Original Article

Quebec Serve and Protect Low Back Pain Study: What About Mental Quality of Life?

Nabiha Benyamina Douma, Charles Côté, Anaïs Lacasse*

Département des Sciences de La Santé, Université Du Québec en Abitibi-Témiscamingue, Rouyn-Noranda, Québec, Canada

A R T I C L E   I N F O

A B S T R A C T

Background: As of now, the impact of low back pain (LBP) and its chronic state, chronic low back pain (CLBP), on mental health-related quality of life (HRQOL) has never been investigated among police officers. The present investigation aims at studying this relationship using a biopsychosocial model.
Methods: Between May and October 2014, a Web-based cross-sectional study was conducted among Quebec police officers (Quebec, Canada). Mental HRQOL was measured using the role emotional (RE) and the mental health (MH) domains of the SF-12v2 Health Survey. The impact of CLBP on mental HRQOL (as opposed to acute/subacute LBP or no LBP) was studied with a multivariate linear regression model.
Results: Of the 3,589 police officers who participated in the study, 1,013 (28.4%) reported CLBP. The mean age of respondents was 38.5 ± 8.7 years, and 32.0% were females. The RE (44.1/100) and MH (49.0/100) mean scores of the CLBP group were comparable with the scores found in populations suffering from cancer or heart diseases. Compared to officers without LBP, the presence of CLBP was significantly associated with lower RE (β: −0.068; $p = 0.003$) and MH (β: −0.062; $p = 0.002$) scores. These relationships were not found in the acute/subacute LBP group.
Conclusion: Our results underscore how frequent CLBP is among police officers and how burdensome it is. Considering the importance of good physical and mental health for this occupational population, police organizations should be aware of this issue and contribute to the efforts toward CLBP prevention and management in the workplace.

1. Introduction

At first glance, police officers could be presumed to be healthy workers due to the physical nature of their work and the high standard prerequisites for physical and mental health at the time of joining the police force [1]. However, the stressful demands of police work (e.g., traumatic events) can induce stress-related impairments [2–5]. In fact, mental health-related quality of life (HRQOL) impairments related to mental work stressors among this population were reported in past studies [5,6].

Also, police officers are exposed to occupational factors that are suspected to increase the risk of developing low back pain (LBP) and chronic low back pain (CLBP) (e.g., body armor, duty belt, and driving a patrol car) [7–14]. Some epidemiological studies brought evidence forward suggesting that LBP, especially CLBP, is frequent and burdensome among this population of workers [7,14,15]. Knowing that LBP and CLBP can significantly reduce people's

HRQOL [16,17], we may wonder how LBP and its chronic state impact the mental HRQOL of police officers in interrelation with other occupational stressors. As of now, the impact of LBP/CLBP on mental HRQOL has never been investigated among this occupational population.

Using a biopsychosocial model, the first objective of this study was to determine the impact of LBP/CLBP on the mental HRQOL of police officers. The second objective was to identify other determinants of mental HRQOL among this population of workers.

2. Materials and methods

2.1. Study design and population

Data collection occurred between May and October of 2014. An online-based cross-sectional survey was distributed to French-speaking police officers of the province of Quebec (Canada). Nine

---

* Corresponding author. Département des sciences de la santé Université du Québec en Abitibi-Témiscamingue 445, Boulevard de l'Université Rouyn-Noranda, QC, J9X 5E4, Canada.
E-mail address: lacassea@uqat.ca (A. Lacasse).

police organizations (employers, occupational safety and health associations, federation of police associations, and police unions) facilitated the recruitment. On-duty police officers were emailed our invitation to complete the online survey. This email invitation contained the survey hyperlink from the SurveyMonkey Gold collector. Based on research methods known to increase participation rate, a reminder email was sent to all on-duty police officers from the targeted organizations 15 days after the initial invitation [18]. In addition, a draw (10 prepaid VISA gift cards of C$200 each) was also used to increase participation rate. The *Université du Québec en Abitibi-Témiscamingue*'s research ethics committee approved the study.

2.2. Questionnaires and measures

2.2.1. Mental HRQOL

Mental HRQOL can be defined as an individual's or a group's perceived physical and mental health over time [19]. For the purpose of this study, mental HRQOL was measured using the role emotional (RE) and the mental health (MH) domains of the SF-12v2 Health Survey [20]. RE reflects how often emotional problems result in role limitations related to the amount of work or regular daily activities accomplished and the care with which they are performed [20]. MH represents the frequency with which respondents are feeling: (a) calm and peaceful and (b) downhearted and depressed [20]. Measures for each domain range from 0 to 100, in which higher scores indicate better mental HRQOL. Group mean scores lower than 47 indicate the presence of impaired functioning or well-being [20]. Scores were calculated with standard and normalized algorithms [mean 50; standard deviation (SD) 10] [20].

2.2.2. LBP presence and its characteristics

The presence of LBP was established by using the French—Canadian version of the Nordic Musculoskeletal Questionnaire—Low Back section [21—23]. A human body drawing was used in the questionnaire to describe the anatomical area of LBP, and participants were asked if they experienced LBP in the previous 12 months (ache, pain, or discomfort in the lower back whether it extends from there to one or both legs or not). All participants who answered "no" to this question were assigned to the no-LBP group. Presence of CLBP among those who reported LBP in the previous 12 months was defined as self-reported LBP symptoms experienced for more than 3 months at the time of the questionnaire completion [24,25]. Those participants formed the CLBP group. The acute/subacute LBP group was composed of participants who reported LBP in the previous 12 months but not CLBP. An item from the Nordic Musculoskeletal Questionnaire asked participants if they had to change job or duty in their lifetime because of LBP. LBP intensity and unpleasantness in the past 7 days were assessed with a numerical rating scale (0 to 10), in which 0 indicated "no pain" and 10, "worst possible pain/most unpleasant pain imaginable". Participants were asked about the number of workdays lost in the past 12 months because of LBP and their perception that their LBP is associated with the work performed in the police force (not associated, partially associated, or totally associated).

2.2.3. Other determinants

Sociodemographic characteristics were also collected such as sex, age, country of origin, living arrangement, annual household income, and region of residency. Participants were also asked about their number of years of experience in the police force (seniority) and in doing car patrol work (do you do car patrol as a part of your work duties?). The Brief Index of Affective Job Satisfaction was used to assess job satisfaction [26]. Calculated scores can range between 4 and 20 in which higher scores indicate greater job satisfaction.

Other questions about occupational ergonomic-related factors derived from (1) a literature search conducted to identify and review LBP studies and HRQOL among police officers or other types of workers and (2) a consultation with 14 key informants (one police force ergonomic specialist, one ergonomic researcher, one chronic pain researcher, one back pain researcher, two health and safety advisors working in police force organizations, and eight police officers). The history of work-related difficult situations of the last 12 months (posttraumatic psychological interventions, making a decision that implied heavy consequences, facing clients' hostility, and exposition to public complaints and critics) was assessed with 5-point Likert scales (never, almost never, sometimes, fairly often, and very often). Participants were also questioned about other work-related factors (last 12 months' work schedule, mean number of hours worked per week, mean number of breaks in a 9-hour work shift, proportion of hours spent wearing a body armor and wearing a duty belt in the last 12 months, doing car patrol, and the mean number of hours spent in a sitting position in a workday).

The 4-item Perceived Stress Scale was used to measure perceived stress over the last 4 weeks [27]. Scores on the 4-item Perceived Stress Scale can range from 0 to 16, and higher scores suggest greater perceived stress. The 2-item Patient Health Questionnaire [28] and the 2-item Generalized Anxiety Disorder scale [28] were used to assess depressed mood and anxiety over the previous 2 weeks. For both scales, scores can range between 0 and 6, and higher scores indicate more depressive symptoms/greater anxiety. To assess the general quality of sleep, the 5th item of the Chronic Pain Sleep Inventory [29] was answered by all participants (11-point numerical rating scale, 0 to 10, higher scores indicate better general quality of sleep). Perceived general health was measured using a 5-point Likert rating scale which can be transformed into a 0—100 score using the SF-12v2 algorithm (Excellent, very good, good, fair, and poor) [20].

The questionnaire also contained questions about comorbidities; height; weight; history of injury in the lower back region; history of trauma/accident at work or outside work; history of surgery in the back region; chronic pain in regions of the body other than the back; weekly hours of light, moderate, and intense physical activity; and smoking habits/alcohol consumption during the last 4 months.

2.3. Statistical analysis

To depict participants' characteristics, descriptive statistics were computed. LBP subgroups (i.e., no-LBP, acute/subacute LBP, and CLBP) were compared regarding their RE and MH mean scores using analysis of variance tests. When significant differences were detected, *post hoc* comparisons were carried out using the Tukey's Honest Significant Difference (Tukey HSD) test. Univariate and multivariate linear regression models were used to identify the determinants of RE and MH. All independent variables measured were included in the multivariate linear regression models except those who showed multicollinearity (i.e., had a tolerance lower than 0.2 when included in the multivariate model [30]). In the LBP groups, the 7-day LBP intensity and the 7-day LBP unpleasantness variables were included in the model, the last two variables had a tolerance below 0.2. They were thus excluded from the model because the variable "LBP groups" was an important independent variable of our study. The sociodemographic variables that had a tolerance below 0.2 in the model were the annual household income, seniority, and age. Because age is a potential confounding variable in the association between LBP and mental HRQOL, we excluded seniority and the annual household income. The statistical significance level was set at 0.05, and SPSS Statistics version 22 (IBM Corp, Armonk, NY) was used to perform all statistical analyses.

Table 1
Study population's characteristics

Characteristics	n = 3,589*
Sociodemographic characteristics	
Gender, n (%)	
Male	2,082 (68.0)
Female	979 (32.0)
Age (y), mean ± SD	38.5 ± 8.7
Born in Canada, n (%)	
Yes	2,975 (97.5)
Living arrangement, n (%)	
Living with spouse/common-law partner	2,576 (84.1)
Living alone	479 (15.6)
Living with a roommate or parents	9 (0.3)
Annual household income (Canadian dollars), n (%)	
Less than 60,000$	160 (5.3)
60,000−79,999$	312 (10.3)
80,000−99,999$	652 (21.5)
100,000$ and more	1,909 (62.9)
Region of residency, n (%)	
Nonremote regions†	2,738 (89.4)
Remote resource regions†	323 (10.6)
LBP presence and its characteristics	
LBP groups, n (%)	
Non-LBP group	1,151 (32.3)
Acute/subacute group	1,398 (39.2)
CLBP group	1,013 (28.4)
7-d LBP intensity, mean ± SD	1.9 ± 2.5
7-d LBP unpleasantness, mean ± SD	2.0 ± 2.7
Number of days lost from work in the police force because of LBP in the past 12 mo, mean ± SD	4.0 ± 24.6
Perception that LBP is linked to the work done in the police force	
Not linked/no LBP in one's lifetime	552 (15.5)
Partially linked	1,727 (48.5)
Totally linked	1,283 (36.0)
Occupational characteristics	
Seniority, mean ± SD	14.8 ± 8.3
Car patrol officers, n (%)	
Yes	2,208 (67.4)
Health and lifestyle characteristics	
General health from the HRQOL questionnaire, mean ± SD	52.7 ± 7.6
Chronic pain in other regions of the body than in the back, n (%)	
Yes	1,217 (39.8)
BMI, n (%)	
Normal/underweight (BMI < 25 kg/m²)	1,155 (38.0)
Overweight (25 ≤ BMI < 30 kg/m²)	1,393 (45.9)
Obese (BMI ≥ 30 kg/m²)	488 (16.1)
Mean hours per week of light physical activity, mean ± SD	6.6 ± 5.6
Mean hours per week of moderate/intense physical activity, mean ± SD	4.4 ± 3.7
Smoking during the last 4 mo, n (%)	
Yes	231 (7.6)
Number of alcohol consumption per week during the past 4 mo, mean ± SD	4.9 ± 5.1

BMI, body mass index; CLBP, chronic low back pain; LBP, low back pain; SD, standard deviation.

* Proportion of missing data across the presented variable ranges from 0.8 to 15.5%.

† Remote resource regions as defined by Revenu Québec (i.e., the provincial revenue agency): Bas-Saint-Laurent (region 01), Saguenay−Lac-Saint-Jean (region 02), Abitibi-Témiscamingue (region 08), Côte-Nord (region 09), Nord-du-Québec (region 10), Gaspésie−Îles-de-la-Madeleine (region 11). Nonremote regions are near a major urban center.

3. Results

In May 2014, the Quebec police forces counted 16,201 members [31]. The online survey page was reached by 3639 Quebec police officers. Among them, 3,589 accepted to complete the questionnaire (98.6%) and thus composed the convenience sample for the

Table 2
Role emotional and mental health domains' scores from the SF-12v2 Health Survey measured among Quebec police officers without LBP vs. with acute subacute LBP versus with CLBP

SF-12's domains	HRQOL scores of the RE and MH domains, mean ± SD				
	Total n = 3,284*	Non-LBP group n = 1,099	Acute/subacute LBP group n = 1,248	CLBP group n = 937	p
Role emotional	47.2 ± 9.9	48.6 ± 9.5	48.2 ± 9.2	44.1 ± 10.5	<0.001†
Mental health	50.8 ± 8.0	51.8 ± 7.9	51.4 ± 7.5	49.0 ± 8.5	<0.001‡

CLBP, chronic low back pain; HRQOL, health-related quality of life; LBP, low back pain; SD, standard deviation.

* Proportion of missing data across the presented variable ranges from 7.7 to 8.5%.

† Statistically significant differences between the CLBP group and the other two groups (i.e., the non-LBP group and the acute/subacute LBP group). No Statistically significant differences between non-LBP group and acute/subacute LBP group.

‡ Statistically significant differences between the CLBP group and the other two groups (i.e., the non-LBP group and the acute/subacute LBP group). No statistically significant differences between the non-LBP group and the acute/subacute LBP group.

study. Table 1 shows participants' characteristics. Women represented 32.0% of the sample, and the mean age of study participants was 38.5 ± 8.7 years. The sample was composed of police officers from all administrative regions of the province of Quebec. The average number of years of work in the police force was 14.8 ± 8.3. The sample's mean score of general health was 52.7 ± 7.6 (/100). Chronic pain in other regions of the body than the back was reported by 39.8% of participants. The three groups (no-LBP, acute/subacute LBP, and CLBP) represented, respectively, 32.3%, 39.2%, and 28.4% of the study sample.

3.1. Mental HRQOL scores among LBP subgroups

As shown in Table 2, group comparison regarding RE domain shows statistically significant differences between the study groups (i.e., no-LBP, acute/subacute LBP, and CLBP; $p < 0.001$), with the lowest RE score found in the CLBP group (mean ± SD: 44.1 ±10.5). Tukey HSD tests revealed statistically significant differences between the CLBP group and the other two groups [i.e., no-LBP group ($p < 0.001$) and acute/subacute LBP group ($p < 0.001$)], but no statistically significant difference was detected between the no-LBP group (mean ± SD: 48.6 ± 9.5) and the acute/subacute LBP group (mean ± SD: 48.2 ± 9.2; $p = 0.576$). The CLBP group presented an RE score indicating the presence of impaired functioning/well-being (<47) [20].

Comparison regarding MH domain indicated statistically significant differences between the study groups (i.e., no-LBP, acute/subacute LBP, and CLBP; $p < 0.001$), with the lowest MH score found in the CLBP group (mean ± SD: 49.0 ± 8.5). Again, Tukey HSD tests revealed statistically significant differences between the CLBP group and the two other groups [i.e., no-LBP group ($p < 0.001$) and acute/subacute LBP group ($p < 0.001$)], but no statistically significant difference was detected between the no-LBP group (mean ± SD: 51.8 ± 7.9) and the acute/subacute LBP group (mean ± SD: 51.4 ± 7.5; $p = 0.330$) (Table 2).

Figs. 1 and 2 show the average RE and MH scores found in the CLBP group of our study contrasted with the general population norms [20] and other impaired populations such as people suffering from cancer or heart diseases [32].

3.2. CLBP associated with poorer mental HRQOL

For the sake of brevity, Table 3 only presents the factors significantly associated with RE and MH in the multivariate model

($p < 0.05$). The results of all univariate and complete multivariate linear regression analyses are provided in Appendix A. In the multivariate linear regression analyses that adjust for all potential confounders, the presence of CLBP (vs. the absence of LBP) was significantly associated with lower RE (β: −0.068; $p = 0.003$) and MH (β: −0.062; $p = 0.002$) scores. When compared to the absence of LBP, the presence of acute/subacute LBP was not a significant predictor of mental HRQOL scores in the multivariable analyses.

3.3. Other factors associated with mental HRQOL

The multivariate analyses revealed that changing job or duties because of LBP in one's lifetime (β: −0.067; $p < 0.001$), more frequent posttraumatic psychological interventions after difficult situations (sometimes vs. never/almost never β: −0.038; $p = 0.026$ and fairly often/very often vs. never/almost never β: −0.034; $p = 0.046$), higher perceived stress (β: −0.196; $p < 0.001$), more depressed mood (β: −0.197; $p < 0.001$), greater anxiety (β: −0.058; $p = 0.008$), and living alone (vs. living with a spouse/common-law partner) (β: −0.051; $p = 0.003$) were significantly associated with lower RE scores. Factors associated with higher RE scores were higher job satisfaction (β: 0.103; $p < 0.001$), better general health (β: 0.105; $p < 0.001$). and better quality of sleep (β: 0.081; $p < 0.001$).

Higher perceived stress (β: −0.325; $p < 0.001$), more depressed mood (β: −0.167; $p < 0.001$), greater anxiety (β: −0.164; $p < 0.001$), and being a female (β: −0.075; $p < 0.001$) were significantly associated with lower MH scores. Factors associated with higher MH scores were higher job satisfaction (β: 0.071; $p < 0.001$), better general health (β: 0.091; $p < 0.001$), better quality of sleep (β: 0.090; $p < 0.001$), and being older (β: 0.045; $p = 0.019$).

4. Discussion

To the best of our knowledge, this is the first study to assess the impact of LBP/CLBP on mental HRQOL among police officers. Indeed, other studies have investigated the determinants of mental quality of life among police officers in univariate and/or multivariate analyses but did not include LBP/CLBP within their statistical models [5,6].

When adjusting for potential confounders, poorer mental HRQOL was found among police officers suffering from CLBP (i.e., limitations related to the amount of work or regular daily activities accomplished and the care with which they are performed; lower frequency of calm and peaceful feelings; and higher frequency of downhearted and depressed feelings). Compared to workers with no LBP, acute/subacute symptoms were not associated with lower mental HRQOL scores. Noteworthy here is that police officers suffering from CLBP reported RE domain impairment. These results are in line with previous studies that showed that chronic pain can impair HRQOL [17,33,34].

Reflecting further on the significant impact of CLBP, when comparing the mental HRQOL scores of the CLBP group with those of other populations of patients such as those suffering from cancer and heart disease [20], our results revealed that the RE and MH domains' scores of our CLBP group are comparable with those of other populations of patients. These results are in line with a previous study conducted by Nayme et al (2001) which found that the HRQOL of CLBP patients who are cared for in a pain center was poorer than that of patients with cancer and comparable with that of drug addicts [16]. In the same vein, the quality of life of individuals from the general population who are suffering from chronic pain was found to be below that of people with other chronic diseases [33]. Our study demonstrated how much CLBP is burdensome for police officers and underlined the importance for police organizations to promote CLBP prevention to improve mental HRQOL in this population of workers.

4.1. Other biopsychosocial determinants of mental HRQOL

Regarding occupational factors, lower job satisfaction was found to be associated with poorer RE and MH domains. This result is in line with what was found by Marconato and Monteiro (2015). Specifically, they found that lower job satisfaction was associated with poorer quality of life [35]. On the other hand, Yamada et al (2016) brought evidence that low mental HRQOL was more frequent among workers reporting job dissatisfaction [36].

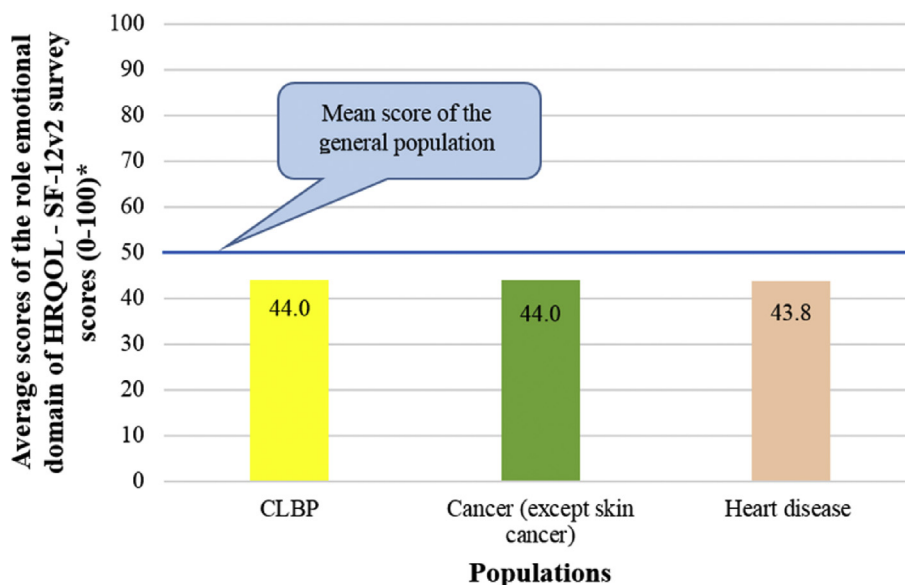
Fig. 1. Comparison of the SF-12v2 RE domain score found in our study population with that of other populations [20,32]. *Higher scores indicate better RE. CLBP, chronic low back pain; HRQOL, health-related quality of life; RE, role emotional.
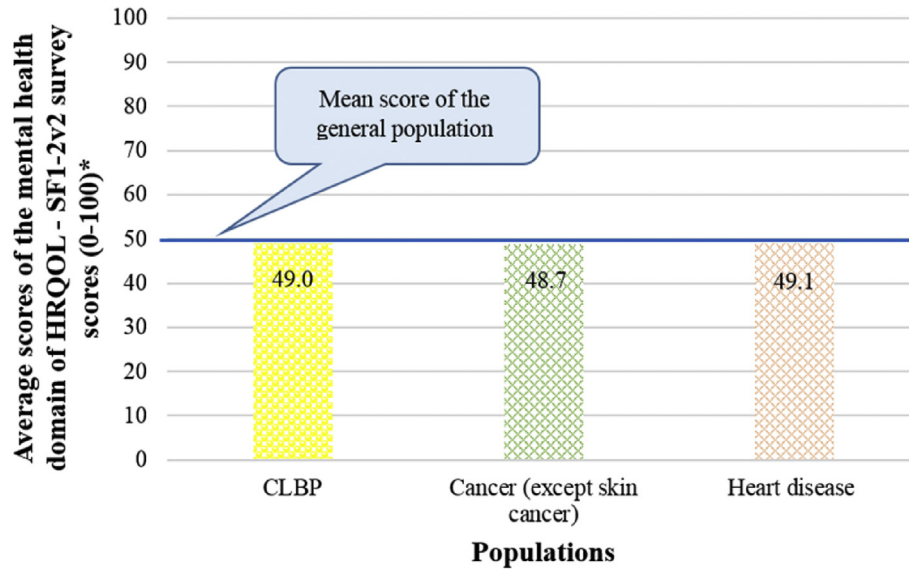
Fig. 2. Comparison of the SF-12v2 MH domain scores found in our study population with that of other populations [20,32]. *Higher scores indicate better MH. CLBP, chronic low back pain; HRQOL, health-related quality of life; MH, mental health.

Receiving more frequent posttraumatic interventions was associated with poorer RE domain, which is in line with other studies. Indeed, Slottje et al (2007) found that police officers exposed to traumatic events (i.e., supporting injured people from an aircraft crash disaster) reported poorer mental HRQOL [37]. Similarly, Mendlowicz and Stein (2000) reported in a review that

posttraumatic stress disorder has a negative impact on the quality of life [38].

In our study, we found that general health was positively and significantly associated with mental HRQOL, which is in line with Marconato and Monteiro's (2015) study. They found that perceived general health and mental quality of life among firefighters and

Table 3
Determinants of the role emotional and mental health domains from the health-related quality of life (SF-12v2 Health Survey) among police officers

Characteristics	Role emotional						Mental health					
	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p
LBP presence and its characteristics												
LBP (vs. absence of LBP)												
Acute/subacute LBP	−0.020	0.398	0.316	0.019	0.431	0.377	−0.028	0.328	0.155	−0.001	0.311	0.964
CLBP	−0.206	0.429	<0.001	−0.068	0.496	**0.003**	−0.162	0.353	<0.001	−0.062	0.357	**0.002**
Have changed job or duties because of LBP in one's lifetime (vs. no)												
Yes	−0158	0.568	<0.001	−0.067	0.580	**<0.001**	0.066	0.470	<0.001	−0.025	0.418	0.123
Sociodemographic characteristics												
Sex (vs. males)												
Females	−0.069	0.385	<0.001	−0.038	0.423	0.060	−0.123	0.310	<0.001	−0.075	0.304	**<0.001**
Age (y)	−0.070	0.21	<0.001	−0.005	0.025	0.809	−0.018	0.017	0.313	0.045	0.018	**0.019**
Living arrangement (vs. with spouse/common-law partner)												
Alone	−0.093	0.494	<0.001	−0.051	0.463	**0.003**	−0.096	0.339	<0.001	−0.016	0.334	0.289
Other (with cotenant or parents)	0.010	3.301	0.583	0.032	2.883	0.056	−0.019	2.673	0.282	−0.003	2.078	0.815
Occupational and ergonomic-related factors												
Job satisfaction (BIAJS score)	0.302	0.061	<0.001	0.103	0.066	<0.001	0.320	0.049	<0.001	0.071	0.048	**<0.001**
Had a posttraumatic psychological intervention after difficult situation in the past 12 mo (vs. never/almost never)												
Sometimes	−0.073	0.651	<0.001	−0.038	0.624	**0.026**	−0.074	0.533	<0.001	−0.027	0.453	0.071
Fairly often/very often	−0.099	1.130	<0.001	−0.034	1.108	**0.046**	−0.058	0.915	0.001	0.018	0.792	0.240
Mean number of hours in sitting posture in a workday	−0.027	0.047	0.125	0.000	0.045	0.985	−0.003	0.038	0.855	−0.007	0.032	0.660
Health- and life style–related factors												
Perceived stress over the past 4 weeks (PSS-4 score)	−0.437	0.064	<0.001	−0.196	0.085	**<0.001**	−0.579	0.047	<0.001	−0.325	0.061	**<0.001**
Depressed mood over the past 2 weeks (PHQ-2 score)	−0.452	0.154	<0.001	−0.197	0.217	**<0.001**	−0.523	0.119	<0.001	−0.167	0.157	**<0.001**
Anxiety over the past 2 weeks (GAD-2 score)	−0.374	0.143	<0.001	−0.058	0.186	**0.008**	−0.511	0.108	<0.001	−0.164	0.135	**<0.001**
Quality of sleep (5th item from the CPSI)	0.298	0.083	<0.001	0.081	0.090	**<0.001**	0.349	0.066	<0.001	0.090	0.065	**<0.001**
General health (from the SF-12v2 Health Survey)	0.277	0.022	<0.001	0.105	0.025	**<0.001**	0.287	0.018	<0.001	0.091	0.018	**<0.001**

BIAJS, Brief Index of Affective Job Satisfaction; CLBP, chronic low back pain; CPSI, Chronic Pain Sleep Inventory; GAD-2, 2-item Generalized Anxiety Disorder scale; LBP, low back pain; PHQ-2, 2-item Patient Health Questionnaire; PSS-4, 4-item Perceived Stress Scale; SE, standard error.
Significant p values (<0.05) are in bold.
* Multicollinearity: For all variables included in the multivariate model, tolerance was greater than 0.2.

rescue professionals were substantially and positively correlated [35].

In our study, higher levels of stress were associated with poorer mental HRQOL, which is in line with previous findings by Alexopoulos et al (2014) in their study of Greek police officers. In fact, they reported that higher levels of stress increased the risk of reporting suboptimal quality of life [6]. Our results are also in line with those of other studies that showed that stress-related disorder has a negative impact on the quality of life [39,40].

Depressed mood and anxiety among police officers were also associated with poorer mental HRQOL. These results are in line with those of a study by Antunes et al (2013) which showed that patients with depression had poorer RE and MH domain scores [41]. The same tendency was found among police officers in Greece [6]. In fact, Alexopoulos et al found that depression and anxiety were related to lower quality of life [6]. In the same vein, Scholich et al reported that depression is associated with HRQOL impairments [42]. A combination of depression and CLBP lead to worse HRQOL among CLBP patients [43].

Based on these results, it appears important to screen police officers suffering from depression, anxiety, and posttraumatic disorder when establishing workers' priority to access CLBP prevention and management programs in their police organizations. Strategies to improve job satisfaction are also recommended to improve mental HRQOL among police officers.

4.2. Strength and limitations

The present study constitutes the first investigation of the impact of LBP/CLBP on the mental HRQOL of police officers. However, the cross-sectional design of the study prevents us from establishing causal relationships [44]. Future longitudinal explorations of such impacts will thus be relevant. A major strength of our study was the large sample size and the recruitment of police officers from all regions of the province of Quebec which highly contribute to the representativeness of our sample. It is nonetheless difficult to assess completely the potential for participation bias. In fact, the very nature of our recruitment as well as ethical reasons made it impossible to calculate the response rate or compare results between participants and nonparticipants. However, when comparing our sample to Canadian and Quebec police forces statistics, we found that our study participants are comparable in terms of demographics such as age and sex [31,45].

5. Conclusion

Our study suggests that the presence of CLBP is associated with mental HRQOL impairments among police officers. Other sociodemographic, occupational and health-related factors are also associated with mental HRQOL (i.e., job satisfaction, posttraumatic stress disorder, perceived stress, anxiety, and depressed mood). This emphasizes the importance of promoting the implementation of CLBP prevention and management programs. Because other occupational and health-related factors (physical and psychological factors) are simultaneously involved in modulating mental HRQOL, these factors should also be considered within CLBP prevention and management strategies aimed at improving mental HRQOL. Prevention programs should also involve multidisciplinary teams. Indeed, multidisciplinary strategies focusing on chronic pain management have already proved to be effective in improving mental HRQOL [46]. Strategies aimed at improving job satisfaction among police officers should also be part of the prevention plan to avoid low mental HRQOL among these workers.

Conflict of interest

All authors declare no conflicts of interest and have no financial interests related to this study.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.shaw.2018.08.006.

Appendix. Determinants of the role emotional and mental health domains of the health-related quality of life (SF-12v2 Health Survey) among police officers

Characteristics	Role emotional						Mental health					
	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p
LBP presence and its characteristics												
LBP (vs. absence of LBP)												
Acute/subacute LBP	−0.020	0.398	0.316	0.019	0.431	0.377	−0.028	0.328	0.155	−0.001	0.311	0.964
CLBP	−0.206	0.429	<0.001	−0.068	0.496	**0.003**	−0.162	0.353	<0.001	−0.062	0.357	**0.002**
Perception that LBP is linked to the work done in the police force (vs. not linked/no LBP in one's lifetime)												
Partially linked	−0.100	0.490	<0.001	−0.007	0.519	0.792	−0.119	0.401	<0.001	−0.011	0.374	0.633
Totally linked	−0.174	0.513	<0.001	−0.048	0.574	0.084	−0.136	0.420	<0.001	−0.001	0.414	0.979

(continued)

Characteristics	Role emotional						Mental health					
	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p	Crude ß	SE	p	Adjusted ß*	SE	Adjusted p
Have changed job or duties because of LBP in one's lifetime (vs. no)												
Yes	−0158	0.568	<0.001	−0.067	0.580	**<0.001**	0.066	0.470	<0.001	−0.025	0.418	0.123
Sociodemographic characteristics												
Sex (vs. males)												
Females	−0.069	0.385	<0.001	−0.038	0.423	0.060	−0.123	0.310	<0.001	−0.075	0.304	**<0.001**
Age (years)	−0.070	0.021	<0.001	−0.005	0.025	0.809	−0.018	0.017	0.313	0.045	0.018	**0.019**
Country of birth (vs. other)												
Canada	0.007	1.161	0.704	0.026	1.142	0.119	−0.004	0.935	0.846	0.014	0.815	0.331
Living arrangement (vs. with spouse/common-law partner)												
Alone	−0.093	0.494	<0.001	−0.051	0.463	**0.003**	−0.096	0.339	<0.001	−0.016	0.334	0.289
Other (with cotenant or parents)	0.010	3.301	0.583	0.032	2.883	0.056	−0.019	2.673	0.282	−0.003	2.078	0.815
Residents of nonremote regions (vs. remote resource regions)[†]	−0.022	0.586	0.229	−0.016	0.538	0.343	−0.006	0.475	0.755	−0.002	0.387	0.909
Occupational and ergonomic-related factors												
Job satisfaction (BIAJS score)	0.302	0.061	<0.001	0.103	0.066	**<0.001**	0.320	0.049	<0.001	0.071	0.048	**<0.001**
Had a posttraumatic psychological intervention after difficult situation in the past 12 months (vs. never/almost never)												
Sometimes	−0.073	0.651	<0.001	−0.038	0.624	**0.026**	−0.074	0.533	<0.001	−0.027	0.453	0.071
Fairly often/very often	−0.099	1.130	<0.001	−0.034	1.108	**0.046**	−0.058	0.915	0.001	0.018	0.792	0.240
Made a decision implying heavy consequences in the past 12 months (vs. never/almost never)												
Sometimes	0.023	0.427	0.279	0.025	0.410	0.222	−0.008	0.347	0.417	0.009	0.295	0.607
Fairly often/very often	−0.048	0.455	0.020	−0.021	0.481	0.336	−0.033	0.370	0.117	0.016	0.347	0.413
Faced clients' hostility in the past 12 months (vs. never/almost never)												
Sometimes	0.007	0.483	0.762	0.005	0.484	0.840	0.010	0.392	0.663	0.009	0.349	0.643
Fairly often/very often	−0.017	0.440	0.445	−0.005	0.563	0.852	−0.020	0.357	0.366	−0.012	0.406	0.626
Exposed to public complaints and critics in the past 12 months (vs. never/almost never)												
Sometimes	0.010	0.500	0.634	0.017	0.473	0.418	0.004	0.406	0.835	−0.001	0.341	0.970
Fairly often/very often	−0.046	0.425	0.031	0.020	0.456	0.392	−0.058	0.345	0.007	−0.005	0.328	0.809
Work schedule in the past 12 months (vs. day)												
Evening	0.004	1.585	0.842	0.009	1.683	0.587	0.004	1.228	0.831	0.005	1.213	0.740
Night	0.026	0.997	0.153	0.027	1.053	0.153	0.010	0.807	0.562	0.015	0.760	0.380
Variable	0.060	0.368	0.001	0.024	0.521	0.362	0.059	0.299	0.001	0.043	0.376	0.064
Mean number of hours worked per week	0.022	0.025	0.214	−0.003	0.025	0.854	0.036	0.021	0.043	0.016	0.018	0.285
Mean number of breaks in a 9-h work shift	−0.059	0.204	0.001	−0.029	0.198	0.098	−0.025	0.167	0.152	0.010	0.143	0.531
Proportion of hours spent wearing a body armor in the past 12 months	0.038	0.004	0.029	0.008	0.008	0.834	0.030	0.003	0.087	−0.036	0.006	0.265
Proportion of hours spent wearing a duty belt in the past 12 months	0.029	0.004	0.093	−0.033	0.008	0.298	0.039	0.003	0.028	0.004	0.005	0.897
Do car patrol (vs. no)												
Yes	0.033	0.369	0.056	0.002	0.655	0.945	0.036	0.300	0.040	0.006	0.473	0.832
Mean number of hours in sitting posture in a workday	−0.027	0.047	0.125	0.000	0.045	0.985	−0.003	0.038	0.855	−0.007	0.032	0.660
Health- and life style–related factors												
Perceived stress over the past 4 weeks (PSS-4 score)	−0.437	0.064	<0.001	−0.196	0.085	**<0.001**	−0.579	0.047	<0.001	−0.325	0.061	**<0.001**
Depressed mood over the past 2 weeks (PHQ-2 score)	−0.452	0.154	<0.001	−0.197	0.217	**<0.001**	−0.523	0.119	<0.001	−0.167	0.157	**<0.001**
Anxiety over the past 2 weeks (GAD-2 score)	−0.374	0.143	<0.001	−0.058	0.186	**0.008**	−0.511	0.108	<0.001	−0.164	0.135	**<0.001**
Quality of sleep (5th item from the CPSI)	0.298	0.083	<0.001	0.081	0.090	**<0.001**	0.349	0.066	<0.001	0.090	0.065	**<0.001**
General health (from the SF-12v2 Health Survey)	0.277	0.022	<0.001	0.105	0.025	**<0.001**	0.287	0.018	<0.001	0.091	0.018	**<0.001**
BMI (vs. normal/underweight–BMI < 25 kg/m^2)												
Overweight ($25 \leq$ BMI < 30 kg/m^2)	−0.010	0.396	0.628	−0.015	0.408	0.462	0.020	0.321	0.323	−0.019	0.294	0.308
Obese (BMI ≥ 30 kg/m^2)	−0.028	0.539	0.156	0.010	0.572	0.636	0.002	0.437	0.904	0.008	0.412	0.670
Injury in the lower back region in one's lifetime (vs. no)												
Yes	−0.107	0.426	<0.001	−0.014	0.431	0.441	−0.071	0.350	<0.001	0.013	0.310	0.401
History of trauma/accident at work or outside work (vs. no)												
Yes	−0.049	0.387	0.007	−0.025	0.363	0.144	−0.031	0.314	0.087	−0.015	0.261	0.334
Surgery in the back region in one's lifetime (vs. no)												
Yes	−0.056	1.108	0.002	−0.003	1.016	0.871	−0.038	0.917	0.037	−0.013	0.748	0.394
Chronic pain in other regions of the body than in the back (vs. no)												
Yes	−0.172	0.363	<0.001	−0.004	0.364	0.821	−0.167	0.294	<0.001	−0.010	0.263	0.531
Comorbidities [0 vs. 1 and more (max 5)]	−0.077	0.504	<0.001	0.004	0.495	0.834	−0.069	0.408	<0.001	−0.002	0.356	0.889
Mean hours per week of light physical activity	0.016	0.032	0.378	0.010	0.029	0.571	0.023	0.026	0.202	−0.002	0.021	0.879
Mean hours per week of moderate/intense physical activity	0.098	0.048	<0.001	−0.009	0.047	0.610	0.127	0.039	<0.001	0.022	0.034	0.166

(continued)

Characteristics	Role emotional						Mental health					
	Crude ß	SE	*p*	Adjusted ß*	SE	Adjusted *p*	Crude ß	SE	*p*	Adjusted ß*	SE	Adjusted *p*
Smoking during the past 4 months (vs. no)												
Yes	−0.042	0.685	**0.020**	−0.008	0.638	0.617	−0.043	0.552	**0.018**	−0.012	0.457	0.410
Number of alcohol consumption per week during the past 4 months	−0.036	0.0.35	**0.048**	0.005	0.033	0.774	−0.054	0.029	**0.003**	−0.026	0.024	0.082

BIAJS, Brief Index of Affective Job Satisfaction; BMI, Body Mass Index; CLBP, chronic low back pain; CPSI, Chronic Pain Sleep Inventory; GAD-2, 2-item Generalized Anxiety Disorder scale; LBP, low back pain; PHQ-2, 2-item Patient Health Questionnaire; PSS-4, 4-item Perceived Stress Scale; SE, standard error.
Significant *p* values (<0.05) are in bold.
* Multicolinearity: For all variables included in the multivariate model, tolerance was greater than 0.2.
† Remote resource regions as defined by *Revenu Quebec* (i.e., the provincial revenue agency): *Bas-Saint-Laurent* (region 01), *Saguenay—Lac-Saint-Jean* (region 02), *Abitibi-Témiscamingue* (region 08), *Côte-Nord* (region 09), *Nord-du-Québec* (region 10), *Gaspésie—Îles-de-la-Madeleine* (region 11). Nonremote regions are near a major urban center.

References

[1] Royal Canadian Mounted Police (RCMP). Qualifications and requirements; March 2017. Available from: http://www.rcmp-grc.gc.ca/en/qualifications-and-requirements?gclid=EAIaIQobChMIvLWYwtPa2QIVkLfACh0f8wKKEAAYASABEgJ-KvD_BwE. [Accessed November 2017].

[2] Gershon RR, Lin S, Li X. Work stress in aging police officers. J Occup Environ Med 2002;44(2):160—7.

[3] McCarty WP, Skogan WG. Job related burnout among civilian and sworn police personnel. Police Quarterly 2012;16(1):66—84.

[4] Price M. Psychiatric disability in law enforcement officers. Behav Sci Law 2017;35(2):113—23.

[5] Lipp ME. Stress and quality of life of senior Brazilian police officers. Span J Psychol 2009;12(2):593—603.

[6] Alexopoulos EC, Palatsidi V, Tigani X, Darviri C. Exploring stress levels, job satisfaction, and quality of life in a sample of police officers in Greece. Saf HealthWork 2014;5(4):210—5.

[7] Brown JJ, Wells GA, Trottier AJ, Bonneau J, Ferris B. Back pain in a large Canadian police force. Spine (Phila Pa 1976) 1998;23(7):821—7.

[8] Gruevski KM, McKinnon CD, Dickerson CR, Callaghan JP. The impact of mobile data terminal use on posture and low-back discomfort when combined with simulated prolonged driving in police cruisers. Int J Occup Saf Ergon 2013;19(3):415—22.

[9] Burton AK, Tillotson KM, Symonds TL, Burke C, Mathewson T. Occupational risk factors for the first-onset and subsequent course of low back trouble. A study of serving police officers. Spine (Phila Pa 1976) 1996;21(22):2612—20.

[10] Vincent P. Le ceinturon sous la loupe de la prévention. Maux de dos, hanches eccymosées...personne n'est à l'abri. Exposé de la situation. Québec: Commission de la santé et de la sécurité du travail; 2004.

[11] Hovbrender A, Raschke SU. Identification of potential risk factors for injury to police officers in using new technologies. British Columbia: Work Safe British Columbia; 2009.

[12] Côté MM. Auto-patrouille et maux de dos chez les policiers du Québec. Bilans de connaissances. Montréal: Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST); 1989.

[13] Holmes MW, McKinnon CD, Dickerson CR, Callaghan JP. The effects of police duty belt and seat design changes on lumbar spine posture, driver contact pressure and discomfort. Ergonomics 2013;56(1):126—36.

[14] Gyi DE, Porter JM. Musculoskeletal problems and driving in police officers. Occup Med 1998;48(3):153—60.

[15] Benyamina Douma N, Cote C, Lacasse A. The Quebec serve & protect low back pain study: a web-based cross-sectional investigation of prevalence and functional impact among police officers. Spine (Phila Pa 1976) 2017;42(19):1485—93.

[16] Nayme P, Dazord A, Payre D, Joux-Ruesch A, Richard A, Calmels P, Navez M, Laurent B. Quality of life of lumbago patients cared for in a pain center. Presse Medicale 2001;30(35):1727—32.

[17] Shim JH, Lee KS, Yoon SY, Lee CH, Doh JW, Bae HG. Chronic low back pain in young Korean urban males: the life-time prevalence and its impact on health related quality of life. J Korean Neurosurg Soc 2014;56(6):482—7.

[18] Schleyer TK, Forrest JL. Methods for the design and administration of web-based surveys. J Am Med Inform Assoc 2000;7(4):416—25.

[19] Prevention CoDCa. Health-related quality of life (HRQOL) Concepts; November 2017. Available from: https://www.cdc.gov/hrqol/concept.htm. [Accessed November 2017].

[20] Maruish ME. User's manual for the SF-12v2 health survey. 3rd ed. Lincoln, RI: QualityMetric Incorporated; 2012.

[21] Forcier L, Beaugrand S, Lortie M, Lapointe C, Lemaire J, Kuorinka I, Duguay P, Lemay F, Buckle P. L'ABC de l'utilisation d'un questionnaire sur la santé musculosquelettique : de la planification à la diffusion des résultats. Québec: Institut de recherche Robert Sauvé en santé et en sécurité du travail (IRSST); 2001.

[22] Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G, Jorgensen K. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon 1987;18(3):233—7.

[23] Crowford JO. The Nordic musculoskeletal questionnaire. Occup Med 2007;57:300—1.

[24] Bouhassira D, Lanteri-Minet M, Attal N, Laurent B, Touboul C. Prevalence of chronic pain with neuropathic characteristics in the general population. Pain 2008;136(3):380—7.

[25] Costa Lda C, Maher CG, McAuley JH, Hancock MJ, Herbert RD, Refshauge KM, Henschke N. Prognosis for patients with chronic low back pain: inception cohort study. BMJ 2009;339:b3829.

[26] Thompson ER, Phua FTT. A brief index of affective job satisfaction. Group Organ Manage 2012;37(3):275—307.

[27] Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Social Behav 1983;24(4):385—96.

[28] Kroenke K, Spitzer RL, Williams JB, Lowe B. The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. Gen Hosp Psychiatry 2010;32(4):345—59.

[29] Kosinski M, Janagap CC, Gajria K, Schein J. Psychometric testing and validation of the chronic pain sleep inventory. Clin Ther 2007;29(Suppl. l):2562—77.

[30] Menard S. Applied logistic regression analysis. California: Thousand Oaks: Sage; 1995.

[31] Hutchins H. Police resources in Canada, 2014; 2015. Report No.: 0715-271X.

[32] Ware JE, Kosinski M, Turner-Bowker DM, Gandek B. User's manual for the SF-12v2® health survey with a supplement documenting SF-12® health survey). Lincoln, RI: QualityMetric Incorporated; 2002. 2009.

[33] Hogan ME, Taddio A, Katz J, Shah V, Krahn M. Health utilities in people with chronic pain using a population-level survey and linked health care administrative data. Pain 2017;158(3):408—16.

[34] Vartiainen P, Heiskanen T, Sintonen H, Roine RP, Kalso E. Health-related quality of life and burden of disease in chronic pain measured with the 15D instrument. Pain 2016;157(10):2269—76.

[35] Marconato RS, Monteiro MI. Pain, health perception and sleep: impact on the quality of life of firefighters/rescue professionals. Rev Lat-Americana Enferm 2015;23(6):991—9.

[36] Yamada K, Matsudaira K, Imano H, Kitamura A, Iso H. Influence of work-related psychosocial factors on the prevalence of chronic pain and quality of life in patients with chronic pain. BMJ Open 2016;6(4):e010356.

[37] Slottje P, Twisk JW, Smidt N, Huizink AC, Witteveen AB, van Mechelen W, Smid T. Health-related quality of life of firefighters and police officers 8.5 years after the air disaster in Amsterdam. Qual Life Res 2007;16(2):239—52.

[38] Mendlowicz MV, Stein MB. Quality of life in individuals with anxiety disorders. Am J Psychiatry 2000;157(5):669—82.

[39] Colovic O, Lecic-Tosevski D, Mandic V, Toskovic O. The impact of stress related disorders on quality of life. Psychiatr Danub 2009;21(2):199—205.

[40] Tsai SY. A study of the health-related quality of life and work-related stress of white-collar migrant workers. Int J Environ Res Public Health 2012;9(10):3740—54.

[41] Antunes RS, de Macedo BG, Amaral Tda S, Gomes Hde A, Pereira LS, Rocha FL. Pain, kinesiophobia and quality of life in chronic low back pain and depression. Acta Ortop Bras 2013;21(1):27—9.

[42] Scholich SL, Hallner D, Wittenberg RH, Hasenbring MI, Rusu AC. The relationship between pain, disability, quality of life and cognitive-behavioural factors in chronic back pain. Disabil Rehabil 2012;34(23):1993—2000.

[43] Tsuji T, Matsudaira K, Sato H, Vietri J. The impact of depression among chronic low back pain patients in Japan. BMC Musculoskelet Disord 2016;17(1):447.

[44] Rothman KJ, Greenland S, Lash TT. Modern epidemiology. Philadelphia: Lippincott Williams & Wilkins; 2008.

[45] Service de Police de la Ville de Montréal (SPVM). Rapport annuel 2014. Montreal: Service de Police de la Ville de Montréal (SPVM); 2015.

[46] Bourgault P, Lacasse A, Marchand S, Courtemanche-Harel R, Charest J, Gaumond I, Barcellos de Souza J, Choiniere M. Multicomponent interdisciplinary group intervention for self-management of fibromyalgia: a mixed-methods randomized controlled trial. PLoS One 2015;10(5):e0126324.