

Chiropractors' characteristics associated with their number of workers' compensation patients

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Study design: *A cross-sectional survey.*

Objective: *The purpose of this study was to identify characteristics of Canadian doctors of chiropractic (DCs) associated with their number of workers' compensation patients.*

Summary of background data: *It has been previously hypothesized that DCs that treat a relatively high volume of workers' compensation cases may have different characteristics than the general chiropractic community.*

Methods: *Secondary data analyses were performed on data collected in the 2011 survey of the Canadian Chiropractic Resources Databank (CCRD). The CCRD survey included 81 questions concerning the practice and concerns of DCs. Of the 6,533 mailed*

Plan d'étude : *Une enquête transversale.*

Objectif : *Cette étude visait à déterminer les caractéristiques des chiropraticiens canadiens associées à leur nombre de patients traités pour accidents de travail.*

Introduction : *Selon des hypothèses émises précédemment, les chiropraticiens qui traitent un nombre relativement élevé de patients pour accidents de travail peuvent avoir des caractéristiques différentes de l'ensemble des chiropraticiens.*

Méthodologie : *Des analyses secondaires de données ont été effectuées sur des données recueillies dans l'enquête de 2011 de la banque de données de ressources chiropratiques canadiennes (CCRD). Cette enquête comportait 81 questions relatives à l'exercice et aux préoccupations des chiropraticiens. Sur les*

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questionnaires, 2,529 (38.7%) were returned. Of these, 652 respondents did not meet our inclusion criteria, and our final study sample included 1,877 respondents. Bivariate analyses were conducted between predetermined independent variables and the annual number of workers' compensation patients. A negative binomial multivariate regression was performed to identify significant factors associated with the number of workers' compensation patients.

Results: On average, DCs received 10.3 (standard deviation (SD) = 17.6) workers' compensation cases and nearly one-third did not receive any such cases. The type of clinic (other than sole provider), practice area population (smaller than 500,000), practice province (other than Quebec), number of practice hours per week, number of treatments per week, main sector of activity (occupational/ industrial), care provided to patients (electrotherapy, soft-tissue therapy), percentage of patients with neuromusculoskeletal conditions, and percentage of patients referred by their employer or a physician were associated with a higher annual number of workers' compensation cases.

Conclusion: Canadian DCs who reported a higher volume of workers' compensation patients had practices oriented towards the treatment of injured workers, collaborated with other health care providers, and facilitated workers' access to care.

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KEY WORDS: chiropractic, Workers' Compensation Board, occupational, work related, survey, care seeking

Introduction

“Work disability occurs when a worker is unable to stay at work or return to work because of an injury or disease”¹. Work disability is associated with many consequences for the worker, employer, healthcare system and compensation system.² There is increasing evidence that health care providers may influence work disability, both positively

6 533 questionnaires envoyés, il y a eu 2 529 (38,7 %) réponses. Parmi celles-ci, 652 ne répondaient pas à nos critères d'inclusion. Donc, l'échantillon final utilisé pour notre étude comprenait 1 877 répondants. Des analyses bivariées ont été menées entre les variables indépendantes prédéterminées et le nombre annuel de patients traités pour accidents de travail. Une régression multivariée binomiale négative a été réalisée pour déterminer les facteurs importants associés avec le nombre de patients traités pour accidents de travail.

Résultats : En moyenne, les chiropraticiens ont traité 10,3 (écart-type = 17,6) patients pour accidents de travail et près d'un tiers n'ont pas reçu de tels cas. Les facteurs suivants ont été associés à un nombre annuel plus élevé de patients traités pour accidents de travail : type de clinique (autre que fournisseur unique), population de la ville de la clinique (inférieure à 500 000), province de la clinique (autre que le Québec), nombre d'heures de cabinet par semaine, nombre de traitements par semaine, principal secteur d'activité (professionnelle / industrielle), soins prodigués aux patients (électrothérapie, thérapie des tissus mous), pourcentage de patients atteints de maladies neuro-musculo-squelettiques, et pourcentage de patients référés par leur employeur ou un médecin.

Conclusion : Les chiropraticiens canadiens qui ont déclaré un nombre plus élevé de patients traités pour accidents de travail avaient des pratiques axées sur le traitement des travailleurs blessés, ont collaboré avec d'autres fournisseurs de soins de santé, et ont facilité l'accès aux soins des travailleurs.

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MOTS CLÉS : chiropratique, commission des accidents du travail, lié au travail, enquête, recours aux soins

and negatively.³ The most prevalent components of clinical return-to-work interventions for musculoskeletal disorders are physical exercises, education and behavioral treatments.⁴ These components are considered the core components of return-to-work interventions.⁵⁻⁹ Unfortunately, early aggressive care may delay recovery¹⁰⁻¹⁴ from whiplash injuries and not listening carefully to the patient

(particularly women) may delay return-to-work for occupational low back pain¹⁵. Unnecessary diagnostic imaging tests are also frequently ordered.¹⁶⁻²⁰

It has been demonstrated that general practitioners are less likely to implement evidence-based management of back pain than occupational physicians and occupational therapists.^{21,22} The latter health care providers experience fewer barriers to guideline implementation because their tasks focus on disability prognosis, yellow flag management, and return to activity parameters.²² However, little is known about the impact of doctors of chiropractic (DCs) on work disability and their adherence to guidelines. Chiropractic and medical care appear to have similar cost-effectiveness during the treatment of occupational low back pain^{23,24} and chiropractic adherence to radiological guidelines appears to be increasing²⁵⁻²⁸. The broad approaches described by DCs experienced in the treatment of occupational injuries are consistent with those proposed by evidence-based guidelines.²⁹ Barriers related to different provincial workers' compensation systems have previously been identified by Canadian DCs.²⁹ It has been hypothesized that DCs that treat a relatively high volume of workers' compensation cases may have different characteristics than the general chiropractic community.²⁹ In Quebec, the act regulating occupational injuries grants physicians the role of sole gatekeeper.³⁰ This is the only province where chiropractic care, to be reimbursed by the provincial workers' compensation board, must be prescribed by a medical doctor. It is thus reasonable to hypothesize that DCs from the province of Quebec treat fewer workers' compensation cases on average than DCs from other provinces.

Little is known about the characteristics of health care providers who tend to treat more workers' compensation cases. Identifying those characteristics is important for understanding the care seeking behaviours of injured workers. This research project aimed to perform a secondary data analysis from a nationwide survey to describe the characteristics of Canadian DCs who tend to treat more workers' compensation cases.

Specific objective

To identify DCs' characteristics that are associated with the number of workers' compensation patients they treat.

Methods

Study design

We performed a cross-sectional analysis using the 2011 survey of the Canadian Chiropractic Resources Databank (CCRD).³¹ Members of the Canadian Chiropractic Association (CCA) were surveyed using a self-administered questionnaire (mail or online version). The University of Montreal Health Research Ethics Board approved this study (13-106-CERES-D).

Study Population

The study population included all Canadian DCs who were CCA members and had active practices in 2011. DCs practicing another profession (i.e., dentist, physician, nurse, occupational therapist, physiotherapist, psychologist or radiologist), or not in active practice (i.e., practicing less than 10 hours per week or 37 weeks yearly, retired and semi-retired) were excluded. During the 2011 iteration of the CCRD, 6,533 survey questionnaires were mailed to members of the CCA. The respondents were able to return the paper version of the questionnaire by mail or to complete the survey online. 1,889 questionnaires were returned by mail and 640 were completed online, resulting in a total of 2,529 completed questionnaires. The effective response rate was 38.7 percent. A total of 652 respondents were excluded because they were practicing another profession, not in active practice, or had missing answers for the main dependent variable. The current study included 1,877 respondents (Figure 1).

Source of data

The CCRD survey includes 81 questions detailing the practice and concerns of DCs and is used to inform the Canadian Chiropractic Association about services to provide to their membership.³¹ For this project, we used information concerning professional activities, education, research and teaching activities, main sectors of activity, care provided to patients, chiropractic techniques used, type of conditions treated, and referral practices.

Description of study variables

Annual number of workers' compensation patients treated by a DC (dependent variable)

The annual number of workers' compensation pa-

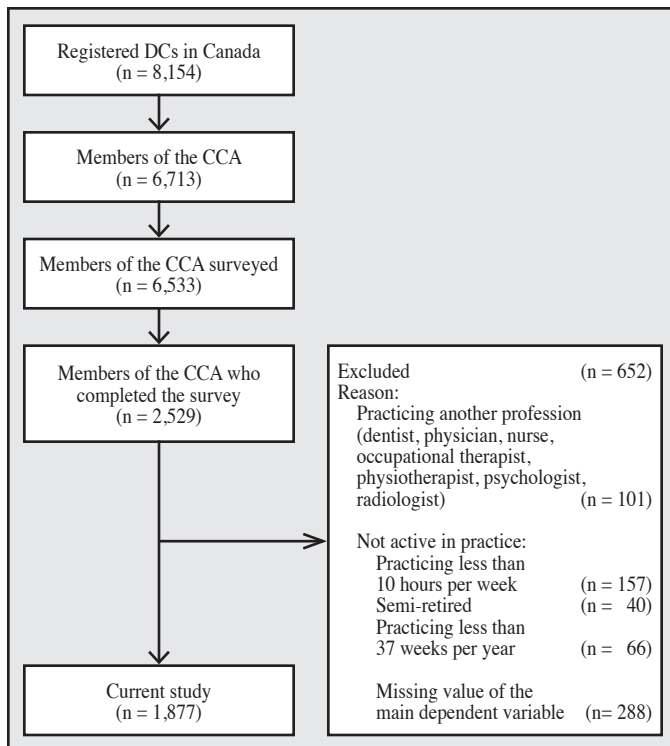


Figure 1.

Flow chart diagram showing the inclusion and exclusion of respondents through each stage of the study

tients treated by a DC was obtained by multiplying the respondent's answers to the following questions:

- The average number of new patients / week
- The average number of weeks practicing chiropractic per year
- The percentage of monthly income from the workers' compensation board.

DC characteristics (independent variables)

The survey administered by the CCRD includes multiple items that describe the practice of DCs. The questionnaire contained items classified into five category headings: background information (demographics), professional activity, education, training and affiliations, practice characteristics, finances and income³¹. Pertinent themes were selected a priori and our hypotheses of the association between selected variables and the number of workers' compensation cases are listed in Appendix 1.

Analyses

We generated frequencies (categorical variables) or means and standard deviations (continuous variables) for variables that we determined as relevant a priori. To investigate non-responses to the survey, we compared the analyzed sample to the complete CCA membership for all available characteristics (i.e., sex, college of graduation, years of practice and province of exercise) using Student's t-tests and Pearson's chi-square test. Bivariate analyses were conducted between all the predetermined independent variables and the annual number of patients referred by MDs using Student's t-tests and ANOVA for categorical variables and Pearson's correlation coefficients for continuous variables. When appropriate, the Games-Howell for unequal variances post-hoc test was applied.³² All comparisons were 2-tailed and considered statistically significant at $p < 0.05$.

Because our data were highly skewed and over dispersed (i.e., the variance was greater than the mean), a multivariate negative binomial regression was performed to identify factors associated with the number of workers' compensation cases. We did not include the number of new patients per week and the number of weeks of practice per year in our model because they were used to construct the dependent variable. All other independent variables with a $P < 0.25$ in bivariate analyses were entered into the multivariate negative binomial regression model. The least significant variables were removed from the model individually until all remaining variables had a $P < 0.10$ to form the preliminary model. We then attempted to reintroduce all the excluded variables individually. The final model was created by reintroducing variables into the model if they had a $P < 0.10$ or if their introduction altered the other variables' coefficients by more than 10%. We reported the incidence rate ratios (IRR) and their 95% confidence intervals for each independent variable included in the final model. The IRR values were obtained from the regression coefficients on an exponential scale. IRR values greater than 1 represent an increase in the annual number of workers' compensation cases and values lower than 1 represent a decrease. For continuous variables, the IRR represents the average change in the predicted annual number of workers' compensation patients for a one-unit increase of the independent variable. For categorical variables, the IRR represents the factor of change in the predicted annual number of workers' compensation patients

Table 1.
Descriptive statistics of DC characteristics (n=1877)

General information			
Sex; n (%)	Male	1,313	(70.0%)
	Female	564	(30.0%)
Age (years); mean (SD)		43.7	(10.8)
Years of practice; mean (SD)		16.5	(10.9)
Type of practice; n (%)	Solo practitioner	646	(34.4%)
	Group of DCs	379	(20.2%)
	Multidisciplinary without MD	741	(39.5%)
	Multidisciplinary with MD	91	(4.8%)
	Missing	20	(1.1%)
Practice province; n (%)	British Columbia	303	(16.1%)
	Alberta	270	(14.4%)
	Saskatchewan	79	(4.2%)
	Manitoba	85	(4.5%)
	Ontario	793	(42.2%)
	Quebec	260	(13.9%)
	Atlantic provinces	87	(4.6%)
Primary practice community population; n (%)	Under 10,000	232	(12.4%)
	Between 10,000 and 49,999	367	(19.6%)
	Between 50,000 and 99,999	285	(15.2%)
	Between 100,000 and 499,999	488	(26.0%)
	Over 500,000	490	(26.1%)
	Missing	15	(0.8%)
Views on adequacy of supply of DCs in community; n (%)	Too few	100	(5.3%)
	Too many	717	(38.2%)
	The right number	763	(40.6%)
	I do not know	297	(15.8%)
Professional activities			
Number of hours of practice per week; mean (SD)		37.5	(10.1)
Number of weeks of practice per year; mean (SD)		48.8	(2.0)
Number of new patients per week; mean (SD)		3.4	(2.6)
Number of treatments per week; mean (SD)		105	(74)
Education, research and teaching			
Chiropractic college of graduation; n (%)	CMCC	1,111	(59.2%)
	UQTR	125	(6.7%)
	PCC-D	151	(8.0%)
	PCC-W	68	(3.6%)
	LoganU	41	(2.2%)
	WSU	83	(4.4%)
	NUHS	52	(2.8%)
	NSHSU	51	(2.7%)
	LCC-W	24	(1.3%)
	LU	23	(1.2%)
	Others	146	(7.8%)
	Missing	2	(0.1%)
Postgraduate education; n (%)		232	(12.4%)
Number of hours of continued education per year; mean (SD)		26.8	(39.2)
Involved in research; n (%)	Yes, currently	126	(6.7%)
	Not now, but in the last 3 years	193	(10.3%)
	No	1,542	(82.2%)
	Missing	15	(0.8%)
Involved in teaching; n (%)		116	(6.2%)
Practice management seminar in the last 3 years; n (%)		561	(29.9%)
Client of chiropractic practice management service; n (%)		143	(7.6%)

Main sectors of activity			
Consulting/ specialized assessment; n (%)		246	(13.1%)
Geriatrics; n (%)		224	(11.9%)
Maintenance/ wellness; n (%)		1,111	(59.2%)
Nutrition; n (%)		154	(8.2%)
Occupational/ Industrial; n (%)		60	(3.2%)
Pediatrics; n (%)		243	(12.9%)
Pregnancy; n (%)		137	(7.3%)
Rehabilitation; n (%)		306	(16.3%)
Sports Injuries; n (%)		539	(28.7%)
Care provided to patients			
DC takes his/her own radiographs; n (%)		435	(23.2%)
Percentage of patients radiographed; mean (SD)		34.8	(31.9)
Acupuncture; n (%)		386	(20.6%)
Cryotherapy; n (%)		908	(48.4%)
Diathermy; n (%)		56	(3.0%)
Electrotherapy; n (%)		792	(42.2%)
Exercises; n (%)		1,595	(85.0%)
Heat Packs; n (%)		552	(29.4%)
Laser; n (%)		469	(25.0%)
Low volt therapy; n (%)		192	(10.2)
Patient education; n (%)		1,530	(81.5%)
Soft-tissue therapy; n (%)		1,537	(81.9%)
Traction, flexion/distraction; n (%)		746	(49.7%)
Ultrasounds; n (%)		683	(36.4%)
Adjustment practice; n (%)	Full spine only	114	(6.1%)
	Full spine and extremities	1,728	(92.8%)
	Cervical spine only	12	(0.6%)
	Other	20	(1.1%)
	Missing	3	(0.2%)
Chiropractic technique used			
Diversified; n (%)		1,746	(93.0%)
Sacral Occipital technique; n (%)		222	(11.8%)
Hole In One; n (%)		54	(2.9%)
Gonstead; n (%)		199	(10.6%)
Thompson; n (%)		519	(27.7%)
Activator; n (%)		988	(52.6%)
Cranio-sacral technique; n (%)		154	(8.2%)
Type of condition treated			
Percentage of patients with neuromusculoskeletal conditions; mean (SD)		91.0	(14.0)
Percentage of patients with somatovisceral conditions; mean (SD)		7.0	(11.1)
Percentage of patients with vascular related conditions; mean (SD)		1.2	(5.4)
Referral practice			
Percentage of patients referred to other health care providers; mean (SD)		14.9	(15.7)
Percentage of patients referred by their employer; mean (SD)		1.7	(5.4)
Percentage of patients referred by a physician; mean (SD)		8.1	(13.0)

Missing value were always less than 4%

CMCC = Canadian Memorial Chiropractic College
 UQTR = Université du Québec à Trois-Rivières
 PCC-D = Palmer College of Chiropractic, Davenport
 PCC-W = Palmer College of Chiropractic, West LoganU = Logan University
 WSU = Western States University
 NUHS = National University of Health Sciences
 NWSHU = Northwestern Health Sciences University
 LCC-W = Life Chiropractic College, West LU = Life University

Table 2.
Comparison on the analyzed sample population with all Canadian Chiropractic Association (CCA) members

Variables	Analyzed Sample (n = 1,877)	CCA Members (n = 6,713)	p-value
Sex; n (%)			0.021
Male	1,313 (70.0%)	4,273 (67.1%)	
Female	564 (30.0%)	2,093 (32.9%)	
Missing (n)	0	347	
Years of practice; mean (SD)	16.5 (10.9)	14.7 (11.1)	<0.001
Missing (n)	5	856	
Practice province; n (%)			<0.001
British Columbia	303 (16.1%)	914 (14.5%)	
Alberta	270 (14.4%)	904 (14.3%)	
Saskatchewan	79 (4.2%)	177 (2.8%)	
Manitoba	85 (4.5%)	222 (3.5%)	
Ontario	793 (42.2%)	3,026 (47.9%)	
Quebec	260 (13.9%)	829 (13.1%)	
Atlantic provinces	87 (4.6%)	247 (3.9%)	
Missing (n)	0	394	
Chiropractic College of graduation; n (%)			0.495
CMCC	1,111 (59.3%)	3,718 (58.4%)	
UQTR	125 (6.7%)	395 (6.2%)	
PCC-D	151 (8.1%)	515 (8.1%)	
PCC-W	68 (3.6%)	192 (3.0%)	
LoganU	41 (2.2%)	140 (2.2%)	
WSU	83 (4.4%)	307 (4.8%)	
NUHS	52 (2.8%)	214 (3.4%)	
NSHSU	51 (2.7%)	155 (2.4%)	
LCC-W	24 (1.3%)	62 (1.0%)	
LU	23 (1.2%)	85 (1.3%)	
Others	146 (7.8%)	583 (9.2%)	
Missing (n)	2	347	

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 NWHSU = Northwestern Health Sciences University
 LCC-W = Life Chiropractic College, West
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attributable a given category of the independent variable under examination compared to the reference category. All analyses were performed using SPSS for Mac (version 21.0, IBM corporation, Armonk, NY, USA).

Results

On average, DCs received 10.3 (standard deviation (SD) = 17.6) workers' compensation cases per year. This finding represents 6.2% of all new patients treated by DCs on average in a year. The distribution of the workers' compensation cases was heavily skewed to the right (Figure 2), with 29.9% of DCs receiving no such cases and 5% receiving more than 40 per year. The results of the bivariate analyses examining the associations between DC characteristics and the number of workers' compensation

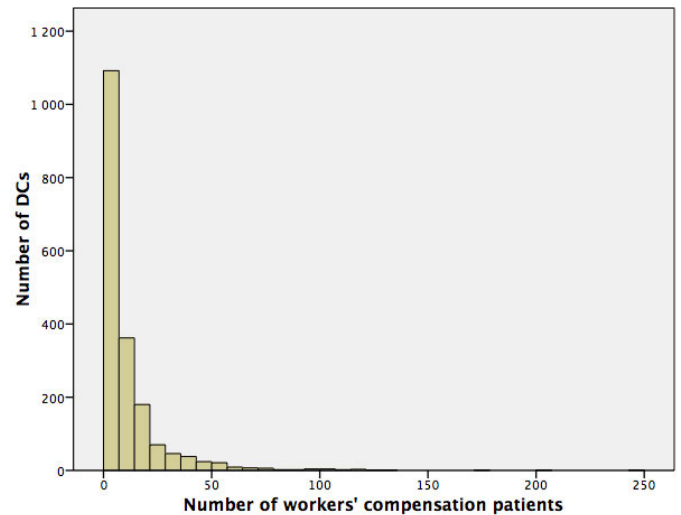


Figure 2.
Distribution of the annual number of workers' compensation patients

cases are presented in Table 3. In this table, the numbers in the second column represent the average number of workers' compensation patient seen each year and SD for categorical variables and the Pearson's correlation coefficients for continuous variables.

Representativeness of the current study

The characteristics of the analyzed sample are presented in Table 1. When compared with the complete 2011 membership of the Canadian Chiropractic Association, the analyzed sample had similar distributions in terms of college of graduation, but the analyzed sample included slightly more males (2.9%), included slightly more experienced DCs (1.8 years) and had a significantly different provincial distribution (Table 2).

Table 3.

DC characteristics associated with the number of workers' compensation patients seen per year in bivariate analyses

Variables	Association with the annual number of workers' compensation patients; mean (SD)	p-value
General information		
Sex	Male 11.5 (19.4) Female 7.5 (12.3)	<0.001
Age (years) ^p	r = -0.018	0.442
Years of practice ^p	r = -0.021	0.370
Type of practice	Sole practitioner 9 (18) Group of DCs 11 (19) Multidisciplinary without MD 11 (15) Multidisciplinary with MD 14 (29)	0.030*
Practice province	British Columbia 8 (12) Alberta 9 (17) Saskatchewan 28 (28) Manitoba 19 (19) Ontario 9 (17) Quebec 5 (10) Atlantic provinces 22 (30)	<0.001 ^a
Practice area population	Under 10,000 11 (18) Between 10,000 and 49,999 12 (18) Between 50,000 and 99,999 10 (14) Between 100,000 and 499,999 12 (21) Over 500,000 8 (15)	0.003 ^b
Number of DCs in relation to the demand	Too few 12 (23) Too many 9 (17) The right number 12 (19) I do not know 8 (12)	0.001 ^c
Professional activities		
Number of hours of practice per week ^p	r = 0.158	<0.001
Number of weeks of practice per year ^p	r = 0.030	0.192
Number of new patients per week ^p	r = 0.485	<0.001
Number of treatments per week ^p	r = 0.212	<0.001
Education, research and teaching		
College of graduation	CMCC 11 (18) UQTR 5 (12) PCC-D 9 (18) PCC-W 7 (8) LoganU 16 (22) WSU 13 (20) NUHS 12 (20) NSHSU 14 (18) LCC-W 13 (20) LU 7 (9) Others 9 (13)	0.004 ^d
Post graduate studies	Yes 9 (14) No 11 (18)	0.224
Number of hours of continued education ^p	r = -0.019	0.416
Involved in research	Yes, currently 13 (30) Not now, but in the last 3 years 10 (16) No 10 (17)	0.112
Involved in teaching	Yes 12 (27) No 10 (17)	0.330
Management training in the last 3 years	Yes 9 (18) No 11 (18)	0.191
Client of chiropractic practice management service	Yes 8 (16) No 10 (18)	0.164
Main sectors of activity		
Consulting/ specialized assessment	Yes 10 (18) No 10 (18)	0.900
Geriatrics	Yes 10 (15) No 10 (18)	0.921
Maintenance/ wellness	Yes 9 (16) No 12 (19)	0.011
Nutrition	Yes 10 (18) No 10 (17)	0.932
Occupational/ Industrial	Yes 18 (21) No 10 (17)	0.009
Pediatrics	Yes 8 (15) No 11 (18)	0.037
Pregnancy	Yes 9 (16) No 10 (18)	0.345
Rehabilitation	Yes 13 (19) No 10 (17)	0.002
Sports Injuries	Yes 12 (20) No 10 (17)	0.005

Care provided to patients			
Do you take your own radiographs	Yes 8 (14) No 11 (19)	<0.001	
Percentage of patients radiographed ^p	r = -0.073	0.002	
Acupuncture	Yes 14 (25) No 9 (15)	0.001	
Cryotherapy	Yes 12 (17) No 9 (18)	0.001	
Diathermy	Yes 16 (17) No 10 (18)	0.016	
Electrotherapy	Yes 13 (19) No 9 (16)	<0.001	
Exercises	Yes 11 (18) No 8 (14)	0.003	
Heat Packs	Yes 13 (21) No 9 (16)	<0.001	
Laser	Yes 12 (17) No 10 (18)	0.062	
Low volt therapy	Yes 14 (22) No 10 (17)	0.013	
Patient education	Yes 11 (18) No 9 (16)	0.042	
Soft-tissue therapy	Yes 11 (18) No 8 (16)	0.037	
Traction, flexion/distraction	Yes 12 (19) No 9 (17)	0.001	
Ultrasounds	Yes 13 (18) No 9 (17)	<0.001	
Adjustment practice	Full spine only 11 (16) Full spine and extremities 10 (18) Cervical spine only 4 (8) Other 7 (9)	0.522	
Chiropractic technique used			
Diversified	Yes 11 (18) No 7 (20)	0.034	
Sacral Occipital technique	Yes 8 (14) No 11 (18)	0.093	
Hole In One	Yes 6 (9) No 10 (18)	0.002	
Gonstead	Yes 12 (20) No 10 (17)	0.166	
Thompson	Yes 11 (18) No 10 (18)	0.207	
Activator	Yes 10 (17) No 10 (19)	0.826	
Cranio-sacral technique	Yes 9 (15) No 10 (18)	0.197	
Types of conditions treated			
Percentage of patients with neuromusculoskeletal condition ^p	r = 0.068	0.003	
Percentage of patients with somatovisceral conditions ^p	r = -0.058	0.012	
Percentage of patients with vascular related conditions ^p	r = -0.014	0.560	
Referral practice			
Percentage of patients referred to other health care providers ^p	r = 0.025	0.283	
Percentage of patients referred by their employer ^p	r = 0.080	0.001	
Percentage of patients referred by a physician ^p	r = 0.218	<0.001	

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^p Pearson correlation coefficient
^a Saskatchewan, Manitoba and the Atlantic provinces are significantly higher than the other provinces. British Columbia, Alberta and Ontario are significantly lower than Saskatchewan, Manitoba and the Atlantic provinces, but significantly higher than Quebec.
^b "Over 500,000" is significantly lower than "Between 10,000 - 49,999" and "Between 100,000 - 499,999"
^c "The right number of DCs" is significantly higher than "Too many DCs" and "I do not know"
^d CMCC is significantly higher than UQTR and PCC-W
 * No significant differences after the post hoc testing.

Association with the number of workers' compensation cases

Bivariate results

General information

Male DCs and DCs who perceived that there was an appropriate number of DCs in their area received significantly more workers' compensation cases. DCs from Saskatchewan, Manitoba and the Atlantic provinces received significantly more workers' compensation cases than DCs from the other provinces. DCs from British Columbia, Alberta and Ontario received significantly fewer workers' compensation cases than DCs from Saskatchewan, Manitoba and the Atlantic provinces, but significantly more cases than DCs from Quebec. DCs practicing in areas of more than 500,000 inhabitants received significantly less workers' compensation cases than those practicing in areas with populations between 10,000 and 49,999 inhabitants or between 100,000 and 499,999 inhabitants. Age and years of practice were not significantly associated with the number of workers' compensation cases. Post hoc specific comparisons did not reveal significant differences between the types of practice.

Professional activities

The number of hours of practice per week, the number of new patients per week and the number of treatments performed per week were all significantly, positively correlated with the number of workers' compensation cases. The number of weeks of practice per year was not significantly correlated with the number of workers' compensation cases.

Education, research and teaching

DCs who had graduated from the Canadian Memorial Chiropractic College (CMCC) received significantly more workers' compensation cases than those who had graduated from the Université du Québec à Trois-Rivières (UQTR) and Palmer West (PCC-W). The amount of postgraduate education, continuing education, teaching, management training, practice management services, and research activities were not significantly associated with the number of workers' compensation cases.

Main sectors of activity

DCs reporting occupational/industrial practice, rehabilitation practice, or sports injury management as a main sector of activity received significantly more workers' compensation cases. DCs reporting maintenance/wellness activities or pediatric care as a main sector of activity received significantly fewer workers' compensation cases. Reporting that consulting/specialized assessment activities, geriatric care, nutritional activities, or pregnancy care was a main sector of activity was not significantly associated with the number of workers' compensation cases.

Care provided to patients

DCs that performed their own radiographs received significantly fewer workers' compensation cases than those who referred their patients to radiology clinics. The percentage of patients who were radiographed was significantly negatively correlated with the number of workers' compensation cases. Providing acupuncture, cryotherapy, diathermy, electrotherapy, exercises, heat packs, low volt, soft-tissue therapy, traction, flexion/distraction, ultrasound or patient education was associated with a significantly greater number of workers' compensation cases. The adjustment practice and providing laser therapy were not significantly associated with the number of workers' compensation cases.

Chiropractic techniques used

DCs reporting the use of the Diversified technique received significantly more workers' compensation cases. DCs reporting the use of the Hole-In-One technique received significantly fewer workers' compensation cases. The uses of the Thompson, Sacro-occipital, Gonstead, Activator or Cranio-Sacral techniques were not associated with the number of workers' compensation cases.

Types of conditions treated

The reported percentage of patients with neuromusculoskeletal conditions was significantly positively correlated with the number of workers' compensation cases. The reported percentage of patients with somatovisceral conditions was significantly negatively correlated with the number of workers' compensation cases. The reported percentage of patients with vascular conditions was not significantly associated with the number of workers' compensation cases.

Table 4.
Variables associated with the annual number of workers' compensation patients in the multivariate negative binomial regression model (n=1,733)

	IRR	Wald's 95% confidence interval of the IRR	p-value
(Constant)	0.60	(0.30 to 1.19)	0.143
<i>General information</i>			
Type of clinic			
Sole practitioner	Reference	–	–
Group of DCs	1.23	(1.04 to 1.54)	0.018
Multidisciplinary without MD	1.19	(1.01 to 1.40)	0.039
Multidisciplinary with MD	1.35	(0.96 to 1.89)	0.082
Population of practice area			
Under 10,000	1.19	(0.94 to 1.51)	0.157
Between 10,000 and 49,999	1.37	(1.10 to 1.69)	0.004
Between 50,000 and 99,999	1.19	(0.96 to 1.48)	0.122
Between 100,000 and 499,999	1.36	(1.11 to 1.67)	0.003
Over 500,000	Reference	–	–
Practice province			
Quebec	Reference	–	–
British-Columbia	1.63	(1.23 to 2.15)	0.001
Alberta	1.52	(1.13 to 2.05)	0.005
Saskatchewan	4.34	(2.89 to 6.52)	<0.001
Manitoba	2.67	(1.81 to 3.90)	<0.001
Ontario	1.23	(0.96 to 1.58)	0.106
Atlantic provinces	3.04	(2.07 to 4.46)	<0.001
<i>Professional activity</i>			
Number of hours of practice per week	1.02	(1.01 to 1.03)	<0.001
Number of treatments per week	1.01	(1.00 to 1.01)	<0.001
<i>Education, research and teaching</i>			
Post graduate studies	0.78	(0.63 to 0.96)	0.017
Management training in the last 3 years	0.76	(0.65 to 0.89)	<0.001
<i>Main sectors of activity</i>			
Occupational/ Industrial	1.59	(1.09 to 2.32)	0.017
<i>Care provided to patients</i>			
DC performs his own radiographs	0.85	(0.70 to 1.03)	0.098
Electrotherapy	1.30	(1.12 to 1.52)	0.001
Soft-tissue therapy	1.21	(1.01 to 1.47)	0.044
<i>Chiropractic techniques used</i>			
Sacro Occipital technique	0.78	(0.62 to 0.98)	0.030
Thompson	1.21	(1.04 to 1.42)	0.017
Cranio-sacral technique	0.79	(0.60 to 1.02)	0.073
<i>Types of conditions treated</i>			
Percentage of patients with neuromusculoskeletal conditions	1.01	(1.00 to 1.01)	0.009
<i>Referral practice</i>			
Percentage of patients referred by their employer	1.02	(1.01 to 1.04)	0.003
Percentage of patients referred by a physician	1.02	(1.01 to 1.03)	<0.001

IRR = incidence rate ratio
Pearson's chi-square = 2,264
Pearson's chi-square/degree of freedom = 1.329

Referral practice

The reported percentages of patients referred by their employer or by a physician were significantly positively correlated with the number of workers' compensation cases. The reported percentage of patients referred to other health care providers was not significantly correlated with the number of workers' compensation cases.

Multivariate results

Our final multivariate model (Table 4) included the following: type of clinic; population of practice area; province of practice; number of hours of practice per week; number of treatments per week; post graduate studies; management training; main sector of activity (occupational/ industrial); providing radiographic examination at the clinic; care provided to patients (electrotherapy, soft-tissue therapy); chiropractic technique used (Sacro Occipital technique, Thompson, Cranio-sacral technique); percentage of patients with neuromusculoskeletal conditions; and the percentage of patients referred by their employer or a physician. All the independent variables of the final model influenced the dependent variable in the same direction as in the bivariate analyses; however, slight changes in their statistical significance were observed. Quebec DCs received significantly fewer workers' compensation cases than DCs of the other provinces, but the difference from Ontarians was not significant when controlling for all other variables. Sole practitioners received significantly less workers' compensation cases than DCs practicing with a group of DCs or in a multidisciplinary clinic (without an MD) when controlling for all other variables. Postgraduate studies, management training, and some chiropractic techniques (Sacro Occipital, Thompson and Cranio-sacral techniques) were not significant in the bivariate analyses but became significant in the multivariate model. Providing radiographic examination at the clinic was significantly associated with the number of workers' compensation cases in the bivariate analyses, but not in the multivariate model.

Discussion

Several of our intuitive a priori hypotheses were not confirmed: age, years of practice, number of DCs in relation to demand, post graduate studies, continued education, adjustment practice, involvement in research and teaching activities were not associated with the reported number of workers' compensation cases treated per year.

CMCC graduates reported more workers' compensation cases than graduates from UQTR in the bivariate analysis, but the college of graduation was not statistically significant in the multivariate analysis. The difference observed in the bivariate analysis was most likely attributable to provincial differences because nearly all UQTR graduates are practicing in Quebec.

The results of our analysis indicate that three broad categories of factors may influence the number of workers' compensation cases that a DC reports, including the DC's interactions with other health care providers, a practice oriented toward the treatment of injured workers, and potential access to care.

Interactions with other health care providers

In both our bivariate and multivariate analyses, receiving more physician referrals was associated with a greater number of reported workers' compensation cases. This is consistent with the results of a previous American study that concluded that physicians were involved in the treatment of the majority of workers receiving care for occupational low back pain.³³ Sending the patient to another clinic for radiologic investigation was associated with a greater number of reported workers' compensation cases. This association may also indicate better physician-DC collaboration. Working in a multidisciplinary clinic without a physician was also associated with a greater number of reported workers' compensation cases when controlling for the amount of physician referrals. This result suggests that collaboration with other health care providers is also important during the care of injured workers. This result is supported by the literature, which views inter-professional collaboration as a cornerstone of successful return-to-work.³⁴⁻³⁷ Surprisingly, referring more patients to other health care providers was not associated with the number of reported workers' compensation cases. This result may be because in the context of occupational injuries, DCs may receive referral patients that are primarily within their scope of practice. DCs reporting maintenance and wellness care as a main sector of activity reported significantly fewer workers' compensation cases in all our analyses. This is potentially because they may be perceived as providers of excessive care by other health care providers^{38,39} or by patients who want to rapidly return to work. DCs attending management training reported significantly fewer workers' compensation cases only when control-

ling for other variables in the final model. Their marketing strategy may be perceived to be aggressive, which can have a negative impact on physician referrals.³⁹ DCs interested in developing an occupational practice should develop good inter-professional relationships with physicians and other health care providers.

Practices oriented on the treatment of injured workers

It is not surprising that DCs with occupational/industrial and rehabilitation as main sectors of activity report more workers' compensation cases. Although sports injuries can be similar to occupational injuries, a pediatric-oriented practice is obviously different from an occupational practice. An explanation for the significantly lower number of reported workers' compensation cases associated with the completion of post graduate studies may be that these DCs specialize in a different field than occupational injury DCs. It is also not surprising that DCs that treat a higher percentage of patients with neuromusculoskeletal conditions report more injured workers because occupational injuries generally lie within their scope of practice. Occupational diseases are not within the scope of chiropractic practice and require medical care.

DCs that treat more injured workers also appear to provide care that respects radiographic guidelines, with less radiographic use associated with an increased number of reported workers' compensation cases.^{27,28,40-42} Common components of clinical return-to-work interventions for musculoskeletal disorders⁴, such as physical exercise and patient education, were also associated with higher numbers of reported workers' compensation cases. In fact, every additional treatment modality (with the exception of laser therapy) had a significant positive impact on the number of reported workers' compensation cases in the bivariate analyses. Electrotherapy and soft-tissue therapy met the inclusion criteria for the multivariate model. DCs that offer multimodal care may be perceived as having added value over those that provide only spinal manipulations. Although these results are interesting, clinician DCs should consider the best interests of their patients and remember that spinal traction, laser therapy, electrotherapy and ultrasound are not recommended by the National Institute for Health and Care Excellence (NICE) guidelines for the early management of persistent, non-specific low back pain.⁴³

In our bivariate analyses, the Diversified technique had a significant positive impact on the number of reported workers' compensation cases while the Hole In One technique had a significant negative impact. In our multivariate analysis, the Thompson technique had a significant positive impact on the number of workers' compensation cases reported while Sacral Occipital Technique had a significant negative impact when controlling for all other variables. The Hole in One technique is a spinal manipulative technique specializing in the upper cervical area. Because cervical injury is only one type of occupational injury, this may explain why DCs using this technique report fewer workers' compensation cases. Additionally, DCs using the Thompson and Sacral Occipital techniques may provide different care to workers' compensation patients or patients may differently seek care from DCs that use these techniques. Further investigations will be necessary to understand the impact of chiropractic techniques on care seeking behaviors.

DCs that report more workers' compensation cases also report more employer referrals. This observation is interesting because an American study revealed that employers selected the majority of providers for workers who receive care.³³ Employers were more likely to choose physicians, while workers were more likely than employers to select DCs³³.

Our results suggest that DCs that consider occupational/industrial care as a primary sector of activity, stimulate employer referrals and offer care adapted to the needs of injured workers (multimodal care, avoiding excessive radiographic imaging); therefore, these DCs tend to report more workers' compensation cases.

Potential access to care

In both our bivariate and multivariate analyses, the practice area population, practice province and number of practicing hours per week were significantly associated with the reported number of workers' compensation cases. The number of practicing hours per week as well as practicing in a group of DCs (compared with solo practice) increases the number of hours when injured workers are able to seek care. Our results indicate that DCs in larger cities (more than 500,000 inhabitants) report less workers' compensation cases. Usually, Canadians in rural areas experience more difficulty when seeking immediate care.⁴⁴ A possible explanation for these results may be that

injured workers in smaller towns have access to a limited number of providers and seek more care from their local DCs, while the opposite situation is present in metropolitan centers. When DCs perceive that there is an appropriate number of DCs in their area, they report significantly more workers' compensation cases than when they perceive that there are too many DCs, which also supports the previous hypothesis. As expected, Quebecers report significantly fewer workers' compensation cases than DCs from the other provinces in all our analyses. Physicians, the sole gatekeepers to the Quebec worker's compensation system³⁰, are acting as a barrier to chiropractic care. In general, the residents of eastern Canadian provinces are more likely to report difficulty accessing routine and immediate care than residents of western provinces⁴⁴. This may explain why DCs in the Atlantic provinces receive the highest number of workers' compensation cases. Our results suggest that DCs offering more office hours and practicing in areas with limited access to other health care resources report more workers' compensation cases.

Strengths and Limitations

The main strength of this study is the large sample size, which provides sufficient statistical power for modeling all the investigated DC characteristics. The use of an appropriate regression model (negative binomial) also enabled us to deal with the highly skewed distribution of the annual number of workers' compensation cases.

Our results obtained from the secondary analysis of the CCRD cross-sectional survey should be interpreted with caution. As with every cross-sectional study, the temporality of the exposure-outcome relationship cannot be firmly established. A prospective study would provide better evidence regarding the temporality of the observed associations between the different independent variables and the amount of workers' compensation board cases. The low response rate, 38.7%, has important implications. It is possible that non-responders may have systematically differed from responders and that our results may have limited the generalizability to DCs outside of the analyzed group. Additionally, the proportion of respondents differed between the provinces. The DCs in our analysis had an average 1.8 years more practice experience and were 2.9% more often males than the complete CCA membership. Although these differences are relatively small, they are significant and may have biased the magnitude of the

observed associations. It is also possible that DCs that chose to be CCA members have different profiles than non-members. However, in order to reverse the direction of the observed associations, the non-respondents would need to show an inverse relationship between the dependent and the independent variables. The CCRD survey was not designed for the purpose of this study and the metric properties of the questionnaire are unknown. Our composite dependent variable might not reflect the exact number of workers' compensation case seen by DCs. Furthermore, our model only included data available in the CCRD and it is possible that other variables, such as the incidence of occupational injuries in the area of practice, may be of interest.

Nonetheless, we believe our results provide valuable information regarding DC characteristics associated with the amount of workers' compensation cases. Additional qualitative research would be useful to better identify the relevant factors that influence the type of care sought by injured workers and to understand the mechanism underlying the choice of healthcare provider.

Conclusion

The reported number of workers' compensation cases substantially varies among Canadian DCs, with nearly one-third of DCs receiving no cases and a few DCs receiving many cases. Canadian DCs with practices oriented toward the treatment of injured workers that collaborate with other health care providers and facilitate workers' access to care reported more workers' compensation patients.

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Appendix 1
List of a priori hypotheses regarding the association between relevant CCRD variables and the number of workers' compensation patients seen per year

Variable	Hypothesis
General information	
Sex	Women see less workers' compensation patients since they were under represented in a previous study ²⁹ .
Age, years of practice	Older DCs receive fewer workers' compensation patients because they adhere less to new guidelines ²¹ .
Type of practice	DCs in multidisciplinary clinics receive more workers' compensation patients
Practice province	Quebecers receive fewer workers compensation patients because they require prior medical referral.
Practice area population	DCs in smaller towns receive more workers' compensation patients.
Number of DCs in relation to demand	DCs that practice in areas with a high concentration of DCs are expected to receive fewer workers' compensation patients
Professional activities	
Number of hours of practice/week	No association is expected
Number of weeks of practice / year	No association is expected
Number of treatments / week	DCs who receive a high volume of patients are expected to receive fewer workers compensation patients Or DCs treating more patients are more successful at attracting workers' compensation patients
Education, research and teaching	
College of graduation	DCs graduating from a "straight" college receive fewer workers' compensation patients.
Post graduate studies	DCs with post graduate qualifications receive more workers' compensation patients
Number of hours of continued education	DCs that are more up-to-date receive more workers' compensation patients
Management training in the last 3 years	DCs who receive a high volume of patients are expected to receive fewer workers' compensation patients Or DCs treating more patients are more successful at attracting workers' compensation patients
Research involvement	DCs implicated in research receive more workers' compensation patients
Involvement in teaching activities	DCs implicated in teaching activities receive more workers' compensation patients
Main sectors of activity	
Type of practice	DCs who provide more specialized care receive more workers' compensation patients
Care provided to patients	
Radiographs	DCs who prescribe radiographs out of their clinic receive more workers' compensation patients. DCs who perform a higher percentage of radiographs receive less workers' compensation patients.
Type of care provided	DCs who provide complimentary therapies and soft tissue mobilization receive more workers' compensation patients. DCs who prescribe more therapeutic exercise receive more workers' compensation patients.
Adjustment practice	DCs who only treat the cervical spine receive less workers' compensation patients.
Types of conditions treated	
Condition treated	DCs treating more viscerosomatic conditions receive less workers' compensation patients.
Referral Practice	
Percentage of patients referred	DCs receiving more referrals from physicians and employers receive more workers' compensation patients. DCs who refer more patients receive more workers' compensation patients.