

Prevalence and Factors Associated with Chronic Low Back Pain in the Mining Sector in Burkina Faso

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Abstract

Introduction: Low back pain is nowadays a real public health problem in companies. The objective of the study was to determine the prevalence and factors associated with chronic low back pain among workers of a mining company in Burkina Faso. **Material and Methods:** This was a descriptive and analytical cross-sectional study with a retrospective collection that took place from August 1, 2021 to March 16, 2022 in a gold mine in Burkina Faso. It focused on mine workers who participated in the 2019 annual medical visit. **Results:** Out of a total workforce of 880 workers who took part in the annual medical visit in 2019, 165 had chronic common low back pain, *i.e.* a prevalence of 18.75%. The average age of low back pain workers was 37.21 ± 7.5 years. Among the workers suffering from low back pain, 62 (37.58%) held the position of machine operator. Clinically, mechanical pain was found in 113 low back pain workers (76%) and twenty-nine (17.58%) had radicular pain. Standard radiography of the lumbar spine was abnormal in 129 workers (78.18%). In the univariate analysis, the factors associated with the pathology were sex, level of study, work station and seniority in the position. After a logistic regression, the factors associated with its occurrence were whole-body vibration (Fisher's test = 12.7541; $P = 0.000$), male sex (Fisher's test = 8.363; $P = 0.004$), and seniority for 4 to 5 years ($\text{Chi}^2 = 4.0234$; $p = 0.046$). **Conclusion:** The study reveals the existence of chronic low back pain cases among the workers of the mining company. There is a predominance of the pathol-

ogy in men, workers exposed to vibrations and those with a seniority of 4 to 5 years. It is necessary to establish a policy of prevention of low back pain for the benefit of workers, in particular those exposed to vibrations.

Keywords

Chronic Low Back Pain, Prevalence, Associated Factors, Mine, Burkina Faso

1. Introduction

A public health pathology, low back pain is the leading cause of work-related disability before the age of 45 [1]. It affects 60% - 70% of workers in France [2]. According to France's Haute Autorité de Santé (HAS), chronic low-back pain is defined as pain in the lumbar region related to damage to the intervertebral disc and/or posterior vertebral joints, which has been present for more than three months. Pain may radiate to the buttock, iliac crest or thigh, and only exceptionally extends beyond the knee [3].

It may be accompanied by radicular pain when a spinal nerve root is involved, causing pain in the leg along the spinal nerve, accompanied by numbness and tingling, muscle weakness and loss of reflexes [4].

The prevalence of this pathology remains high in the workplace in Africa and particularly in Burkina Faso. Indeed, among workers at the port handling station in Cotonou, this prevalence was 52.6% in 2017 [5]. It was 68.89% in 2019 among motorcycle cab drivers in Porto-Novo, Benin [6]. In Burkina Faso, its prevalence was 59% among physical education and sports teachers (EPS) in Ouagadougou and 76.5% among traditional loincloth weavers in Ouagadougou [7] [8]. In the workplace, this pathology has a number of consequences both for individual workers and for the company as a whole. In fact, chronic low-back pain is the cause of work stoppages and reduced quality of life for sufferers [9] [10]. What's more, the costs associated with treating this pathology in the workplace are considerable, amounting to over a billion euros a year in France [1]. There are also indirect costs that are difficult to assess, such as reduced production, recruitment and training of replacements, and the risk of production stoppages.

In the mining sector, as in other sectors, several risk factors are associated with the onset of this pathology in workers. These include manual handling, vibration, awkward working postures and intense physical work. Non-occupational factors are also associated with its occurrence. In a study carried out among Senegalese nursing staff, manual handling was a risk factor for this pathology [11].

To the best of our knowledge, no study has yet been carried out on this pathology in the mining sector in the country, which had 27 industrial mines in 2022, including 24 gold mines [12]; hence the interest of our study, which aims to determine the prevalence and factors associated with chronic low back pain in the mining sector in Burkina Faso.

2. Materials and Methods

2.1. Type and Period of Study

This was a cross-sectional descriptive and analytical study with retrospective collection that took place from August 1, 2021 to March 16, 2022 in a gold mine in Burkina Faso. It included all workers with low back pain at the mine who attended the 2019 annual medical check-up.

2.2. Inclusion Criteria

Workers suffering from low back pain and who had undergone a radiological examination of the lumbar spine were included in the study.

2.3. Non-Inclusion Criteria

Not included in the study were workers with insufficient data from the medical check-up, or workers absent during the study period.

2.4. Sampling

This was a convenience sample of mine workers who attended the 2019 periodic medical check-up and whose clinical records met the inclusion criteria.

2.5. Study Variables

Chronic low-back pain was the study's dependent variable. The independent variables were: socio-demographic variables (age, gender, marital status) and occupational variables (profession, job position, job seniority).

Mechanical pain is induced pain; it occurs as a result of movement, walking (it is useful to determine the walking perimeter), weight-bearing and weight-bearing. It is pain that calms down with rest. It occurs during the day, mainly at the end of the day (when tired). The intensity of the pain was assessed using the Visual Analogue Scale (VAS). It corresponds to the distance in millimetres between the position of the cursor moved manually by the patient and the "no pain" end of the scale (0 mm), with the other end marked "the worst pain imaginable" (100 mm). The scores obtained from the VAS have a descriptive value for a given individual and make it possible to monitor his or her state of pain. This is the scale most commonly used in our context.

Radicular pain was assessed using the Lasègue sign: in a patient lying supine, flexion of the extended lower limb on the thigh is limited by the pain. If the manoeuvre is performed with the leg bent, mobilisation of the limb is not painful. This sign distinguishes sciatica from joint disorders.

2.6. Data Analysis

For the descriptive study, Microsoft Office software version 2016 with its Word and Excel components was used for analysis and table processing.

The analytical study for the search for associated factors was carried out in two stages using Epi info software version 7.2.4. Fisher's exact test and Chi² test

were used to calculate p-values as a measure of association with chronic low back pain, as well as 95% confidence intervals at the 5% significance level.

After univariate analysis, all variables associated (independent variables) with chronic low back pain (dependent variable) at a threshold of 20% ($p < 0.2$) were included in a multivariate logistic regression model. The association between chronic low back pain and each factor was investigated independently of the other factors using multiple logistic regression. In the end, we retained as factors associated with chronic low-back pain those variables whose p values were <0.05 at the end of the multivariate analysis.

2.7. Ethical Considerations

To carry out the study, the agreement of the mining company's General Manager was obtained.

The anonymity of the questionnaire and the confidentiality of the data collected were respected.

3. Results

3.1. Prevalence of Chronic Low Back Pain

Out of a total of 1200 employees at the mine at the time of the study, 880 took part in the 2019 periodic medical check-up, representing a participation rate of 73.33%. Among the workers who took part in the said visit, 165 had chronic common low-back pain, *i.e.* a prevalence of 18.75%.

3.2. Socio-Demographic Characteristics of Workers with Low Back Pain

The mean age of workers with low back pain was 37.21 ± 7.5 years, with extremes of 22 and 55 years. The male sex was the most represented in the study, with 156 workers (94.55%), and the sex ratio was 17 men to 1 woman. 66 workers (40%) were uneducated.

The socio-demographic characteristics of workers with low back pain are shown in **Table 1**.

Table 1. Socio-demographic characteristics of workers with low back pain.

	Number	Percentage
Age		
≤22	1	0.61
]22 - 32]	47	28.48
]32 - 42]	79	47.88
]42 - 52]	34	20.61
]52 - 55]	4	2.42
Gender		
Male	156	94.55
Female	9	5.45

Continued

Study level		
Primary	30	18.18
Secondary	45	27.27
Higher	24	14.55
No schooling	66	40

3.3. Occupational Characteristics of Workers with Low Back Pain

The majority of workers suffering from low back pain in the study were in the mining department, with a workforce of 67 workers (or 40.61%), followed by the plant department, with 58 workers (35.15%). The machine operator position was the most represented, with 62 workers (37.58%), followed by plant operators, with 34 workers (20.61%). Average job tenure was 3.5 years \pm 1.2 years, with extremes of 1 year and 7 years. The occupational characteristics of the workers are presented in **Table 2**.

Table 2. Occupational characteristics of workers with low back pain.

	Number	Percentage
Department		
Mining	67	40.61
Plant	58	35.15
Garage/Maintenance	22	13.33
Safety	7	4.24
Logistics	5	3.03
Geology	4	2.42
Occupational health and safety	1	0.61
Human resources	1	0.61
Workstations		
Welder	10	6.06
Machine operator	62	37.57
Electrician	11	6.67
Maintainer	3	1.82
Mechanic	19	11.51
Metallurgist	3	1.82
Factory operator	34	20.61
Other professions	23	13.94
Job seniority		
[1 - 3] years	22	13.61
]3 - 5] years	117	70.91
>5 years	26	16.06
Total	165	100

3.4. Clinical Signs

Clinically, isolated low-back pain was found in 136 workers (82.42%).

The Schöber index was abnormal in 111 low-back pain sufferers (67.27%). Mechanical pain was found in 113 workers with low back pain (76%), and radicular pain in 29 workers (17.58%). One hundred and eight workers (65.45%) had no known history of low-back pain prior to employment at the mine. The clinical characteristics of low-back pain are presented in **Table 3**.

Table 3. Clinical features of low back pain in workers.

Clinical features	Number	Percentage
Complaints		
Isolated lumbago	136	82.42
Lumbago + radiation to	29	17.58
Type of pain		
Mechanical	113	68.48
Inflammatory	52	31.52
Pain intensity		
<4	42	25.46
4 - 5	17	10.3
6 - 7	103	62.42
≥8	3	1.82
History of low back pain		
Yes	57	34.55
No	108	65.45
IMC (kg/m²)		
<18.5	10	6.06
18.5 - 24.9	73	44.24
25 - 29.9	63	38.18
>30	19	11.52
Schöber index		
Normal	54	32.73
Abnormal	111	67.27
Doorbell sign		
Present	20	12.12
Absent	145	87.88
Lasègue sign		
Present	55	33.33
Absent	110	66.67

3.5. Triggering Factors

In our study population, a pain-triggering factor was present in 148 workers (89.7%). These were mainly whole-body vibration in 50 workers (30.30%), prolonged standing in 44 workers (26.67%) and manual handling in 34 workers (20.61%). Prolonged sitting was a trigger for low-back pain in 20 workers (12.12%). **Figure 1** shows the distribution of workers suffering from chronic low-back pain, according to the triggering factors.

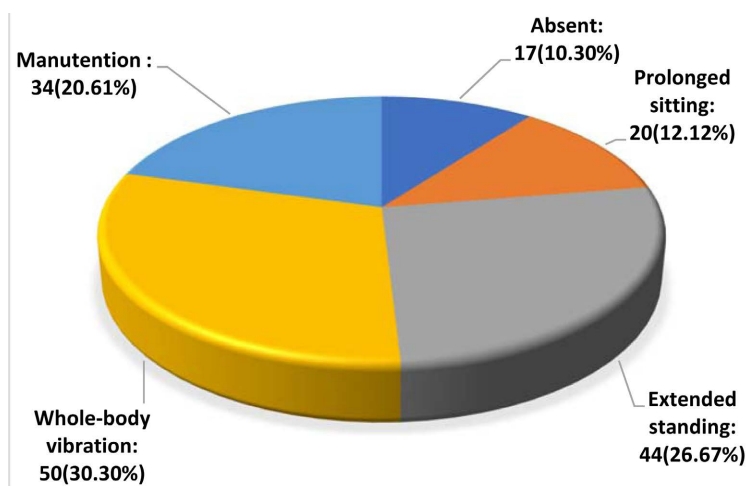


Figure 1. Distribution of workers suffering from chronic low back pain according to triggering factors.

3.6. Radiological Signs

A pathological image was found on standard radiography of the lumbar spine in 129 workers (78.18%), with a high proportion of cases of low back discarthrosis found in 61 workers (36.97%).

Table 4 shows the distribution of workers suffering from low-back pain according to radiological signs.

3.7. Socio-Professional Impact of Chronic Low Back Pain

Low back pain had an impact on walking perimeter in 54 workers (32.73%), on sleep quality in 60 workers (36.36%) and on sex life in 74 workers (44.85%). In addition, 57 workers (34.55%) reported restricted fitness for work due to low back pain, and 33 workers (20%) reported work stoppage due to the condition. **Figure 2** shows the socio-professional impact of chronic low back pain among workers.

Table 4. Distribution of low back pain workers according to radiological signs.

Radiological sign	Number	Percentage
Normal radiography	36	21.82
Lumbar disc osteoarthritis	61	36.97

Continued

Herniated disc	4	2.42
Pinched disc	52	31.51
Isthmic lysis	6	3.64
Other	6	3.64
Total	165	100

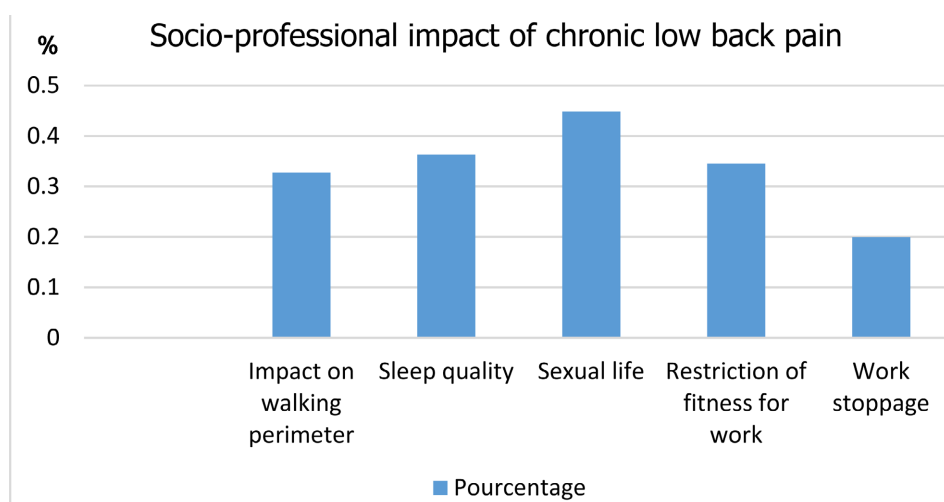


Figure 2. Socio-professional impact of chronic low back pain in workers.

3.8. Factors Associated with Chronic Low Back Pain in Workers

3.8.1. Univariate Analysis

- Chronic lumbago and socio-demographic and occupational characteristics

In the univariate analysis, the socio-demographic and occupational data associated with chronic low back pain were gender ($p = 0.004$), level of education ($p = 0.001$), workstation ($p = 0.001$) and job seniority ($p = 0.046$). **Table 5** presents the univariate analysis of the association between socio-demographic and occupational characteristics and the occurrence of chronic low-back pain in workers.

- Chronic lumbago and clinical signs

On univariate analysis, a significant association was found between low back pain and trigger factors ($p = 0.000$). On the other hand, no statistical association was found between the occurrence of low back pain and body mass index, or the workers' history of low back pain.

Table 6 presents the univariate analysis of the association between clinical signs and the occurrence of chronic low-back pain in workers.

3.8.2. Multivariate Analysis

In the multivariate analysis, the factors independently associated with chronic low back pain were whole-body vibration (Fisher test = 12.7541; $P = 0.000$), male gender (Fisher test = 8.363; $P = 0.004$), and job seniority ($\text{Chi}^2 = 4.0234$; $p = 0.046$).

The results of the multivariate analysis are presented in **Table 7**.

Table 5. Univariate analysis of the association between socio-demographic and occupational characteristics and the occurrence of chronic low back pain.

Socio-demographic and professional characteristics	Number	Percentage	P
Age			
≤22	1	0.61	
]22 - 32]	47	28.48	
]32 - 42]	79	47.88	0.715
]42 - 52]	34	20.61	
]52 - 55]	4	2.42	
Gender			
Male	156	94.55	0.004
Female	9	5.45	
Education level			
Primary	30	18.18	
Secondary	45	27.27	
Higher	24	14.55	
Out of school	66	40	0.001
Marital status			
Married	50	30.3	
Single	115	69.7	0.274
Workstation			
Welder	34	20.60	
Conductor	62	37.57	0.001
Electrician	11	6.66	
Maintainer	3	1.81	
Mechanic	19	11.51	
Metallurgist	3	1.81	
Factory operator	23	35.38	
Other	10	15.38	
Length of service			
[1 - 3] years	22	13.61	
]3 - 5] years	117	70.91	0.046
>5 years	26	16.06	

Table 6. Univariate analysis of the association between clinical signs and the occurrence of chronic low back pain.

Clinical data	Number	Percentage	P
IMC (kg/m²)			
<18.5	10	6.06	0.342
18.5 - 24.9	73	44.24	
25 - 29.9	63	38.18	
>30	19	11.5	
History of low back pain			
Yes	57	34.54	0.073
No	108	65.45	
Triggering factors			
Absent	17	10.30	0.000
Prolonged sitting	44	26.67	
Prolonged standing	20	12.12	
Whole body vibration	50	30.30	
Handling	34	20.61	

Table 7. Multivariate analysis of factors associated with chronic low back pain.

Socio-professional characteristics	Number	Percentage	Statistical	P
Triggering factors				
Absent	17	10.30	12.7541	0.000
Prolonged sitting position	44	26.67		
Prolonged standing position	20	12.12		
Whole body vibration	50	30.30		
Handling	34	20.61		
Gender				
Male	156	94.55	8.363	0.004
Female	9	5.45		
Length of service				
[1 - 3] years	22	13.61	4.0234	0.046
]3 - 5] years	117	70.91		
>5 years	26	16.06		

4. Discussion

4.1. Limits of the Study

We carried out a cross-sectional descriptive and analytical study with retrospec-

tive collection, which did not allow us to follow the evolution of low back pain in workers; This does not make it possible to establish a clear causal link between low back pain and the various factors observed in the study. In addition, there could be an information bias due to the fact that not all of the mining company's workers were included in the study. However, the results obtained represent a database that could prompt further studies with the aim of improving workers' health in the country's growing mining sector.

4.2. Prevalence of Chronic Low Back Pain

Out of a total of 880 workers participating in the study, 165 suffered from chronic common low-back pain, representing a prevalence of 18.75%. The average age of workers with low back pain was 37.21 ± 7.5 years. Males were most represented in the study, with 156 workers (94.55%). Sixty-six workers (40%) had no formal education. Machine operators were the most represented, with 62 workers (37.58%), followed by plant operators, with 34 workers (20.61%). Average job tenure was 3.5 years \pm 1.2 years. Higher prevalences of chronic low-back pain were observed in several studies. In a study of musculoskeletal disorders in a port handling company in Cotonou, Mikponhoue *et al.* [5] noted a prevalence of chronic low back pain of 52.6%.

In France, in companies in the Pays de la Loire region, the prevalence of this pathology was high in both men and women, at 59% and 54% respectively [13]. Several other studies confirm the high prevalence of low-back pain in the workplace. Indeed, in 2021, this pathology was observed in 52% of building construction workers in Nepal [14]. In a hospital setting in Ouagadougou, its prevalence was 56.4% in the study by Ouedraogo *et al.* in 2010 [15]. The low prevalence of low back pain in our study could be explained on the one hand by the preventive actions carried out by the mining company's occupational health staff, notably periodic medical check-ups of workers, staff awareness-raising on the prevention of musculoskeletal disorders in general and low back pain in particular, and monitoring of the working environment and conditions through workplace visits. On the other hand, this could be explained by the fact that our study only took into account cases of chronic low back pain, unlike other studies. Also, low back pain was reported in 17.58% of cases in our series. These results are comparable to those of Amon-Tanoh *et al.* [16], who reported 13.32% low back sciatic pain.

4.3. Factors Associated with Chronic Low Back Pain

In the univariate analysis, the factors associated with chronic low back pain were gender ($p = 0.004$), level of education ($p = 0.001$), workstation ($p = 0.001$) and length of service ($p = 0.046$). The presence of a precipitating factor such as whole-body vibration, prolonged standing or sitting and handling was strongly associated with low-back pain in workers ($p = 0.000$). On the other hand, no statistical association was found between the occurrence of chronic low-back pain

and age, or marital status. Multivariate analysis revealed that the factors independently associated with this pathology among workers were whole-body vibration (Fisher test = 12.7541; $P = 0.000$), male sex (Fisher test = 8.363; $P = 0.004$) and job seniority ($\text{Chi}^2 = 4.0234$; $p = 0.046$). In fact, workers subjected to vibrations were around 13 times more prone to low-back pain. Similarly, men were 8 times more prone to low back pain than women; job seniority of 4 to 5 years increased the risk of low back pain in mine workers by almost 4 times.

Several studies corroborate our findings. In their study of French companies, Fouquet *et al.* observed that men suffered more from low-back pain than women. [13] In Greece, Spyropoulos *et al.* also noted a statistically significant difference between the occurrence of low-back pain and gender among civil servants. [17] Job seniority has also been identified as a risk factor for low-back pain in workers, with a strong predisposition before 10 years' experience. [7] At the start of their professional careers, lack of experience and the quest for promotion can lead young workers to over-invest in their workstations, putting them at greater risk of LBP than older workers. What's more, given the extensive use of vibrating machinery on the mine site, a vibration prevention plan needs to be put in place at the mine, through the acquisition of quieter machines and regular equipment maintenance, in order to safeguard workers' health.

Contrary to our results, age was a risk factor for low back pain among motorcycle cab drivers in Porto-Novo. [6] The same was true for overweight and awkward postures during work, notably bent-over posture, which was a risk factor for low back pain in their study. Although our study did not demonstrate an association between work postures and low back pain, in the literature, awkward postures are known to be a source of low back pain in the workplace and a factor in the transition to chronicity. The pauses observed in our workers' work activity could partly explain our results. In their study of nursing staff in Senegal, Diatta *et al.* [11] noted that women were more prone to back pain than men. These same findings were made by Ouedraogo *et al.* [10] in Ouagadougou, in contrast to our data, where men were around 8 times more exposed than women. The low representation of women in our study could partly explain this state of affairs. What's more, in mining, women are less likely than men to work in jobs requiring intense physical effort. Other authors have demonstrated a significant association between body mass index and the occurrence of low back pain in the workplace [10] [17]. Workers should be encouraged to engage in regular physical activity and control their diet to avoid becoming overweight.

5. Conclusion

The study carried out in a mine in Burkina Faso revealed a prevalence of chronic low-back pain of 18.75% among workers. Factors associated with the occurrence of this pathology were male gender, whole-body vibration and length of service. A multidisciplinary condition, low back pain should not be neglected, as it can have serious professional, social and economic consequences. Workers suffering

from low-back pain were referred to a specialist for appropriate treatment. Preventing this pathology requires the implementation of an occupational risk prevention policy at mining sites, which takes into account the creation of occupational health services, the improvement of working conditions, the effectiveness of statutory medical check-ups and the participation of all workers in information, education and awareness-raising activities.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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