



Chronic back pain and major depression in the general Canadian population

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Abstract

Chronic pain and depression are two of the most common health problems that health professionals encounter, yet only a handful of epidemiological studies have investigated the relationship between these conditions in the general population. In the present study we examined the prevalence and correlates of major depression in persons with chronic back pain using data from the first cycle of Canadian Community Health Survey in a sample of 118,533 household residents. The prevalence of chronic back pain was estimated at 9% of persons 12 years and older. Rates of major depression, determined by the short-form of the Composite International Diagnostic Interview, were estimated at 5.9% for pain-free individuals and 19.8% for persons with chronic back pain. The rate of major depression increased in a linear fashion with greater pain severity. In logistic regression models, back pain emerged as the strongest predictor of major depression after adjusting for possible confounding factors such as demographics and medical co-morbidity. The combination of chronic back pain and major depression was associated with greater disability than either condition alone, although pain severity was found to be the strongest overall predictor of disability.

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1. Introduction

Numerous studies have shown depression to be highly prevalent among persons with chronic pain ([Dworkin and Gitlin, 1991](#); [Fishbain et al., 1997](#); [Rush et al., 2000](#)). In clinic samples, rates of current major depression can range from 30 to 54% ([Banks and Kerns, 1996](#); [Sullivan et al., 1992](#)), significantly higher than the rate of 5–8% found in the general population ([Kessler et al., 2003](#)). Nevertheless, only a small proportion of individuals with chronic pain are referred to pain clinics ([Magni et al., 1990](#); [Wilson et al., 2000](#)). Furthermore, treatment-seeking patients have high levels of emotional distress and greater occupational impairment ([Dersh et al., 2002](#)).

Only a handful of studies have investigated the relationship between pain and depression in the general population. An early study by [Von Korff et al. \(1998\)](#)

involving enrollees of a health maintenance organization found symptoms of depression to be more common in persons with chronic pain compared to pain-free individuals. Depression was unrelated to pain intensity, but correlated with interference from pain and the number of pain sites. Using data from a large US household survey, [Magni et al. \(1990\)](#) estimated the rates of depression in individuals with and without chronic pain at 18 and 8%, respectively. Similar results emerged in a follow-up study ([Magni et al., 1993](#)). Data from a large mail survey in the UK showed psychological distress to be more common in persons with chronic low back pain than pain-free individuals ([Croft et al., 1995](#)). Finally, international data from the World Health Organization (WHO) collaborative study on psychological problems in primary care ([Sartorius et al., 1996](#)) showed that 32% of patients with somatoform pain disorder also met criteria for a depressive disorder ([Von Korff and Simon, 1996](#)).

The weight of evidence from these few epidemiological studies point to depression being more common in persons

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with chronic pain. Precise estimates of prevalence are difficult to extract because of variations in study design, measurement of depression, and definition of chronic pain. Only the WHO study employed a diagnostic interview to identify depression. The remaining studies adapted self-report symptom checklists to identify cases of depression. To date, there has been no community-based epidemiological study on the prevalence of depression in persons with chronic pain in which a structured interview was used to diagnose major depression.

For the present study we examined major depression and chronic back pain using data from the Canadian Community Health Survey-Cycle 1 (CCHS-1.1) administered to over 100,000 individuals in 2000–2001. The main advantages of this data set over other surveys are: (1) the sample size far exceeds previous studies; (2) major depression was determined from a structured interview; and (3) the definition of back pain required 6 months duration, consistent with the current definition (Melzack and Wall, 1999). The specific objectives of the study were to estimate the prevalence of major depression in persons with chronic back pain compared to persons with no pain and to examine the impact of demographic variables and other relevant factors in predicting depression in persons with chronic back pain.

2. Methods

2.1. The study sample

The CCHS-1.1 was conducted by Statistics Canada (2001) between September 2000 and November 2001. The survey is similar to the National Population Health Survey (Statistics Canada, 1996) in content and methodology but much larger in scope. The CCHS-1.1 used multi-staged, stratified random sampling procedures, targeting persons aged 12 years or older who are living in private dwellings in the 10 provinces and the three territories. Persons living on Indian Reserves or Crown lands, clientele of institutions, full-time members of the Canadian Armed Forces and residents of certain remote regions are excluded from this survey. Data were collected from over 130,000 individuals by trained Statistics Canada interviewers using the computer-assisted personal or telephone interviewing method. Informed consent was obtained by Statistics Canada. The response rate was 80%. The content of the CCHS-1.1 comprised a range of questions covering physical and mental health status, lifestyle behaviors, health care utilization, and socioeconomic characteristics. It should be noted that the CCHS-1.1, although comprehensive, is still a self-report survey. No attempts were made to corroborate respondents' reports of medical illness or depressive symptoms using other sources of health information.

2.2. Procedure

2.2.1. Identification of chronic pain cases

The CCHS-1.1 included three questions that were used to identify persons with chronic back pain. First, respondents were asked if they are usually free of pain. The survey then asked respondents whether they suffered from any long-term health conditions in the past 12 months. The definition of a long-term health condition included two criteria: (1) the condition was diagnosed by a health professional and (2) it had lasted at least 6 months. From a list of 20 chronic health conditions respondents indicated any and all that applied in the past 12 months. This list included back problems, as well as arthritis, migraines, diabetes, high blood pressure, and 15 other common conditions. Persons with chronic back pain were identified on the basis of responding 'no' to being free of pain, and endorsing back problems as a long-term health condition. Those with chronic pain were asked to rate the usual intensity of the pain from the choices mild, moderate, or severe (Fig. 1).

2.2.2. Assessment of depression

In the CCHS-1.1 a major depressive episode (MDE) in the preceding 12 months was measured by the WHO's Composite International Diagnostic Interview-Short Form for Major Depression (CIDI-SFMD; World Health Organization, 1990). The CIDI was specifically developed by the WHO to measure depression in epidemiological studies. The interview schedule was developed and validated by Kessler et al. (1994) and has been used in many epidemiological studies of depression in samples ranging in age from 12 to over 60 (Kessler et al., 2003; Wang and Patten, 2001). Extensive field-testing of the CIDI occurred on individuals aged 15 years and over during the US National Comorbidity Survey (Kessler and Walters, 1998; Kessler et al., 1994). The diagnostic accuracy of the CIDI depressive module has shown to be good in adolescents (Patton et al., 1999), the elderly (Turvey et al., 1999), and medically ill populations (Booth et al., 1998). MDE, as defined in the CCHS, represents a purported 90% predictive cut-point for the CIDI-SFMD. This cut-point corresponds to reporting five of eight depressive symptoms (depressed mood, loss of interest, fatigue, difficulties in sleeping and

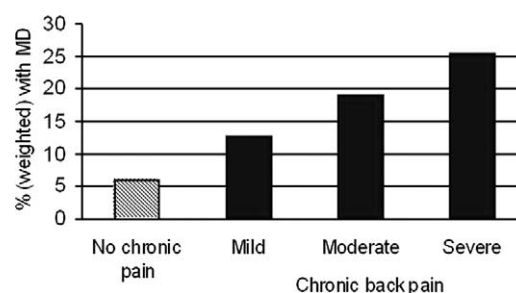


Fig. 1. Prevalence of major depression (MD) in persons with chronic back pain stratified by pain severity. Rate of depression in pain-free individuals depicted for comparison.

concentration, weight gain or loss, feelings of worthlessness and suicidal ideation) in the same 2-week period in the past 12 months, at least one of which must be depressed mood or loss of interest. Therefore, this choice of a cut-point can be justified by its face validity for the DSM-IV criteria (American Psychiatric Association, 1994). The sensitivity and specificity of the CIDI-SFMD using this cut-point when compared against the full version of the CIDI are 90 and 94%, respectively (Kessler et al., 1998); the overall classification accuracy of the CIDI-SFMD in identifying MDE is 93%.

2.2.3. Statistical analysis

Because the CCHS-1.1 used a complex sampling design, estimates of prevalence must take into consideration the sampling and design effects. Researchers cannot assume that the calculations of proportions are based on a simple random sample. Although the point estimates based on the sampling weights alone may be correct, the associated variances based on such calculations are meaningless. In this analysis, estimates of prevalence were calculated using the sampling weights provided by Statistics Canada and their guidelines for calculating confidence intervals were followed (Statistics Canada, 1996). Reported percentages, therefore, are weighted while reported sample sizes are the actual number of observed subjects. Because of missing data on some variables, subgroup sample sizes can vary from comparison to comparison. The statistical software Stata (Version 7.0, Stata Corporation, 2001) was used to perform the analyses. For statistical comparisons of proportions, the χ^2 value for each test was converted to an F -test that takes into consideration the sampling weights for the specific variables under study. The variances associated with the point estimates were calculated using the 'bootstrap' method. Bootstrapping is a technique by which random samples are repeatedly drawn with replacement from observations to obtain a set of estimates (Last, 1995). The observed variance of this set is the bootstrap estimate of variance, from which accurate 95% confidence intervals can be calculated. Traditional logistic regression statistics such as the likelihood ratio tests do not apply when bootstrap estimates are employed. The advantage of this method is that the derived odds ratios are likely very close to the actual population parameters.

3. Results

3.1. Demographic profile

The study sample consisted of 118,533 individuals who provided valid responses to the survey questions concerning chronic pain and major depression. Within this group, 107,933 (weighted 91%) reported to be pain-free; the remaining 10,600 individuals (9%) had chronic back pain. The number of individuals with mild, moderate, and severe pain and the weighted percentages are provided in Table 1 along with the demographic profile of each group. Compared to the pain-free group, individuals with chronic back pain

Table 1
Characteristics of persons with and without chronic back pain

Variable	Chronic back pain (<i>n</i> = 10,600)	Weighted %	No pain (<i>n</i> = 107,933)	Weighted %
<i>Pain severity</i>				
Mild	2659	25.6	–	–
Moderate	5900	55.4	–	–
Severe	2041	19.0	–	–
<i>Gender</i>				
Male	4366	43.8	51,430	50.6
Female	6234	56.2	56,503	49.4
<i>Age group</i>				
12–19	302	2.7	16,589	14.2
20–34	1444	15.7	23,635	26.1
35–50	3518	36.1	31,989	31.3
51–64	2862	26.4	17,868	15.9
65 +	2472	19.1	17,852	12.5
<i>Marital status</i>				
Married/common-law	5814	63.4	55,796	57.3
Not married	4775	36.6	52,011	42.7
<i>Income^a</i>				
Middle-high	7229	81.7	83,218	89.6
Low	2310	18.3	12,920	10.4
<i>Education</i>				
High school or less	5032	49.6	52,239	52.7
Post-secondary	5462	50.4	54,711	47.3
<i>Employment</i>				
Working	5192	61.3	67,483	78.9
Not working	3894	38.7	21,522	21.1
<i>Race</i>				
Caucasian	9783	90.0	96,676	85.0
Non-caucasian	738	10.0	10,462	15.0

^a Categories derived from a Statistics Canada's formula that incorporates total household income and number of people living in the household. For a single person living alone, low is equivalent to <\$15,000CAN and middle-high to >\$15,000CAN.

were on average older (51.3 vs. 42.6 years; $t = -44.00$; $df = 118,532$; $P < 0.00001$), less educated ($F = 16.78$; $df = 1, 117,443$; $P < 0.00001$), and more likely to be female ($F = 78.88$; $df = 1, 118,532$; $P < 0.00001$), single ($F = 70.88$; $df = 1, 118,395$; $P < 0.00001$), Caucasian ($F = 56.23$; $df = 1, 117,658$; $P < 0.05$), and not working (including those retired and on disability; $F = 688.70$; $df = 1, 98,090$; $P < 0.00001$).

The CCHS-1.1 included an assessment of disability days using the 2 weeks prior to the interview as the period of reference. Respondents were asked whether they had to stay in bed (including any night in a hospital) all or most of the day during this period because of illness or injury. This definition of disability has been previously used in epidemiological studies (Broadhead et al., 1990; Patten, 2002). Persons with back pain were more likely to experience days of disability compared to pain-free

individuals (38.8 vs. 12.7%, respectively; $F = 2411.03$; $df = 1, 118,426$; $P > 0.00001$). The rate of disability increased with greater pain severity: 23.7, 35.1 and 50.5% of individuals with mild, moderate, and severe pain reported at least some disability days in the previous 2 weeks.

Because employment rates and disability would be influenced by age, we examined the prevalence of these variables within three broad age categories: 12–19, 20–64, and 65 years (mandatory age of retirement in Canada) or older. These results are shown in Fig. 2. With the exception of the 12–19 year age category for employment, the prevalence rates of not working and disability were significantly higher in back pain group than the no-pain group for all age categories (all $P < 0.00001$).

3.2. Prevalence and correlates of major depression

Rates of major depression as determined by the CIDI-SFMD were estimated at 5.9 and 19.8% for the no pain and chronic back pain groups, respectively. In total, about 1.8% of the Canadian adult population was estimated to have both chronic back pain and major depression. The rate of major depression in persons with back pain increased with higher self-reported pain severity (see Fig. 1). Compared to non-depressed individuals with back pain, persons with chronic back pain and major depression were younger (44.9 vs. 52.7 years; $t = -18.19$; $df = 10,205$; $P < 0.00001$), more likely to be female (64.8 vs. 54.6%; $F = 24.19$; $df = 1, 10,204$; $P < 0.00001$), and more likely to be single (50.1 vs. 33.3%; $F = 87.85$; $df = 1, 10,193$; $P < 0.00001$).

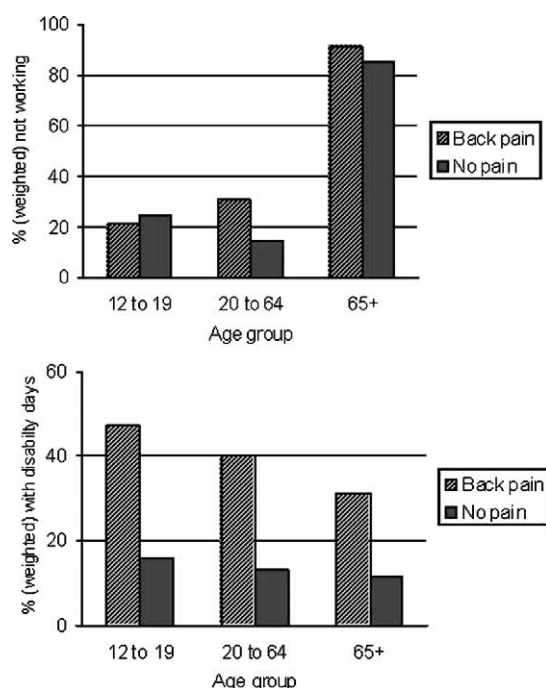


Fig. 2. Prevalence of persons not working (top) and reporting at least one disability day in the past two weeks (bottom) stratified by age category.

3.3. Impact of co-morbidity on socioeconomic status, disability, and health care utilization

For the following analyses, individuals with and without major depression were contrasted within the chronic pain group. Persons with major depression were more likely to be in the low income category compared to non-depressed persons (25.9 vs. 16.3%; $F = 47.61$; $df = 1, 9267$; $P < 0.00001$) but comparable rates of employment were detected (60.1 vs. 61.7%, $F = 0.64$; $df = 1, 8783$; $P > 0.05$). Significantly more depressed than non-depressed persons reported at least some disability days in the last 2 weeks (57.6 vs. 34.3%, respectively; $F = 162.55$; $df = 1, 10,186$; $P < 0.00001$).

A higher proportion of major depressed individuals with back pain consulted a mental health professional in the past 12 months compared to non-depressed persons (47.7 vs. 10.1%, respectively; $F = 683.14$; $df = 1, 10,195$; $P < 0.00001$). Use of mental health services also increased with higher pain intensity: 14.7, 17.0, and 21.6% for persons with mild, moderate, and severe pain, respectively ($P < 0.0002$).

3.4. Prediction of major depression and disability

Logistic regression was conducted to estimate the likelihood of being major depressed based on the presence of chronic back pain after adjusting for possible confounding factors. Because persons with back pain often have other painful conditions (i.e. multiple pain sites) an additional variable, number of other chronic health conditions, was used in these analyses. This approach attempted to control for the influence of pain co-morbidity in raising the risk of depression. The sampling design and weights were accounted for in the analysis by using the bootstrap statistics. We also examined possible interactions between back pain and gender, age, and number of chronic health conditions. Nine variables and the three interactions were found to significantly predict major depression (see Table 2). The presence of back pain emerged as the strongest predictor among all variables and interactions examined. Persons with chronic back pain were about 6.2 times more likely to be depressed than pain-free individuals. Being white, younger, unmarried, having less education, and being in the lower income category also increased one's risk of major depression. Some interesting interaction effects emerged. The age by pain interaction was in the expected direction, but the impact of back pain on major depression was moderated by gender and the number of other chronic health problems reported. For gender, the presence of back pain had more impact on men than women in terms of raising the risk of depression. The interaction between back pain and number of chronic conditions revealed that the strength of back pain as a predictor of depression was reduced when more health problems were present. It should be noted that the strengths of these interactions relative to

Table 2
Results of logistic regression for major depression

Variable ^a	Odds ratio	95% Confidence interval
Chronic back pain	6.17 ^b	5.16–7.58
Gender	1.76 ^b	1.66–1.87
Age	0.99 ^b	0.97–0.98
Marital status	1.47 ^b	1.39–1.55
Income	1.42 ^b	1.33–1.52
Race	0.93	0.86–1.02
Education	0.81 ^b	0.77–0.85
Chronic conditions	1.28 ^b	1.26–1.31
<i>Interactions</i>		
Back × gender	0.67 ^b	0.58–0.77
Back × age	0.98 ^b	0.98–0.99
Back × chronic conditions	0.92 ^b	0.89–0.95

Bootstrap statistics (replications, 500) are displayed. Dependent variable is major depression (0, no; 1, yes).

^a Categories for variables as shown in Table 1.

^b $P < 0.05$.

the back pain variable alone were modest (estimated odds ratios ranging from 0.67 to 0.98).

Using just the back pain sample, a separate logistic regression analysis was conducted to examine the power of pain severity in predicting cases of major depression after controlling possible confounding factors including medical co-morbidity. As expected, individuals who reported their pain intensity as severe had the highest risk of major depression (odds ratio, 1.61; 95% confidence interval 1.34–1.97; $P < 0.05$). Socioeconomic factors and number of chronic health problems emerged as predictors of depression with the same relative strength and ranking of importance as in the analysis involving non-pain individuals.

In a different logistic regression analysis we examined disability as the dependent variable and independent variables consisting of the socioeconomic factors, major depression status, pain severity, and number of chronic

Table 3
Results of logistic regression for disability in persons with chronic back pain

Variable ^a	Odds ratio	95% Confidence interval
Pain severity	2.85 ^b	2.47–1.69
Gender	1.07	0.97–1.19
Age	0.97 ^b	0.96–0.98
Marital status	1.08	0.98–1.18
Income	0.99	0.87–1.12
Race	0.89	0.73–1.05
Education	0.87 ^b	0.80–0.95
Working	1.38 ^b	1.22–1.54
Depression	1.43 ^b	1.18–1.79
Chronic conditions	1.22	1.19–1.25

Bootstrap statistics (replications, 500) are displayed. Dependent variable is disability (0, no vs. 1, yes for disability days in the last 2 weeks).

^a Categories for variables as shown in Table 1.

^b $P < 0.05$.

health problems. The analysis was also conducted on the back pain group. The predictors of disability days were (in order of strength) pain severity, major depression, number of chronic health problems, not working, and younger age (see Table 3).

4. Discussion

The present study examined the relationship between chronic back pain and major depression using a large epidemiological data set. The rate of major depression in persons with chronic back pain was comparable to the rates reported by Magni et al. (1990, 1993) for persons with musculoskeletal pain. This rate is lower than clinic samples, but still much higher than found in individuals in the general population who are usually free of pain. Consistent with other large, population-based studies of depression in Canada and other countries (Blazer et al., 1994; DeMarco, 2000; Kessler et al., 2003), there was significant impact of age, gender, and marital status on depression in persons with and without chronic pain. Specifically, younger persons, women, and those not married were more likely to be depressed regardless of pain status. These findings are also similar to the Magni research group (Magni et al., 1990, 1993). The combination of depression and chronic back pain was associated with greater socioeconomic disadvantage and disability than having either condition alone.

After controlling for the influence of other known risk factors, the presence of chronic back pain was the strongest predictor of major depression among all the variables examined in selected participants. Regarding the interaction between back pain and other long-term health problems, previous studies have found that the number of chronic conditions is associated with depression (Patten, 1999). When the number of chronic conditions increases, the importance of back pain as a risk factor for depression is somewhat reduced. It is possible that for those with less medical co-morbidity, back pain becomes a major factor in predicting depression. In contrast to the findings of Von Korff et al. (1998), we found that risk of major depression increased in a linear fashion with greater pain severity. Persons with severe pain were also more likely to report days of total disability even after controlling for demographic factors such as age. Pain severity was actually a stronger predictor of disability than either major depression or the number of chronic health problems. A possible explanation for this finding is that persons with severe pain had more serious medical conditions (e.g. cancer). This fact would not be represented in the variable number of co-morbid health problems because conditions are afforded equal weighting.

The present study has several strengths compared to previous epidemiological investigations in the area. As noted previously, we employed the largest sample ever used in a population-based study of chronic pain and depression. The response rate of 80% is also higher than most household

surveys (cf. [Kessler et al., 2003](#)). The CCHS-1.1 was administered to residents as young as 12 years of age. To our knowledge, this is the first national, epidemiological study of chronic pain that included adolescents. The definition of back pain required duration of at least 6 months. This specification is closer to the accepted medical criteria ([Melzack and Wall, 1999](#)) than the 1-month duration used in [Magni et al. \(1990\)](#) or the 1-day criteria used in [Von Korff et al. \(1998\)](#). Finally, this is the first household survey on the topic to use a structured diagnostic interview to identify cases of major depression.

A notable limitation of our cross-sectional analysis is that cause and effect cannot be established. Notably, there is no way to determine if major depression is the result of chronic pain or a causative factor. Previous reviews have advocated for depression being a logical consequence to having chronic pain ([Dersh et al., 2002](#)). Persons with chronic back pain may be at the highest risk given that greater musculoskeletal dysfunction can restrict the individual's capacity to work and participate in social activities. These consequences would inevitably contribute to feelings of helplessness and despair in many individuals. Furthermore, chronic pain is associated with severe sleep problems and insomnia can exacerbate both depression and pain ([Ford and Kamerow, 1989](#); [Moldofsky, 1990](#)).

Other limitations of this study require attention. The assessment of chronic pain was very limited. Information on diagnosis, duration, and the precise location of pain was not collected in the CCHS-1.1. In addition, our classification of chronic back pain was indirect. It is possible that some respondents had a more significant source of pain than back. Unfortunately, there is no way to determine how many cases may have been mislabeled as primary back pain. Nevertheless, mislabeled cases would still be persons with chronic pain. The most serious threat to validity is that the results may not generalize to persons with back pain specifically but to the broader group of chronic pain sufferers. We also had no means to control for the influence of somatic symptoms on the diagnosis of depression. Many of the symptoms of chronic pain overlap with the symptoms of major depression (e.g. fatigue, insomnia) and determining the source of these non-specific somatic complaints is very difficult ([Dersh et al., 2002](#)). Although the CIDI has performed well in detecting depression in medically ill samples ([Booth et al., 1999](#)), the prevalence of depression may be inflated due to the somatic items. Furthermore, the CCHS-1.1 used the abbreviated version of the full diagnostic interview, which contained no probe questions to determine the source of symptoms. The fact that individuals classified as being depressed were more likely to seek mental health treatment does provide indirect support of the diagnoses. On the other hand, the reason for consulting a mental health professional was not asked of respondents. All these limitations are typical of epidemiological surveys that focus on general health rather than specific disorders.

In conclusion, this study provides evidence from a large population sample that individuals with chronic back pain are at high risk to experience major depression. Recently, major depression was rated the fourth most disabling medical disorder among adults in the world ([World Health Organization, 2001](#)), and is expected to become the second most disabling illness by 2020 ([Parikh and Lam, 2001](#)). The combination of chronic pain and depression, estimated to affect almost 2% of the general population, appears to represent a substantial health problem that is associated with high rates of disability, socioeconomic disadvantage, and greater utilization of health care resources.

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