distress and depression on CNCP are also highlighted. A number of comorbid medical illnesses increased CNCP risk, including some (such as chronic obstructive pulmonary disease, epilepsy and thyroid disease) that have not hitherto been associated with pain. White race and the affirmation of an important role for spirituality or faith reduced CNCP risk. In contrast to some previous studies, female sex did not emerge as an independent CNCP risk. The present exploratory analysis describes associations between CNCP and a number of characteristics from several domains, thus suggesting many areas for further research.

Key Words: *Canada; Chronic pain; National Population Health Survey; Prevalence; Risk factors*

Les facteurs liés à la douleur non cancéreuse chronique au sein de la population canadienne

La douleur non cancéreuse chronique (DNCC) est un problème de santé prévalent aux effets négatifs et envahissants sur la qualité de vie des patients. Des études épidémiologiques passées sur la DNCC laissent croire à certains corrélats biologiques, psychologiques et sociétaux de la DNCC, mais il a rarement été possible de comparer simultanément la force relative de bon nombre de ces corrélats au sein d'un échantillon de la population canadienne. À l'aide de données tirées de l'Enquête nationale sur la santé de la population (ENSP) du Canada de 1996-1997, on a utilisé la régression logistique ordinale pour examiner la mesure selon laquelle un certain nombre de variables de la population s'associent à la DNCC dans un vaste ensemble de données (n=69 365). L'analyse a révélé des corrélations transversales de diverses forces entre la DNCC et 27 facteurs. Le vieillissement, le faible revenu, le faible niveau d'instruction, la consommation quotidienne de cigarettes, l'inactivité physique et l'abstention d'alcool faisaient partie des facteurs qui accroissaient le risque de DNCC. L'effet considérable de la détresse et de la dépression sur la DNCC est également souligné. Plusieurs maladies comorbides augmentaient le risque de DNCC, y compris certaines (comme la maladie pulmonaire obstructive chronique, l'épilepsie et une maladie thyroïdienne) qui, jusqu'ici, n'étaient pas associées à la douleur. Le fait d'être de race blanche et d'affirmer un rôle important de la spiritualité ou de la foi dans sa vie réduisait le risque de DNCC. Contrairement à des études antérieures, le sexe féminin ne constituait pas un risque indépendant de DNCC. La présente analyse exploratoire décrit des associations entre la DNCC et plusieurs caractéristiques provenant de divers domaines, proposant ainsi de nombreux secteurs de recherche plus approfondies.

Chronic noncancer pain (CNCP) is a mysterious illness that affects an ever-increasing number of people (1). There is no robust, universally accepted etiological model of CNCP at the structural or physiological level. Observational studies of CNCP are therefore important to generate hypotheses of causation and propagation. Several epidemiological studies from different countries provide evidence that CNCP is associated with a number of factors across biological, psychological, social and environmental domains (2-11). Unfortunately, differences in the design of these studies make it difficult to combine their findings and thereby determine the relative importance of more than a small number of such associations at the same time (12). Knowing which independent factors are most strongly associated with CNCP on a population basis may enable researchers to target in vivo studies of etiology, prevention and therapy more fruitfully.

Only observational analysis of a large population permits the simultaneous estimation of the effects of many potential risk factors. Data from the 1996/1997 National Population Health Survey (NPHS), a detailed and wide-ranging interview-based survey of the health of a representative sample of Canadians, is publicly available. Although these data have been used in other studies of CNCP, the analytical goals of those studies were limited (13,14) or very specific (11). We used these data to determine the associations of CNCP with a wider range of factors in the biological, psychological and social domains.

METHODS

The 1996/1997 Canadian NPHS (15) was the second iteration of a biennial cycle of governmentally sponsored interview-based health-related data collection. One of the stated purposes of the NPHS is the provision of data for analytical studies that will assist in understanding the determinants of health. A random sample representative of almost all Canadian residents was recruited. Persons living on First Nations reserves, on Canadian Forces Bases and in some remote areas were excluded. Data were mainly collected by telephone. One part of this survey was the collection of cross-sectional in-depth health-related data, which were used here. The Public Use Microfile version of this dataset includes information from 81,804 respondents drawn from all of Canada's 10 provinces, but not

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its territories. The overall response rate for this part of the NPHS was 94.3%.

An exploratory analysis of the available data was performed for the following purposes: to validate previously published associations of CNCP, to discover hitherto unreported associations of CNCP to generate new hypotheses of CNCP causation and propagation, and to simultaneously compare the relative strengths of as many associations of CNCP as possible.

Because the primary interest for analysis was CNCP in adults, an a priori decision was made to exclude data from children as much as possible. Because the publicly available data only gives respondent age in five-year bands, it was decided to include the 15- to 19-year-old group to capture the experience of the very youngest adults, while recognizing that some teenaged children would be included by doing so. Respondents with cancer were excluded because the absence of cancer is necessary to make the diagnosis of CNCP. Anyone who did not answer the survey questions about the presence of pain was also excluded. A subject with CNCP was defined as one who gave a negative answer to survey question HS-Q28, 'Are you usually free of pain and discomfort?', to which the subject was asked to respond either 'yes' or 'no'. This group of respondents is further subdivided in the dataset according to their answers to question HS-Q29, 'How would you describe the usual intensity of your pain or discomfort?', which could have been answered 'mild', 'moderate' or 'severe'. The resulting NPHS-derived ordinal variable HSC6DSEV thus classifies respondents as having either no pain, or mild, moderate or severe pain, and was the dependent variable in the present analyses.

The present series of candidate explanatory covariates (Table 1) included known associations of CNCP from the literature, along with other items in the dataset that were hypothesized to be of interest, based on clinical experience. In most cases, the presence or absence of any given factor was based on the subject or surrogate's response to a direct question about it. However, three of the covariates in the present study, namely depression, distress and probability of alcohol dependence, were determined using selected items from the Composite International Diagnostic Interview (CIDI) that measures features of a major depressive episode (16). The CIDI measures used in the NPHS are consistent with the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised* (17) and the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* diagnostic standards (18). NPHS items MHC6_2 through MHC6_28 are used to derive a probability of depression caseness (variable MHC6DPP) ranging from 0 to 0.9. In keeping with a previous study of CNCP using NPHS data, any respondent with a probability of caseness of 0.5 or greater was classified as having depression (14), and depression was thus analyzed as a binary variable. The NPHS distress score was derived from items MHC6_1A through MHC6_1F, taken from the CIDI wherein higher scores are indicative of higher levels of distress. Distress scores were rendered into a six-category ordinal variable to take maximal advantage of the available data. The probability of alcohol dependence is given in categories, not as a continuous variable. From the available choices, 0.4 (the closest available to 0.5) was selected as the cut-off probability for defining a respondent as alcohol dependent, instead of available alternatives of 0.05, 0.85 and 1.00, and thus a binary variable was created. The relationship between CNCP (of any intensity, expressed as binary variable for this purpose only) and these independent covariates was determined in a series of univariate analyses using contingency tables, the χ^2 test and a significance level of 0.05. Covariates that were significantly associated with CNCP on univariate testing were entered into an ordinal logistic regression model construction process with pain intensity as the dependent variable. Ordinal logistic regression was selected to use all values of the four-level outcome variable in a more powerful and parsimonious manner than would have resulted from performing separate modelling for mild, moderate and severe pain. Indicators were created for categorical and ordinal variables. A forward stepwise selection algorithm was used. Bootstrap estimation (j=1000) of the maximum likelihood estimates for each covariate retained in the final model was performed to detect any covariate for which variance appeared to be underestimated. Any covariates from the model in which the maximum likelihood estimate obtained from bootstrapping was greater than that in the model by more than 0.10 were to be discarded. In accordance with Statistics Canada guidelines for the analysis of these data, the applicable published survey weight for adult respondents (WT66) was employed, and recommendations concerning rounding of derived indexes were followed. All data tables met Statistics Canada's advised minimum release cut-off size for acceptable error. Statistical analyses were performed using SAS for Windows, version 8.2 (SAS Institute Inc, USA).

RESULTS

Data from 81,804 respondents appear in the published file. Of these, 12,439 (15%) were excluded from the present analysis (10,920 children younger than 15 years of age, 169 who did not answer the question about the presence of pain and 1350 who had cancer), leaving 69,365 respondents to be included in the analysis.

The median age group of the study population was 40 to 44 years. Women constituted 53.4% of the sample. The least sampled province in the unweighted sample was Quebec (0.04% of its population was sampled) and the most sampled was Manitoba (1.4%). Ontario provided the largest provincial component, accounting for 53.1% of the sample, but each province was represented to some extent.

The crude prevalence of CNCP was 14%. In 29% of these cases, its intensity was rated as mild, in 55% moderate and in 16% severe.

Table 2 gives the population frequency and unadjusted CNCP prevalence estimates by each candidate covariate and within-covariate category. For this table only, CNCP was collapsed into a binary variable indicating that it was either present or absent.

Alcohol dependence was not significantly associated with CNCP and was therefore excluded from further analysis. The variables body mass index, region of domicile, being an immigrant, not feeling loved or cared for, food allergies, nonfood allergies, asthma and dementia either did not meet or did not retain sufficient statistical significance for entry into or retention in the final model. For the same reason, not all categories of the covariates marital status, household income and education level were retained in the final model. It was not necessary to remove any covariates after examination of the

TABLE 1
Candidate covariates of chronic noncancer pain

Covariate	Definition or category of response	Reference category for regression model	NPHS variable name
Demographic factors			
Age, years	15–24, 25–34, 35–44, 45–54, 55–64, 65–74, ≥75	15–24	DHC6GAGE
Sex	Male, female	Male	DHC6_SEX
Civil status			
Married	Married, in common-law relationship or with a partner	All others	DHC6GMAR
Single	Single	All others	
Separated	Widowed, separated or divorced	All others	
Region of domicile	Eastern Canada	All others	PRC6_CUR
	Quebec	All others	
	Ontario	All others	
	Prairies	All others	
	British Columbia	All others	
Annual household income	Quintiles, defined by total household income and number of persons. For three-person households, lowest quintile represents annual income <$10,000 and highest quintile >$80,000	Highest quintile	INC6DIA5
Highest educational level			
Less than high school	Did not achieve high school graduation	Attended or graduated from university	EDC6G7
High school graduation	High school graduation		
Some postsecondary	Attended or graduated from postsecondary education, college or trade school		
Some university	Attended or graduated from university		
Immigrant	Born outside Canada	Canadian born	SDC6FIMM
Race	Self-defined by respondent and classified by NPHS into one of 12 named groups, but publicly available data simply summarized as 'white' and 'other'	Nonwhite	SDC6GRAC
Medical factors			
Food allergies	'Has food allergies'	All others	CCC6_1A
Nonfood allergies	'Has allergies other than food allergies'	All others	CCC6_1B
Asthma	'Has asthma'	All others	CCC6_1C
Arthritis	'Has arthritis or rheumatism'	All others	CCC6_1D
Back problems	'Has back problems excluding arthritis'	All others	CCC6_1E
Hypertension	'Has high blood pressure'	All others	CCC6_1F
Migraines	'Has migraines'	All others	CCC6_1G
Chronic obstructive pulmonary disease	'Has chronic bronchitis or emphysema'	All others	CCC6_1H
Sinusitis	'Has sinusitis'	All others	CCC6_1I
Diabetes	'Has diabetes'	All others	CCC6_1J
Epilepsy	'Has epilepsy'	All others	CCC6_1K
Heart disease	'Has heart disease'	All others	CCC6_1L
Ulcers	'Has ulcers'	All others	CCC6_1N
Stroke	'Suffers from the effects of a stroke'	All others	CCC6_1O
Bowel disorder	'Has a bowel disorder such as Crohn's disease or colitis'	All others	CCC6_1Q
Dementia	'Has Alzheimer's disease or other dementia'	All others	CCC6_1R
Thyroid condition	'Has a thyroid condition'	All others	CCC6_1U
Any other chronic condition	Reported the presence of a named chronic health condition not listed above	All others	CCC6_1V
Mental health factors			
Depression	Probability of depression caseness of ≥0.5 based on CIDI	All others	MHC6DPP
Distress	Quantitative distress score derived from CIDI (range 0–24)	Score = 0	MHC6DDS
	Score = 0		
	Score = 1		
	Score = 2		
	Score = 3		
	Score = 4		
	Score = 5–24		

CIDI Composite International Diagnostic Interview; NPHS National Public Health Survey

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TABLE 1 – CONTINUED
Candidate covariates of chronic noncancer pain

Covariate	Definition or category of response	Reference category for regression model	NPHS variable name
Lifestyle factors			
Alcohol dependence	Probability of alcohol dependence of 0.4 or greater based on CIDI	All others	AD-6DSF
Alcohol abstainer	Never drinks alcohol	All others	ALC6_5B
Cigarette smoking			
Never	Never smoked	Never smoked	SMC6DTYP
Occasional	Current or former smoker of cigarettes less frequently than daily		
Daily	Current or former daily smoker		
Body mass index (BMI), kg/m^2			
Low	BMI <20	All others	HWC6GSW
Normal	BMI ≥20 and <27	All others	
High	BMI ≥27	All others	
Physical inactivity	Performed no recreational physical activity in the past 3 months	All others	PAC6_1V
Injury	Has had an activity-limiting injury in the past 12 months	All others	IJC6_1
Spirituality/faith important	Respondents who affirmed that spirituality and/or faith play an important part in their lives	All others	SSS6_1
Not feeling loved or cared for	Respondents giving a negative answer to the question 'Do you have someone who makes you feel loved and cared for?'	All others	SSC6_6

CIDI Composite International Diagnostic Interview; NPHS National Public Health Survey

bootstrap estimates of their CIs according to the a priori criteria.

The c statistic for the multivariate model was 0.81. Table 3 gives the adjusted odds of CNCP associated with each statistically significant covariate, as revealed by the ordinal logistic modelling process. It should be noted that this method incorporates all four levels of the dependent variable. Covariates from the demographic, medical, mental health and lifestyle domains are all represented. The two strongest independent correlates of CNCP were the reported presence of arthritis and back problems, entities that are, of course, largely defined by the presence of pain. Increasing age, low income, low educational attainment and physical inactivity were each correlated with CNCP, with increasing age showing the strongest association. Conversely, female sex, white race and the presence of an important role in life for spirituality or faith were associated with a decreased risk of CNCP. Distress and depression were strongly associated with CNCP, and in the case of distress it was demonstrated that the higher the intensity of distress, the stronger the association with CNCP. The association between cigarette smoking and CNCP was nonlinear; occasional smoking was a negative correlate, but daily smoking increased CNCP risk. Abstention from alcohol was positively associated with CNCP. The named chronic medical conditions that are listed in the database (apart from asthma and dementia) and the miscellaneous grouping of 'other chronic condition' were all positively associated with CNCP. The cardinal symptoms of some of these, such as migraines and sinusitis, are commonly described by sufferers in painful terms, but others, such as hypertension, thyroid disorder, epilepsy and chronic obstructive pulmonary disease (COPD) are usually not.

DISCUSSION

In this large representative sample of the Canadian population, we have demonstrated an overall CNCP prevalence of 14%, and have derived quantitative estimates of the associations between CNCP and 27 other covariates from a variety of domains. Ours is not the first study of CNCP using NPHS data – Millar (13) concluded that CNCP was correlated with age, sex, region of residence, certain medical conditions and mental distress, but did not quantify the relative strengths of these individual associations. Van Den Kerkhof et al (11) calculated the prevalence of CNCP to compare it with that derived from another database and make inferences about factors influencing prevalence estimates. Schopflocher et al (14) used these data to derive prevalence estimates and described some important risks, but did not control for as many variables as we did.

Most of our findings are consistent with previous work in the field. Our finding, for instance, that increasing age is a strong risk factor for CNCP has been described before (2,5,19). Indeed, age is one of the few factors in our analysis in which we can be certain of the direction of this association. To explain the increased risk of CNCP with age, others have invoked the increased prevalence of musculoskeletal degeneration with age (20). By controlling for arthritis (using the question 'do you have arthritis/rheumatism diagnosed by a health professional?'), our analysis should have incorporated at least some of that variance; however, the association between age and CNCP remains strong. Perhaps there is an undocumented factor that explains increased age-related CNCP by a different mechanism. It is noteworthy that the literature describes attenuated responses to experimental painful stimuli as age increases (21), which suggests that increased nociception with age is a better explanation for our finding than a heightening of the subjective response to painful stimuli.

Also consistent with other work are the correlations we found between CNCP, distress and depression (22). Our results illustrate the great potency of these as CNCP risks. For example, in our sample, the presence of either depression or mental distress is a stronger predictor of CNCP than having had an activity-limiting injury in the previous year. In addition to being a risk factor for CNCP, mental illness may make it

TABLE 2
Unadjusted prevalence and point odds of chronic noncancer pain (CNCP) of any severity by risk factor

Variable		Population frequency, %	Prevalence of CNCP, %	Point OR of CNCP
All subjects		100	14.1	
Demographic factors				
Age, years	15–24	13.8	6.8	0.4
	25–34	20.4	8.9	0.5
	35–44	21.0	12.5	0.8
	45–54	15.2	16.0	1.2
	55–64	11.6	20.0	1.6
	65–74	10.6	20.3	1.7
	≥75	7.5	24.7	2.1
Female sex		53.4	15.6	1.3
Male sex		46.7	12.4	0.8
Civil status	Married	56.4	13.7	0.9
	Single	25.3	9.8	0.6
	Separated	18.1	21.3	1.9
Region of domicile	Eastern Canada	4.8	13.9	1.0
	Quebec	3.4	14.1	1.0
	Ontario	53.1	14.1	1.0
	Prairies	36.7	13.9	1.0
	British Columbia	1.9	16.7	1.2
Annual household income (for three-person households)	<$10,000	4.0	23.2	1.9
	$10,000–$19,999	9.4	22.4	1.9
	$20,000–$39,999	23.5	15.4	1.1
	$40,000–$79,999	29.8	11.3	0.7
	>$80,000	11.9	9.3	0.6
	Not stated	21.5	14.0	1.0
Highest educational level	Less than high school	27.8	18.8	1.7
	High school graduation	17.9	12.2	0.8
	Some post-secondary	33.6	14.0	1.0
	Some university	20.7	9.3	0.6
Immigrant		16.2	15.2	1.1
White race		92.5	14.2	1.2
Medical factors				
Bowel disorder		2.0	44.0	5.0
Arthritis		17.9	38.9	6.7
Stroke		1.2	38.4	3.9
Ulcers		3.0	36.9	3.8
Back problems		16.7	35.9	5.2
COPD		3.3	34.9	3.5
Heart disease		5.0	34.5	3.5
Other chronic medical condition		6.3	32.6	3.3
Sinusitis		5.2	29.1	2.7
Diabetes		3.7	29.0	2.6
Migraines		8.1	29.0	2.8
Hypertension		11.9	25.8	2.4
Dementia		0.3	24.8	2.0

CIDI Composite International Diagnostic Interview; COPD Chronic obstructive pulmonary disease

Continued

TABLE 2 – CONTINUED
Unadjusted prevalence and point odds of chronic noncancer pain (CNCP) of any severity by risk factor

Variable		Population frequency, %	Prevalence of CNCP, %	Point OR of CNCP
Medical factors – CONTINUED				
Thyroid disorder		3.9	24.5	2.0
Food allergies		7.2	23.1	1.9
Asthma		7.3	22.1	1.8
Epilepsy		0.6	20.5	1.6
Nonfood allergies		22.1	18.6	1.5
Mental health factors				
Depression		5.5	30.2	2.8
CIDI-derived distress score	0	38.9	8.4	0.4
	1	13.4	10.8	0.7
	2	13.1	12.2	0.8
	3	9.4	15.3	1.1
	4	7.5	16.3	1.2
	5–24	17.7	26.5	2.8
Lifestyle factors				
Alcohol abstainer		14.2	21.6	1.9
Alcohol dependence		5.1	13.7	1.0
Cigarette smoking	Never	41.8	11.7	0.7
	Occasional	8.8	11.2	0.8
	Daily	49.1	16.7	1.5
Body mass index, kg/m^2	<20	5.4	11.9	0.8
	≥20 and <27	43.9	11.1	0.6
	≥27	22.4	16.6	1.3
Physical inactivity		11.1	24.3	2.2
Had activity-limiting injury in past 12 months		10.1	21.2	1.8
Spirituality/faith important		66.0	14.8	1.2
Not feeling loved or cared for		3.1	22.9	1.9

CIDI Composite International Diagnostic Interview; COPD Chronic obstructive pulmonary disease

more difficult for an individual to engage in cognitively or emotionally demanding rehabilitation (12).

Most other studies have found an increased risk of CNCP in women than men, but some, like ours, have not (2,3,7). Munce and Stewart's analysis (23) of data from the Canadian Community Health Survey is one example of a study that found female sex preponderance in CNCP. It revealed an overall crude prevalence for specified pain conditions in women of 1.4 times that of men. This excess prevalence was more pronounced for certain specific CNCP conditions (such as fibromyalgia) and in respondents with depression. We found the same crude risk (OR 1.3 for women) but the direction of this association was reversed after further adjustment in our analysis, suggesting that confounding could be one possible explanation of the female preponderance of CNCP found in many other studies.

Low educational achievement and low income were both independent risk factors for CNCP. Because CNCP rises with age, and most education takes place in early life, the probabilities are either that lower educational achievement places one at risk for the development of CNCP, or that both low educational achievement and CNCP are consequences of some other undescribed factor(s). On the other hand, our study does not allow us to determine whether low income is a result or consequence of CNCP.

Our finding that white respondents report less CNCP than nonwhites has not previously been noted in a Canadian population sample, but ethnocultural differences have been observed among patients presenting to a specialist Canadian CNCP treatment unit (24). The prevalence of CNCP has been noted to vary by race in United Kingdom population studies (25), and black American women with CNCP are known to have more distress and depression than their white counterparts (26). The data did not permit us to draw inferences about the degree to which nonwhite respondents were acculturated to Canadian society, a known negative CNCP correlate (25). Regrettably, the publicly available data did not permit us to describe the epidemiology of CNCP in Canadian Aboriginals, a part of our population that has special health needs in many other spheres (27) and whose CNCP experience is not described quantitatively anywhere else.

Of considerable interest to us is the finding that almost all chronic comorbid medical conditions surveyed were found to be positively associated with CNCP. Millar (13) observed but did not quantify this in the 1994 NPHS dataset. Increased prevalences of CNCP have been described in persons with hypertension (28) and renal failure (29), and pain is a cardinal symptom of some medical conditions such as arthritis. To our knowledge, however, the increased burden of CNCP that we found in association with COPD, epilepsy and thyroid disease has not previously been identified. These are obvious areas for further investigation, both to determine the importance of pain in clinical populations with these disorders and offer treatment if appropriate, and to advance our knowledge of the etiology of CNCP.

Our study is cross-sectional and, therefore, its results cannot be used to determine the direction of the associations we have found. We cannot comment on the utility of seeking to modify the risk factors we have found to ameliorate CNCP on an individual or population basis. In fact, very few of the risk factors we describe here are modifiable. Of the exceptions, our data suggest that reducing physical inactivity and daily smoking would seem to be the only potentially worthwhile areas for change. By correcting for the presence of medical conditions that may limit physical activity (such as obesity, arthritis, heart disease and COPD) and the presence of any activity-limiting injury in the past 12 months, we have made as good an estimate as possible of the risk of CNCP with physical inactivity, but we cannot determine which comes first. Others have noted that obesity, smoking and inactivity are predictive of decreased general functioning (30). Abstention from alcohol consumption was associated with increased CNCP risk, while alcohol dependence was not. In addition, occasional (as opposed to daily) cigarette smoking was negatively associated with CNCP. This suggests to us that the decision to consume, abuse or abstain from licit recreational substances is a marker for another, more fundamental correlate of CNCP. The dataset did not contain sufficient data about nonprescription drug use for analytical purposes.

Our analysis is limited by several factors beyond our control. We cannot be certain that the subjects who answered the index question about pain and discomfort in the way it was posed would have been considered to be true CNCP sufferers if a time-based a priori definition of CNCP had been applied (1). Subjects with usual pain, but of recent onset, may not strictly have had CNCP. On the other hand, a person with regular but intermittent pain and pain-free intervals may not have thought of themselves as 'usually' being in pain. It is not possible to

TABLE 3
Adjusted odds of chronic noncancer pain (CNCP) from regression model

Variable		Point OR of CNCP	95% CI
Demographic factors			
Age, years	15–24	Reference	
	25–34	1.32	1.19–1.47
	35–44	1.57	1.42–1.75
	45–54	1.83	1.64–2.04
	55–64	2.14	1.91–2.39
	65–74	1.99	1.77–2.25
	≥75	2.30	2.02–2.61
Female sex (versus male)		0.92	0.87–0.97
Civil status – married (versus all others)		1.08	1.02–1.14
Annual household income (for three-person households)	$10,000–$19,999	1.25	1.15–1.35
	$20,000–$39,999	1.12	1.06–1.18
	>$80,000	Reference	
Highest education – less than high school (versus all others)		1.31	1.24–1.39
White race		0.81	0.74–0.88
Medical factors			
Arthritis		3.64	3.43–3.87
Back problems		3.58	3.39–3.78
Other chronic medical condition		2.26	2.09–2.45
Bowel disorder		2.15	1.87–2.47
Migraines		1.97	1.84–2.12
Epilepsy		1.64	1.29–2.09
COPD		1.56	1.40–1.74
Heart disease		1.47	1.33–1.62
Stroke		1.39	1.15–1.67
Ulcers		1.32	1.18–1.48
Diabetes		1.30	1.17–1.45
Sinusitis		1.27	1.16–1.39
Hypertension		1.16	1.08–1.25
Thyroid disorder		1.12	1.01–1.24
Mental health factors			
Depression		1.59	1.46–1.74
No distress		Reference	
CIDI distress score = 1		1.12	1.03–1.23
CIDI distress score = 2		1.37	1.42–1.70
CIDI distress score = 3		1.56	1.42–1.70
CIDI distress score = 4		1.61	1.46–1.77
CIDI distress score ≥ 5		2.81	2.63–3.01
Lifestyle factors			
Alcohol abstainer		1.19	1.11–1.27
Cigarette smoking – never		Reference	
Cigarette smoking – occasional		0.90	0.82–0.99
Cigarette smoking – daily		1.12	1.07–1.19
Physical inactivity		1.80	1.69–1.93
Had an activity-limiting injury in past 12 months		1.50	1.40–1.61
Spirituality/faith important		0.93	0.88–0.98

CIDI Composite International Diagnostic Interview; COPD Chronic obstructive pulmonary disease

address this by comparing our prevalence estimate with those derived from population studies using other CNCP identification protocols because overall rates vary so widely. NPHS data are self-reported and cannot be corroborated objectively, leading to concerns about accuracy and the under- or over-reporting of data, which may carry social stigma. The labelling of a respondent as having depression or distress using data derived by a nonhealth professional over the telephone is, at best, an approximation of the data that may have been obtained from a formal psychiatric interview and examination. A more fundamental issue is our assumption that all CNCP phenotypes in the dataset share the same risk factors. On the contrary, it is more likely that the associations we describe here are important in some types of CNCP but not others. One possible source of error over which we did have control was the way in which we categorized complex continuous variables, such as cigarette consumption, alcohol use, distress and depression, for analysis. These variables could arguably have been handled in a number of alternative ways.

Our analysis demonstrates that CNCP is a complex phenomenon with associations that extend into the way the sufferer lives, feels, behaves, was raised, and his or her other medical problems. The finding of associations of a broadly comparable magnitude in each of several such domains provides quantitative support for the widely accepted biopsychosocial model of CNCP (31). The finding of increased risks of pain among those with some common chronic medical illnesses that have not hitherto been traditionally thought of as being associated with pain argues for the conduct of studies to determine pain prevalence in clinical populations with these disorders, and perhaps for the inclusion of pain assessment and management as part of the routine care for these conditions.

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