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Radioclinical Status of Women with Chronic Low Back Pain in the Peri-Urban Area of Kisangani. The Case of Female Back-Load Carriers (by Liyamba)

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Abstract

Background: Chronic low back pain associated with degenerative diseases of the lumbar spine significantly impairs individuals' quality of life. This study aimed to determine the clinical and radiological status of women with chronic low back pain in the peri-urban area of Kisangani who carried heavy loads on their backs, in order to assess the health issues they faced. **Material and Methods:** This was a case-control study involving women aged 15 to 49, including 76 cases. Data collection was retrospective. Statistical inferences were drawn using Pearson's chi-square (χ^2), Student's t-test (TS), and Fisher's exact test (TF). Odds ratios (OR) were calculated for dichotomous variables, with a significance threshold of 5%. Variables showing a bivariate association were included in a multivariate regression model using a stepwise forward selection approach. **Results:** Medical, gynecological, and surgical issues among the cases included inguinal hernia (91%, p 0.007), pelvic organ prolapse (POP) (94%, p 0.001), a history of ≥3 abortions (76%, p 0.001), and cesarean section (82%, p 0.001), alongside knee pain (82%, p 0.001) and hip pain (82%, p 0.001). Degenerative spinal lesions consisted of Grade II anterolisthesis (67%, p 0.001), simple disc degeneration (78%, p 0.001), multilevel disc degeneration (75%, p 0.001), simple lumbar osteoarthritis (79%, p 0.001), and multilevel lumbar osteoarthritis (75%, p 0.001). These lesions were located between L3 and S1 (66%, p 0.001). **Conclusion:** This study demonstrated that, clinically, the cases presented with medical, gynecological, and surgical issues—including inguinal hernia, pelvic organ prolapse (POP), and a history of more than three abortions or a Cesarean section—associated with hip and knee pain. The predominant degenerative spinal lesions were Grade II anterolisthesis, as well as single-level and multilevel discopathy and lumbar spondylosis, located between L3 and S1.

Keywords

Chronic Low Back Pain, Radioclinical Status, Women, Kisangani

1. Introduction

In the work of manual handlers, improper load-lifting techniques can lead to debilitating musculoskeletal disorders, including chronic low back pain [1].

Repeated lifting of loads requiring moderate force can lead to adaptation or even strengthening of the involved tissues. However, lifting heavy loads with excessive frequency—without adequate rest and recovery—can result in fatigue and tissue deterioration. Beyond chronic low back pain, lifting heavy loads can cause disc disorders, various abdominal wall hernias, pelvic organ prolapse, and even osteoarthritis in weight-bearing joints [2].

Chronic low back pain associated with degenerative conditions of the lumbar spine significantly impairs individuals' quality of life [3]. Due to the complex innervation of the spine and its surrounding structures, determining the specific cause of this low back pain can be challenging. Diagnosis is further complicated by the fact that radiological findings for these conditions do not necessarily correlate with the pain experienced by patients, often leading to inadequate symptom management [4] [5]. Management is difficult because taking the patient's history and performing a clinical examination are complex tasks, given the lack of a consensus or a formal "gold standard" approach [6]. Physical examination of the lumbar spine involves inspection and palpation. Additionally, active and passive tests of spinal range of motion may be performed [7].

Lumbar osteoarthritis (lumbar spondyloarthrosis) is one of the most common degenerative conditions. Its etiology stems from a multifactorial pathogenesis [4]. The clinical presentation of symptomatic lumbar osteoarthritis typically involves referred pain, morning stiffness, and restricted movement. Clinical examination helps rule out numerous causes of spinal pain, including neoplasms, disc herniation, and spinal stenosis. However, there are no validated orthopedic examination maneuvers capable of diagnosing lumbar osteoarthritis [8].

Intervertebral disc degeneration (discarthrosis) is defined as the wear and tear of the disc. Advanced stages lead to a loss of water content, reduced disc height, and segmental instability. Establishing a precise diagnosis for lumbar discarthrosis is difficult; treatment is controversial, and treatment failures are common [9] [10].

Spondylolisthesis is characterized by the slippage of a vertebra relative to the one beneath it. Forward displacement is termed anterolisthesis; backward displacement, retrolisthesis; and lateral displacement, laterolisthesis. The clinical presentation varies widely, ranging from asymptomatic cases to those involving severe pain, neurological impairment, and functional disability [11]. Degenerative spondylolisthesis primarily affects the elderly, with a marked predilection for women [12].

Early diagnosis and appropriate management of these degenerative spinal conditions are essential. To establish a definitive diagnosis, clinicians can use computed tomography (CT), magnetic resonance imaging (MRI), and conventional radiography (CR) [11]. However, obtaining CT or MRI scans is time-consuming and costly, making them difficult to access in resource-poor settings. High-quality CR can facilitate definitive diagnosis—being inexpensive and easily accessible [13]—and improve patient management [14] [15].

Several studies conducted in sub-Saharan Africa and the Democratic Republic of Congo have demonstrated a strong correlation between carrying loads on the head or back and the development of degenerative spinal lesions among certain women in rural and peri-urban areas [16]-[19].

A study conducted on the outskirts of Kisangani—examining the socio-anthropometric profile of women suffering from chronic low back pain in the Lubuya Bera sector [20]—revealed that these women had started carrying loads through Liyamba at a very early age and carried heavy loads of more than 50 kg, sometimes corresponding to double her body mass, at an almost daily rate on their backs using a type of basket known as a "Liyamba", as illustrated in **Figure 1**.

Figure 1. (a) Woman carrying a basket of dried cassava chips (fufu); (b) carrying firewood; (c) carrying a basket of fresh maize cobs.

A hypothesis was proposed: this artisanal practice, which adhered to no relevant guidelines, could alter spinal alignment and lead to the early onset of degenerative lumbar lesions. Clinical examination and conventional radiography were essential for establishing a definitive diagnosis [20].

Previous research had analyzed specific aspects of lifting or manual handling in various international and African settings—covering psychosocial, ergonomic, clinical, radiological, and therapeutic factors, as well as risk factors for chronic low back pain [21]-[23]—without addressing the clinical and paraclinical aspects of carrying heavy loads on the back in resource-limited settings like the one in this study.

Furthermore, there was a significant lack of awareness regarding proper techniques for carrying loads on the back and a lack of scientific evidence concerning the adverse effects on the lumbar spine in this resource-poor environment, where women typically sought hospital care only in cases of advanced lesions or confirmed complications [22].

The objective of this research was to determine the clinical and radiological status of women suffering from chronic low back pain in the peri-urban area of Kisangani who carried heavy loads on their backs (a practice known as "Liyamba"), in order to assess the health issues they faced.

2. Material and Methods

2.1. Study Site and Population

This study was conducted in the Lubuya Bera administrative sector, on the outskirts of the city of Kisangani in the northeastern Democratic Republic of Congo. The study population consisted of women of reproductive age (15 to 49 years old) suffering from chronic low back pain.

2.2. Study Type and Period

A case-control study was conducted involving women aged 15 to 49 over a twenty-two-month period, from March 2024 to December 2025.

This clinical-radiological study took place during this period because the women had recently been recruited for the determination of their socio-anthropometric profiles, they were available and unlikely to be lost to follow-up.

2.3. Sample, Sampling Technique, and Inclusion/Exclusion Criteria

Based on an expected exposure probability of 0.25 (P2*) among unaffected individuals, an odds ratio (OR) of 2, a 95% confidence level, and a relative precision of 50%, the minimum sample size was calculated to be 76 subjects [24]. Consequently, the study included 76 cases (women with chronic low back pain) and 76 controls (unaffected women), recruited from the same setting and sharing similar characteristics.

To select the study participants, three healthcare facilities located along three different road routes were identified as consultation sites. These facilities were chosen to ensure good representativeness, given their satisfactory patient volume and service utilization rates, as well as their significant social influence within their respective communities.

The facilities selected were the Mbilinga Referral Health Center (at the 15 km mark) for the Buta route, the Ngene Ngene Referral Health Center (at the 16 km mark) for the Ituri route, and the Banduku Referral Health Center (at the 9 km mark) for the Isangi route.

Community Mobilization Unit (CAC) committees and Community Health Workers (RECOs) associated with these facilities were trained to raise awareness, identify, and recruit eligible women suffering from low back pain (lumbago) in their respective areas. Head nurses (HN) at each facility were trained in the use of data collection forms and other necessary equipment. All recruited women were registered and listed by the CAC chairpersons, and the lists were then forwarded to the respective head nurses for data centralization. In consultation with the HN team, an interview schedule was established, and medical appointments were arranged for the female respondents—organized by road route—for consultations as required.

Hundreds of women were examined and treated based on their presenting complaints. Following these medical consultations, a non-probability convenience sample was used to select 26 cases from the Mbilinga Referral Health Center, 25 from the Banduku Center, and 25 from the Ngene Ngene Center.

Controls were recruited from among family members accompanying sick relatives, as well as women receiving treatment for other health issues at these facilities who had freely consented to participate in the study [20].

2.4. Inclusion and Exclusion Criteria

2.4.1. As a Case

Inclusion criteria: having received treatment on multiple occasions or having experienced regular daily lower back pain for 3 months or more; woman of childbearing age defined as a woman aged 15 to 49 who menstruates regularly or is experiencing amenorrhea due to pregnancy or lactation [20]; woman residing or active within the Lubuya Bera Sector community who has freely consented to participate in this study.

Exclusion criteria: woman with pain of traumatic origin; woman with a history of a known vertebral lesion—whether congenital or acquired, treated or untreated (traumatic, metabolic, infectious, dystrophic, etc.).

2.4.2. As a Control

Female subject, aged 15 to 49, residing in the Lubuya Bera Sector community, who does not have experienced regular daily lower back pain for 3 months or is being treated for another condition or is accompanying a patient with chronic low back pain during their treatment, and has freely consented to participate in this study.

2.4.3. Variables of Interest

1) **Dependent variable**: chronic low back pain (present or absent).

2) **Independent variables**

- Self-reported medical complaints regarding low back pain included: mode of onset, pattern, intensity, duration of morning stiffness, aggravating factors, relieving factors, and involvement of non-lumbar joints.

- Self-reported gynecological, obstetric, and surgical data included obstetric history (number of miscarriages and infant deaths, history of Cesarean section or other laparotomy); pelvic organ prolapse and abdominal wall hernia were assessed during the physical examination.
- Physical data collected during the examination included assessment of spinal alignment (viewed from the back and side) and spinal mobility (flexion, left and right lateral bending, and left and right rotation).
- Radiological data included findings from conventional X-rays: normal, disc space narrowing, areas of osteosclerosis, osteophytes, vertebral compression, fracture lines, and vertebral body slippage. The definitive radiological diagnosis included disc degeneration, lumbar osteoarthritis, spondylolisthesis, lumbar scoliosis, and the location of the degenerative condition.

Low back pain intensity at the consultation was estimated using the Visual Analog Scale (VAS) ranging from 0 to 10, where 0 represented no pain and 10 represented the worst pain ever experienced. In this study, pain intensity was categorized as follows: mild (0 - 4), moderate (5 - 6), and severe (7 - 10). The self-reported duration of morning spinal stiffness (impairment) was assessed using a 3-point Likert scale (0 = none, 1 ≤ 30 min, or 2 > 30 min). In this study, this morning impairment was evaluated relative to the time of rising: 0 = no impairment (activity possible immediately upon waking), 1 ≤ 30 min (impairment resolves before rising), and 2 > 30 min (impairment persists after rising). Lateral flexion was considered limited if the patient, while standing, was unable to bend sideways and reach beyond the level of the knee with their fingertips. Limited rotation was defined as asymmetry in turning left or right while seated; limited lumbar flexion was measured as the fingertip-to-floor distance in centimeters [25]-[28].

Pelvic organ prolapse (POP) was defined as the descent of pelvic structures—including the anterior or posterior vaginal wall, uterus, cervix, or vaginal apex—into or beyond the vaginal canal, resulting from the weakening of pelvic floor supporting tissues, including muscles, fascia, and ligaments [29] [30]. The criteria used to classify the degree of prolapse were as follows. At stage I, the respondent has the sensation of something slipping slightly into the vagina, without perceiving anything at the vaginal opening. At stage II, she feels something slipping down to the level of the vaginal opening. At stage III, the uterus has descended, and the uterine body protrudes up to 1 cm beyond the vaginal opening. At stage IV, more than 1 cm of the uterus protrudes from the vaginal opening; she experiences difficulty walking and seeks medical attention for this [31].

2.5. Enrollment Procedure

Clinical examinations were conducted at medical facilities within the Lubuya Bera administrative sector—specifically the Mbilinga Referral Health Center (PK 15, Buta Road), the Banduku Health Center (PK 9, Yangambi Road), and the Ngenengene Center (PK 16, Bangboka Road) [20]. Following the examination, each participant was issued a referral slip for a dorso-lumbosacral spine X-ray (anteroposterior and lateral views) to be performed at the Kisangani University Clinics (CUKIS).

Lists of participants were compiled by health facility, and imaging appointments were scheduled in groups of 5 to 10 women to avoid overloading the service.

A formal request for a fee reduction was submitted to the CUKIS Steering Committee, resulting in a one-third discount on imaging costs. Consequently, the principal investigator covered all expenses associated with the participants' X-rays.

2.6. Data Collection Technique

Data collection was retrospective. The clinical examination of the women followed a pre-established data collection form covering all independent variables. Furthermore, the women surveyed were encouraged to raise any health issues they were experiencing during the consultation.

2.7. Measurement Protocol

From July to December 2025, the interpretation of radiographic images for both cases and controls was performed by a team of radiologists under the supervision of a Full Professor specializing in medical imaging from the University of Kinshasa, assisted by two senior assistants—one from the University of Kisangani and the other from the University of Kinshasa. The written radiographic reports for each participant were provided for analysis. All radiographic images were produced at the CUKIS Medical Imaging Department under the supervision of a medical imaging specialist. The evaluators remained blinded to the participants' clinical and physical data.

The CUKIS radiology department was equipped with an Agfa Healthcare X-ray unit (CR 10-X, CR 30-X series) featuring a digital detector.

X-ray images of the thoraco-lumbo-sacral spine were taken in anteroposterior and lateral views with the participant standing barefoot, undressed down to the level of the buttocks, and hands clasped above the head, at a distance of approximately 1 meter from the radiation source [32].

An osteophyte was defined as a small bony outgrowth extending from the natural anatomical boundaries of a lumbar vertebra [33].

Discarthrosis was defined as narrowing or a reduction in the height of the space between two adjacent lumbar vertebrae, occurring at a single level (isolated) or at multiple levels (multilevel) [4] [25].

Structural lumbar osteoarthritis was defined radiologically by the presence of discarthrosis, vertebral endplate sclerosis, and osteophytes on lumbar radiographs, occurring either at a single level (isolated lumbar osteoarthritis) or at multiple levels (multilevel lumbar osteoarthritis) [4] [25] [34].

The severity of spondylolisthesis (anterolisthesis) was classified into five grades using the Meyerding system, based on the extent of the slippage of the superior vertebra over the inferior one: 0 - 25% was Grade I, 25% - 50% was Grade II, 50% - 75% was Grade III, 75% - 100% was Grade IV, and greater than 100% was Grade

V, known as spondyloptosis [35] [12].

2.8. Data Analysis Technique

The collected data were organized into an Excel database and subsequently exported to STATA 15. Categorical data were described using proportions, while quantitative data were presented as mean ± SD and median with the interquartile range (p25 - p75), depending on whether the distribution was symmetrical. Statistical inference was performed using Pearson's chi-square test for categorical variables, and Student's t-test or Fisher's test for quantitative variables, based on their respective conditions of application. Odds ratios (ORs) were calculated for dichotomous variables to identify factors associated with chronic low back pain in the context of this study. Finally, variables showing a significant association in the bivariate analysis were included in a multivariate regression model using a stepwise forward selection approach; the adjusted odds ratio (AOR) was calculated at a 5% significance level [20].

2.9. Ethical Considerations

This study was approved by the Ethics Committee of the University of Kisangani (UNIKIS/CEP/006/2023). All cases and controls freely consented to participate in the study. Any participant suspected of being pregnant was removed from the sample and excluded from radiological examinations to avoid exposing the fetus to the harmful effects of X-rays. Participants were reimbursed for round-trip travel costs between Lubuya Bera and CUKIS and provided with a snack. All personnel who contributed to performing the examinations and analyzing the images were compensated.

3. Results

The mean age of women with chronic low back pain was 42.1 ± 6.0 years; the most significant clinical characteristics observed were sudden onset, constant pain, severe pain, and a duration of morning pain/stiffness exceeding 30 minutes. Any work requiring physical exertion was a factor that aggravated the pain, while medication intake was a significantly more effective pain-relief factor than other care alternatives. Other joints significantly affected were the knee and the hip (**Table 1**, **Table 2**).

Table 3 below shows that the anteroposterior view of the back revealed exclusively scoliotic features, whereas the lateral view predominantly showed lumbar hyperlordosis. Left and right lateral bending and rotation were severely restricted.

Table 4 shows that normal radiological findings differed significantly between cases and controls, with several characteristic lesions; the most frequent were simple disc degeneration, multilevel disc degeneration, simple lumbar osteoarthritis, and multilevel lumbar osteoarthritis. The most common sites for degenerative vertebral lesions were L4-L5, L5-S1, and L3-S1.

Table 5 shows that abortion, prolapse, Caesarean section, and Multilevel discarthrosis were factors associated with chronic low back pain ($p < 0.05$).

Table 6 shows that factors mentioned above were not associated with chronic low back pain.

Table 1. Medical complaints associated with low back pain.

Variables		Cases n = 76 (%)	Controls n = 76 (%)	Total N = 152	p-value
Age (mean et SD)	//////////////////////////	42.1 ± 6.0	28.9 ± 9.0	///////////////	0.001*
Onset	Sudden	2 (67)	1 (33)	3	0.007
	Unknown	0 (0)	9 (100)	9	
	Gradual	74 (53)	66 (47)	140	
Pattern	Unkown	0 (0)	1 (100)	1	0.001
	Intermittent	39 (34)	75 (66)	114	
	Constant	37 (100)	0 (0)	37	
Intensity	Mild	0 (0)	29 (100)	29	0.001
	Moderate	9 (16)	46 (84)	55	
	Severe	67 (99)	1 (1)	68	
Duration of morning pain/disability	No pain	0	41	41	0.001**
	≤30 minutes	18 (38.3)	29 (61.7)	47	
	>30 minutes	58 (90.6)	6 (9.4)	64	
Aggravating factor	Carrying new loads	54 (42)	75 (58)	129	0.001**
	Any physical work	22 (96)	1 (4)	23	
Relieving factor	Medication use	69 (78)	20 (22)	89	0.001**
	Rest	1 (2)	55 (98)	56	
	Traditional remedies	6 (86)	1 (14)	7	
Other affected joint	Neck	1 (33)	2 (67)	3	0.001**
	Back	1 (25)	3 (75)	4	
	Knee	43 (84)	8 (16)	51	
	Hip	18 (82)	4 (18)	22	
	None	13 (18)	59 (82)	72	

*T-student; **Chi carré de Pearson.

Table 2. Gynecological, obstetric, and surgical data. Certain co-morbidities—such as inguinal hernia, pelvic organ prolapse, or a history of Caesarean section, miscarriage, or infant death (occurring more than three times)—were associated with chronic low back pain ($p < 0.05$).

Variables	Categories	Cases n = 76 (%)	Controls n = 76 (%)	Total N = 152	p-value
Medical/surgical history	Inguinal hernia	10 (91)	1 (9)	11	0.007*

Continued

	Laparotomy	8 (67)	4(33)	12	
	None	58 (45)	71 (55)	129	
Gynecological/Obstetric history	Cesarean section	9 (82)	2 (18)	11	0.001*
	Pelvic organ prolapse	17 (94)	1 (6)	18	
	Implant	4 (22)	14 (78)	18	
	Myoma	2 (67)	1 (33)	3	
	None	44 (43)	58 (57)	102	
Abortion	1 to 2	0 (0)	26 (100)	26	0.001*
	3 to 4	72 (59)	50 (41)	122	
	>4	4 (100)	0 (0)	4	
Infant death	1 to 2	26 (30)	60 (70)	86	0.001*
	3 to 4	50 (76)	16 (24)	66	

*Pearson's chi-squared test.

Table 3. Physical and radiological data (diagnosis).

Variables	Categories	Cases n = 76 (%)	Controls n = 76 (%)	Total N = 152	p-value
Back posture (posterior view)	Normal	35	76	111	0.001*
	Scoliosis	41 (100)	0 (0)	41	
Back posture (lateral view)	Normal curvature	6 (10)	56 (90)	62	0.001*
	Lumbar hyperlordosis	70 (78)	20 (22)	90	
Hand-to-floor distance (Cm)	0	8 (10)	71 (90)	79	0.001**
	5	18 (86)	3 (14)	21	
	10	42 (98)	1 (2)	43	
	12	2 (100)	0 (0)	2	
	15	5 (83)	1 (17)	6	
	20	1 (100)	0 (0)	1	
Left lateral flexion	Limited	69 (93)	5 (7)	74	0.001*
	Normal	7 (9)	71 (91)	78	
Right lateral flexion	Limited	69 (93)	5 (7)	74	0.001*
	Normal	7 (9)	71 (91)	78	
Left rotation	Limited	69 (93)	5 (7)	74	0.001*
	Normal	7 (9)	71 (91)	78	
Right rotation	Limited	69 (93)	5 (7)	74	0.001*
	Normal	7 (9)	71 (91)	78	

*Pearson's chi-square; **Fisher's test.

Table 4. Radiological diagnosis.

Variables	Categories	Cases n = 76 (%)	Controls n = 76 (%)	Total N = 152	p-value
DIAGNOSTIC **RX**	Normal	16 (23)	54 (77)	70	0.001*
	Anterolisthesis I	3 (60)	2 (40)	5	
	Anterolisthesis II, simple discarthrosis	2 (67)	1 (33)	3	
	Anterolisthesis II, multilevel discarthrosis	1 (100)	0 (0)	1	
	Simple discarthrosis	14 (78)	4 (22)	18	
	Multilevel discarthrosis	9 (75)	3 (25)	12	
	Multilevel discarthrosis, left vertebral laterolisthesis	1 (100)	0 (0)	1	
	Multilevel discarthrosis, dextroconcave scoliosis	1 (50)	1 (50)	2	
	Multilevel discarthrosis, dextroconvex scoliosis	1 (100)	0 (0)	1	
	Thoracic hyperkyphosis	1 (100)	0 (0)	1	
	Multilevel lumbar osteoarthritis	8 (75)	4 (25)	12	
	Multilevel lumbar osteoarthritis, dextroconcave scoliosis	4 (100)	0 (0)	4	
	Multilevel lumbar osteoarthritis, dextroconvex scoliosis	0 (0)	1 (100)	1	
	Simple lumbar osteoarthritis	11(79)	3(21)	14	
	Simple lumbar osteoarthritis, dextroconcave scoliosis	1 (33)	2 (67)	3	
	Uninterpretable	1 (50)	1 (50)	2	
AFFECTED SITE	L1-L5	0 (0)	1	1	0.001*
	L1-S1	2 (50)	2 (50)	4	
	L2-L3	1 (100)	0 (0)	1	
	L2-L4	2 (67)	1 (33)	3	
	L2-L5	5 (100)	0 (0)	5	
	L2-S1	5 (100)	0 (0)	5	
	L3-L4	2 (100)	0 (0)	2	
	L3-L5	2 (100)	0 (0)	2	
	L3-S1	8 (67)	4 (33)	12	
	L4-L5	15 (83)	3 (17)	18	
	L4-S1	4 (67)	2 (33)	6	
	L5-S1	12 (67)	6 (33)	18	

*Fisher's test.

Table 5. Bivariate analysis of factors associated with chronic low back pain.

Variables	Categories	Chronic low back pain		OR	95% CI	p-value
		Present n = 76	Absent n = 76			
Abortion	Yes	76 (60)	50 (40)	-	-	0.001

Continued

	No	0 (0)	26 (100)			
Prolapse	Yes	15 (100)	0 (0)	-	-	0.001
	No	61 (45)	76 (55)			
Cesarean section	Yes	9 (82)	2 (18)	4.97	1.09 - 48.4	0.028
	No	67 (48)	74 (52)			
Multilevel lumbar osteoarthritis	Yes	12 (71)	5 (29)	2.63	0.8 - 10.0	0.076
	No	64 (47)	71 (53)			
Multilevel discarthrosis	Yes	14 (88)	4 (22)	4	1.17 - 17.5	0.013
	No	62 (46)	72 (54)			
Anterolisthesis	Yes	6 (75)	2 (25)	3.13	0.53 - 32.5	0.15
	No	70 (49)	74 (51)			

Table 6. Multivariate analysis of factors associated with chronic low back pain.

Variables	n (%)	aOR	95% CI	p-value
Abortion	126 (83)	0		
Cesarean section	11 (7)	1.47	−0.12 - 3.06	0.070
Prolapse	15 (10)	0		
Multilevel discarthrosis	18 (12)	0.87	−0.37 - 2.11	0.168

4. Discussion

This study aimed to determine the clinical and radiological status of women suffering from chronic low back pain in the peri-urban area of Kisangani, specifically those who carried heavy loads on their backs.

The medical complaints and physical signs observed in this study aligned with the clinical definition of chronic low back pain found in the literature, demonstrating persistent discomfort and an impaired quality of life for the affected women [36] [37].

The results of this study showed that the prevalence of pelvic organ prolapse and inguinal hernia was significantly higher among women with chronic low back pain (94% and 91%, respectively) compared to the control group (6% and 9%; $p < 0.001$). Many authors have reported similar findings [38] [39]. They posited that, in addition to commonly cited risk factors, such as advanced age, early childbearing, grand multiparity, vaginal delivery, short interpregnancy intervals, assisted delivery (e.g., vacuum extraction), high birth weight, high body mass index, and levator ani muscle malformations, repetitive heavy lifting during the peripartum period contributes to the increased incidence of pelvic organ prolapse and abdominal wall hernia in developing countries. This is attributed to the influence of relaxin, which causes the body's musculo-ligamentous structures to loosen and stretch. Other authors have noted that carrying heavy loads on the head or back—

as seen in this context—causes increased intra-abdominal pressure and raises overall biomechanical tension on the musculoskeletal tissues supporting the muscles and ligaments that anchor the pelvic organs; this places additional strain on weakened pelvic floor tissues, thereby accelerating the development of prolapse and the protrusion of viscera through weak points in the abdominal wall [29] [40] [41]. In this study, prolapse occurred in women of reproductive age. Tinelli [42] noted a high rate of pelvic organ prolapse in older, postmenopausal women and in those with high parity, attributed to ligamentous laxity resulting from senescence. However, he observed that certain postural alterations—specifically excessive lumbar curvature caused by poor lifting technique—could shift the vaginal axis toward a more vertical orientation in younger women, thereby facilitating uterine descent.

This study showed that the rate of spontaneous abortion was significantly higher among women with chronic low back pain (59%) compared to controls (41%, $p < 0.001$). Spontaneous abortion is documented as the most common pregnancy complication, occurring in approximately 10% to 15% of all confirmed and suspected pregnancies worldwide. Pregnancy loss can result from direct trauma, as well as stress and emotional distress stemming from physical, emotional, and sexual abuse [43]. Furthermore, recurrent spontaneous abortion can be caused by chromosomal or genetic abnormalities, anatomical anomalies (congenital and acquired), autoimmune diseases, pre-thrombotic states, endocrine factors, infections, and environmental or psychological factors [44].

In the context of this study in the Lubuya Bera community—an impoverished rural area—the need to transport food and non-food items for daily consumption, combined with sometimes difficult water supply conditions, compelled women to carry heavy loads even during vulnerable periods of their lives, such as early pregnancy. Given the challenges of diagnosing early pregnancy (first trimester) in an isolated rural setting, we concur with Alberman [45] that the true prevalence of recurrent miscarriage in the Lubuya Bera community might be higher than reported. Carrying and lifting loads during these times posed an increased risk of miscarriage due to reduced load-bearing capacity associated with ligamentous laxity. According to MacDonald [46], while carrying heavy loads could trigger an isolated miscarriage—through reduced uterine blood flow or physical stress capable of inducing preterm contractions—it was not identified as the primary cause of recurrent pregnancy loss. He estimated that high-intensity physical activity in women with a history of miscarriage could increase the risk of very early pregnancy loss. Similarly, Juhl [47], supported by Meierhofer [23], reached the same conclusion: frequent heavy lifting during pregnancy was identified as a potential risk factor for spontaneous miscarriage, particularly when accompanied by prolonged standing. Standing for more than two hours a day also increased the likelihood of preterm birth. However, these authors noted that evidence linking specific load-carrying practices—such as carrying loads on the head or back—to recurrent miscarriage had not yet been established.

This research showed that a history of Caesarean section was significantly more common among women with chronic low back pain (82%) compared to the control group (18%; $p < 0.001$). A link between Caesarean delivery and low back pain was noted; approximately 70% of women who underwent a Caesarean section reported back and lower back pain during their recovery [48]. Several indications for elective or emergency Caesarean sections were identified, notably fetal distress, fetopelvic disproportion, malpresentation, pre-eclampsia, uterine rupture, umbilical cord prolapse, and antepartum hemorrhage.

In the context of this study, where pregnant women continued to carry heavy loads on their backs, this physical strain—causing increased intra-abdominal pressure—could lead to changes in pelvic alignment. The documented risk was pelvic organ prolapse, which in turn contributed to fetal malpresentation [48].

According to Wilson [49], although no statistical correlation links the mode of delivery to the immediate onset of lower back pain, several factors specific to Caesarean sections could promote or aggravate existing lower back pain. For instance, Caesarean scars could create adhesions between internal tissues (fascia, muscles, organs). These scars tissues disrupted mobility and the distribution of physical loads, potentially resulting in persistent lower back pain.

Additionally, Gialdini C *et al.* [50] estimated that the incision of abdominal muscles and tissues temporarily reduced spinal support by weakening the abdominal wall, thereby placing greater strain on the back muscles to compensate. Furthermore, these authors noted that—while often transient—pain at the epidural or spinal anesthesia injection site was frequently reported by patients as a source of lower back discomfort. Finally, postoperative and postpartum factors—such as postural changes—played a role; following a Caesarean section, abdominal pain often led women to adopt a stooped posture to protect the incision. This misalignment created muscle tension in the lower back. Caring for the baby—specifically carrying, breastfeeding, or lifting the infant from the crib—placed strain on a back already made vulnerable by pregnancy hormones that loosen ligaments [51]. However, Bettaieb H *et al.* [52] demonstrated that the occurrence of lower back pain during the postpartum period did not depend on the circumstances of the pregnancy or delivery; nevertheless, its impact on women's quality of life appeared to be significant.

The results of the present study showed that the proportions of grade I and II degenerative anterolisthesis (**Figure 2(a)**) were significantly higher among patients with chronic low back pain (60% and 67%) compared to controls (40% and 37%; $p < 0.001$). A study conducted by Akkawi [35] demonstrated that the prevalence of degenerative spondylolisthesis was strongly age-dependent—common in individuals over 50 due to ligamentous hyperlaxity—and sex-dependent, with a female-to-male ratio of 6:1 attributed to hormonal influences. In a context comparable to the present study regarding women carrying heavy loads on their backs, Knapik *et al.* [53] demonstrated that when an individual walked while carrying a load in this manner, forward trunk inclination generated repetitive microtrauma to the vertebrae and other perivertebral structures with every step, causing constant mechanical stress. Even in women under the age of 50, excessive mechanical stress at each level of the lumbar spine can lead to intervertebral disc degeneration—characterized by loss of disc height—and laxity of the annulus fibrosus and facet joints. Wang *et al.* [54] estimated that this degeneration altered the wear patterns and deformation of the vertebral joints. The articular surface gradually shifted toward a sagittal and horizontal orientation, and its capacity to resist anterior shear forces diminished, resulting in vertebral segmental instability and progressive degenerative spondylolisthesis. For these authors, disc degeneration and degenerative spondylolisthesis reinforce each other, creating a vicious circle [54].

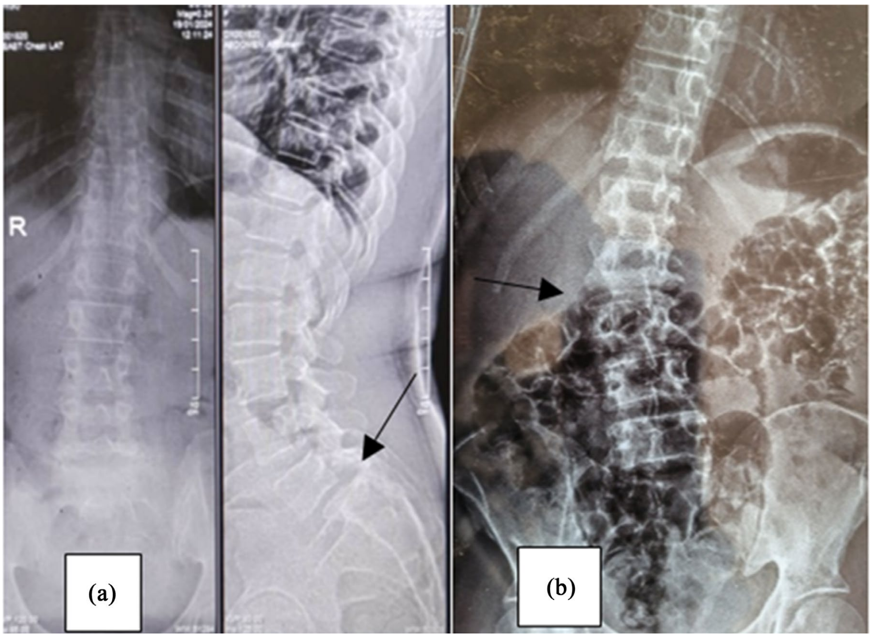

Figure 2. Radiographic images of women with chronic low back pain: (a) anterolisthesis at L5-S1 in a 38-year-old woman; (b) multilevel lumbar osteoarthritis (L2-L4) with right-convex scoliosis in a 41-year-old woman.

The results of the present study showed that the proportions of simple disc degeneration (discarthrosis), multilevel disc degeneration, simple lumbar osteoarthritis, and multilevel lumbar osteoarthritis (**Figure 2(b)**) were significantly higher among patients with chronic low back pain (78%, 75%, 79%, and 75%, respectively) compared to the control group (22%, 25%, 21%, and 25%; $p < 0.001$). These findings were consistent with those obtained by Goode *et al.* [21], who noted that radiographic images frequently obtained during initial consultations for incident chronic low back pain revealed spinal osteoarthritis.

In their study, Farshad *et al.* [55] found a high incidence of spondylophytes in the general population. They observed that their formation began as early as age 20. By age 40, small spondylophytes were present in the majority of the population, and by age 80, severe forms were present in almost all patients [55]. In the context of this study, where young women carried heavy loads on their backs, this activity regularly caused strain and mechanical stress on the spine. Ramirez *et al.* [56] noted that repetitive stress on spinal tissues—particularly under high spinal loads—was associated with a high risk of fatigue failure in vertebral tissues. Such fatigue of the lumbar paraspinal musculature was linked to impaired postural control and an increased risk of workplace injury. According to Chaib [57], activity-related lumbar injuries generally did not occur immediately following a traumatic event but rather developed once ligaments began to slacken after prolonged stretching. The body would respond by adopting alternative measures to maintain spinal stability. Muscle spasms could develop along the spine, triggered by a ligamentomuscular reflex in which stretched ligaments reacted rapidly by signaling overlying muscles to contract, thereby preventing spinal destabilization. This author also noted that the body responded to joint instability by inducing a low-grade inflammatory state, which potentiated degenerative changes—such as spondylophyte formation—that could help reduce the force per unit area acting on the joints.

In this study, excess load placed on the back muscles could lead to abnormal joint movements and result in injuries, changes in joint alignment, and the worsening of arthritis, as demonstrated by Lindsey *et al.* [4]. This arthritis was advanced due to the deterioration of the viscoelastic properties of synovial fluid—specifically hyaluronic acid, which acts as a lubricant and shock absorber for the spine. In addition to the decline in synovial fluid, leukotrienes and prostaglandins caused inflammation in the facet joints. This inflammation attracted neutrophils and macrophages, leading to vasodilation and venous congestion within the joint. The recurrent nature of the injury sensitized pain receptors (nociceptors) over time. Furthermore, insufficient blood supply contributed to the pathogenesis of intervertebral disc degeneration, demonstrating that osteoarthritis is a disorder directly linked to overuse and wear and tear [58] [59].

The results of this study showed that, in addition to lower back pain, the other joints significantly affected were the knee and the hip; among patients with chronic low back pain, the prevalence was 84% for the knee and 82% for the hip, compared to 16% and 18% in the control group ($p < 0.001$). The correlation between hip pain and low back pain appears to be primarily biomechanical and postural in nature. The hip and the lumbar spine are closely linked by the joint chain connecting the femur, the pelvis, and the vertebral column [21]. In the context of this study, where the patients with low back pain were required to carry heavy loads on their backs, this created an overload on the back and weight-bearing joints, leading to simultaneous wear in both joints—a condition known in English-speaking literature as "hip-spine syndrome".

According to Kechagias [60], when a hip became painful or stiff—due to hip osteoarthritis, for instance—the body would naturally alter its movement patterns to minimize pain. This could create spinal imbalance. Pain often resulted in a limp. To compensate for the hip's limited mobility, the back was subjected to asymmetrical or uncomfortable loads, potentially leading to long-term lower back pain. Furthermore, the patient might adopt an abnormal posture, giving rise to the various forms of scoliosis observed in this study (**Figure 2(b)**). Loss of hip flexibility forced the pelvis to tilt, often increasing lumbar hyperlordosis or creating compensatory muscle tension. Chang CC *et al.* [61], discussing "Hip-Spine Syndrome", described the strong interaction between these two regions (hip and lumbar spine), considering the joints interdependent. The hip is connected to the pelvis, which in turn is directly linked to the lumbar spine; any restriction in hip mobility disrupted the overall balance of the pelvis and, by extension, the spine. They described the concept of movement limitation: if the hip could no longer perform normal rotation or extension, the lumbosacral junction would "absorb" the body's rotational movements, accelerating wear on the discs or vertebral joints. However, Kouyoumdjian [62] observed that the psoas muscle acts as a direct bridge between the lumbar vertebrae and the femur; inflammation or tension—caused by hip osteoarthritis, for example—could radiate directly to the lower back. He also noted that muscle imbalance or gluteal muscle insufficiency placed an excessive load on the erector spinae muscles, thereby promoting lower back pain. Thus, Oshima *et al.* [63] observed that any change in alignment resulting from pathological or degenerative alterations in the knee, hip, or spine could lead to compensatory changes at other sites—along with the progression of deformities—in order to maintain postural balance [64].

This study showed that the most common sites for degenerative spinal lesions were L4-L5, L5-S1, and L3-S1. These results were consistent with those obtained by Musa [65], who noted that the segment most frequently affected by degenerative spondylolisthesis was L4-L5, while high-grade listhesis was more common at the L5-S1 level. These degenerative lesions predominantly occurred between L3 and S1 due to the anatomical configuration and mechanical stresses unique to these levels. These vertebrae formed a transition zone and were subjected to significant stress. According to Koslosky E *et al.* [66], the L5 vertebra possesses a distinctive anatomy. It is the final mobile vertebra of the spine. Its body is wedge-shaped—taller anteriorly than posteriorly—a feature that determines the lumbosacral angle. Its transverse processes are short and stout, and its inferior articular processes are oriented differently to interlock perfectly with the sacrum, creating a natural locking mechanism. This unique anatomy predisposed the area to very specific and intense mechanical stresses [65]. According to Lin *et al.* [67], the lumbosacral junction (L5-S1) served as the connecting point between the mobile section of the spine (the lumbar region) and the fixed section (the sacrum). The L5 vertebra bore almost the entire weight of the upper body. The L5-S1 junction formed an inclined angle, with the sacral plateau (S1) naturally tilted forward. Gravity exerted a constant shear force, pushing the L5 vertebra to slide along this "slope". In the context of this study, the women of Lubuya Bera carried heavy loads on their backs, thereby overloading the upper part of their spines. For Goode [21], the L4-L5-S1 region acted as the back's primary pivot point, combining maximum load-bearing with significant flexion mobility; this heavily stressed anatomical junction absorbed the full weight of the upper body, transferring the weight of the torso to the legs.

A bivariate analysis in this study—related to the radioclinical status of women who carry heavy loads on their backs by Liyamba—revealed that four variables were significantly associated with chronic low back pain.

A history of Caesarean section was associated with an odds ratio (OR) of 4.97. This meant that a Caesarean section performed on a woman in the peri-urban area of Kisangani increased the risk of developing chronic low back pain more than fourfold. This highlights the need to regulate the indications for and performance of Caesarean sections in resource-limited settings.

In this study, multilevel disc degeneration had an odds ratio of 4, degenerative anterolisthesis 3.13, and lumbar osteoarthritis 2.63; this indicates that these radioclinical diagnoses increased the risk of developing chronic low back pain fourfold, more than threefold, and more than twofold, respectively. These degenerative conditions were primarily diagnosed via conventional radiography in young women of childbearing age who were exposed to strenuous physical demands—specifically carrying heavy loads on their backs, sometimes using a traditional basket known as a "Liyamba".

However, a multivariate analysis revealed that, overall, the factors mentioned above were not associated with low back pain. This meant that, within the scope of this study, these factors—found in both those with and without low back pain—could not on their own account for the patients' chronic low back pain, given the potential involvement of various other factors and confounders.

5. Conclusion

This study clinically demonstrated that the female patient from Lubuya Bera, who suffered from chronic low back pain, exhibited all the characteristics of low back pain accompanied by hip and knee pain. Her medical history included a Caesarean section and recurrent spontaneous abortions, with comorbidities of pelvic organ prolapse and inguinal hernia. Conventional radiography revealed several degenerative conditions, the most frequent being anterolisthesis, simple disc degeneration, multilevel disc degeneration, simple lumbar osteoarthritis, and multilevel lumbar osteoarthritis, primarily affecting the L3 to S1 levels.

Limitations

Most of the clinical data collected for this study relied on self-reported health complaints and were subject to potential reporting bias. The failure to record neurological signs meant that radiating pain could not be characterized. A lack of sufficient financial resources prevented the performance of spinal CT scans—which were available in Kisangani—as well as the production of knee and hip radiographs. The small sample size may limit the generalizability of the findings. Therapeutic aspects and clinical management were not addressed in this study.

Current Knowledge on the Subject

- It has been shown that carrying loads on the back or head among women with chronic low back pain leads to degenerative lumbar spine conditions and disorders associated with increased intra-abdominal pressure.
- The impact on these women's quality of life appeared to be significant.

Contribution of Our Study to Existing Knowledge

- Clinical assessment revealed that women with chronic low back pain in Lubuya Bera lived with constant, intense lower back pain and prolonged morning stiffness, accompanied by hip and knee pain.
- Conventional radiography enabled the diagnosis of degenerative spinal conditions.

Future Outlook

Conduct further studies on the holistic management of these women with chronic low back pain, with the aim of improving their quality of life. Investigate the neurological impact by performing CT scans or even MRI scans in any suspected cases.

Author Contributions

First author: conception, data collection, redaction; Second et third authors: data statistics analysis; Fourth et the latest: conception et text correction.

Conflicts of Interest

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

References

[1] Dave, B.R., Krishnan, A., Rai, R.R., Degulmadi, D. and Mayi, S. (2021) The Effect of Head Loading on Cervical Spine in Manual Laborers. *Asian Spine Journal*, **15**, 17-22. https://doi.org/10.31616/asj.2019.0221

[2] Assadi, S.N. (2022) Carrying Load and Related Health Disorders and Disability. *Indian Journal of Occupational and Environmental Medicine*, **26**, 129-132. https://doi.org/10.4103/ijoem.ijoem_352_21

[3] Chiu, H.Y., Su, I.W., Yu, Y.W., Chen, Y.C., Chen, C.C. and Lin, J.H. (2023) Soreness or Sng: A Common Symptom with Differential Clinical Impact from Pain in Degenerative Lumbar Spine Diseases. *BMJ Open Quality*, **12**, e001982. https://doi.org/10.1136/bmjoq-2022-001982

[4] Lindsey, T. and Dydyk, A.M. (2023) Spinal Osteoarthritis. StatPearls.

[5] Sharma, R., Kamboj, K. and Bhardwaj, J. (2019) Gender Response and Safe Carrying Load Limit for Sugar Industry Workers. *International Journal of Occupational Safety and Ergonomics*, **25**, 51-60. https://doi.org/10.1080/10803548.2018.1503401

[6] Custers, P., Van de Kelft, E., Eeckhaut, B., Sabbe, W., Hofman, A., Debuysscher, A., *et al.* (2024) Clinical Examination, Diagnosis, and Conservative Treatment of Chronic Low Back Pain: A Narrative Review. *Life*, **14**, Article 1090.

https://doi.org/10.3390/life14091090

[7] Sarzi-Puttini, P., Atzeni, F., Fumagalli, M., Capsoni, F. and Carrabba, M. (2005) Osteoarthritis of the Spine. *Seminars in Arthritis and Rheumatism*, **34**, 38-43. https://doi.org/10.1016/j.semarthrit.2004.03.011

[8] Gellhorn, A.C., Katz, J.N. and Suri, P. (2013) Osteoarthritis of the Spine: The Facet Joints. *Nature Reviews Rheumatology*, **9**, 216-224. https://doi.org/10.1038/nrrheum.2012.199

[9] Liyew, W.A. (2020) Clinical Presentations of Lumbar Disc Degeneration and Lumbosacral Nerve Lesions. *International Journal of Rheumatology*, **2020**, Article ID: 2919625. https://doi.org/10.1155/2020/2919625

[10] David, G., Ciurea, A.V., Iencean, S.M. and Mohan, A. (2010) Angiogenèse dans la dégénérescence du disque intervertébral lombaire. *Journal de la médecine et de la vie*, **3**, 154-161.

[11] Margetis, K. and Gillis, C.C. (2025) Spondylolisthesis. StatPearls.

[12] Mohile, N.V., Kuczmarski, A.S., Lee, D., Warburton, C., Rakoczy, K. and Butler, A.J. (2022) Spondylolysis and Isthmic Spondylolisthesis: A Guide to Diagnosis and Management. *The Journal of the American Board of Family Medicine*, **35**, 1204-1216. https://doi.org/10.3122/jabfm.2022.220130r1

[13] An, C.H., Lee, J.S., Jang, J.S. and Choi, H.C. (2022) Part Affinity Fields and Coordconv for Detecting Landmarks of Lumbar Vertebrae and Sacrum in X-Ray Images. *Sensors*, **22**, Article 8628. https://doi.org/10.3390/s22228628

[14] Nocetti, D., Villalobos, K., Marín, N., Monardes, M., Tapia, B., Toledo, M.I., *et al.* (2023) Radiation Dose Reduction and Image Quality Evaluation for Lateral Lumbar Spine Projection. *Heliyon*, **9**, e19509. https://doi.org/10.1016/j.heliyon.2023.e19509

[15] Chen, X., Deng, Q., Wang, Q., Liu, X., Chen, L., Liu, J., *et al.* (2022) Image Quality Control in Lumbar Spine Radiography Using Enhanced U-Net Neural Networks. *Frontiers in Public Health*, **10**, Article 891766. https://doi.org/10.3389/fpubh.2022.891766

[16] Kadota, J.L., McCoy, S.I., Bates, M.N., Mnyippembe, A., Njau, P.F., Prata, N., *et al.* (2020) The Impact of Heavy Load Carrying on Musculoskeletal Pain and Disability among Women in Shinyanga Region, Tanzania. *Annals of Global Health*, **86**, 17. https://doi.org/10.5334/aogh.2470

[17] Dansou, H.P., Akplogan, B., Lawani, M.M. and Dedjan, A. (2010) Le port de charge cephalique et ses consequences sur le rachis lombraire des femmes beninoises en milieu rural. *Journal de la Recherche Scientifique de l'Universite de Lome*, **8**. https://doi.org/10.4314/jrsul.v8i2.51927

[18] Echarri, J.J. and Forriol, F. (2002) Effect of Axial Load on the Cervical Spine: A Study of Congolese Woodbearers. *International Orthopaedics*, **26**, 141-144. https://doi.org/10.1007/s00264-002-0336-6

[19] Jumah, K.B. and Nyame, P.K. (1994) Relationship between Load Carrying on the Head and Cervical Spondylosis in Ghanaians. *West Africa Journal of Medicine*, **13**, 181-182.

[20] Talona, L.R., Ntsambi, E., Basandja, L.E., Losimba, L.J., Amisi, K.R., Tshimbila, K.J.M.V., *et al.* (2025) Socio-Anthropometric Profile of Women with Chronic Low Back Pain in a Peri-Urban Environment in the City of Kisangani. *Open Journal of Applied Sciences*, **15**, 1529-1553. https://doi.org/10.4236/ojapps.2025.156106

[21] Goode, A.P., Cleveland, R.J., George, S.Z., Schwartz, T.A., Kraus, V.B., Renner, J.B., *et al.* (2022) Predictors of Lumbar Spine Degeneration and Low Back Pain in the

Community: The Johnston County Osteoarthritis Project. *Arthritis Care & Research*, **74**, 1659-1666. https://doi.org/10.1002/acr.24643

[22] Motaung, T.G., Ellapen, T.J. and Paul, Y. (2022) The Consequence of Head-Loading on the Neuro-Musculoskeletal Health of the Ilembe District Youth of Kwazulu-Natal. *African Journal of Disability*, **11**, a1039. https://doi.org/10.4102/ajod.v11i0.1039

[23] Meierhofer, R., Tomberge, V.M.J., Inauen, J. and Shrestha, A. (2022) Water Carrying in Hills of Nepal-Associations with Women's Musculoskeletal Disorders, Uterine Prolapse, and Spontaneous Abortions. *PLOS ONE*, **17**, e0269926. https://doi.org/10.1371/journal.pone.0269926

[24] Lwanga, S.K., Lemeshow, S. and World Health Organization (1991) Détermination de la taille d'un échantillon dans les études sanométriques: Manuel pratique. Organisation mondiale de la Santé.

[25] Chamoro, M., Heymans, M.W., Oei, E.H.G., Bierma-Zeinstra, S.M.A., Koes, B.W. and Chiarotto, A. (2024) Diagnostic Models to Predict Structural Spinal Osteoarthritis on Lumbar Radiographs in Older Adults with Back Pain: Development and Internal Validation. *Osteoarthritis and Cartilage Open*, **6**, Article ID: 100506. https://doi.org/10.1016/j.ocarto.2024.100506

[26] Chiarotto, A., Maxwell, L.J., Ostelo, R.W., Boers, M., Tugwell, P. and Terwee, C.B. (2019) Measurement Properties of Visual Analogue Scale, Numeric Rating Scale, and Pain Severity Subscale of the Brief Pain Inventory in Patients with Low Back Pain: A Systematic Review. *The Journal of Pain*, **20**, 245-263. https://doi.org/10.1016/j.jpain.2018.07.009

[27] van den Berg, R., Jongbloed, L.M., Kuchuk, N.O., Roorda, L.D., Oostveen, J.C.M., Koes, B.W., *et al.* (2017) The Association between Self-Reported Low Back Pain and Radiographic Lumbar Disc Degeneration of the Cohort Hip and Cohort Knee (CHECK) Study. *Spine*, **42**, 1464-1471. https://doi.org/10.1097/brs.0000000000002228

[28] Smeets, R., Köke, A., Lin, C., Ferreira, M. and Demoulin, C. (2011) Measures of Function in Low Back Pain/Disorders: Low Back Pain Rating Scale (LBPRS), Oswestry Disability Index (ODI), Progressive Isoinertial Lifting Evaluation (PILE), Quebec Back Pain Disability Scale (QBPDS), and Roland-Morris Disability Questionnaire (RDQ). *Arthritis Care & Research*, **63**, S158-S173. https://doi.org/10.1002/acr.20542

[29] Kuo, C.H., Martingano, D.J. and Mikes, B.A. (2025) Pelvic Organ Prolapse. StatPearls.

[30] Bump, R.C., Mattiasson, A., Bø, K., Brubaker, L.P., DeLancey, J.O.L., Klarskov, P., *et al.* (1996) The Standardization of Terminology of Female Pelvic Organ Prolapse and Pelvic Floor Dysfunction. *American Journal of Obstetrics and Gynecology*, **175**, 10-17. https://doi.org/10.1016/s0002-9378(96)70243-0

[31] Akter, F., Gartoulla, P., Oldroyd, J. and Islam, R.M. (2016) Prévalence et facteurs de risque du prolapsus symptomatique des organes pelviens dans le Bangladesh rural: Étude transversale. *Revue internationale d'urogynécologie*, **27**, 1753-1759.

[32] Farmer, C., Haas, R., Wallis, J., O'Connor, D. and Buchbinder, R. (2024) Are Clinically Unimportant Findings Qualified as Benign in Lumbar Spine Imaging Reports? A Content Analysis of Plain X-Ray, CT and MRI Reports. *PLOS ONE*, **19**, e0297911. https://doi.org/10.1371/journal.pone.0297911

[33] Taçyıldız, A.E. and İnceoğlu, F. (2024) Classification of Osteophytes Occurring in the Lumbar Intervertebral Foramen. *Tomography*, **10**, 618-631. https://doi.org/10.3390/tomography10040047

[34] Lane, N.E., Nevitt, M.C., Genant, H.K. and Hochberg, M.C. (1993) Reliability of New

Indices Radiographic Osteoarthritis of the Hand and Hip and Lumbar Disc Degeneration. *The Journal of Rheumatology*, **20**, 1911-1918.

[35] Akkawi, I. and Zmerly, H. (2000) Degenerative Spondylolisthesis: A Narrative Review. *Acta Biomedica*, **92**, e2021313.

[36] Agence Nationale d'Accréditation et d'Evaluation en Santé (ANAES) (2000) Diagnostic, prise en charge et suivi des malades atteints de lombalgie chronique. ANAES.

[37] Chenot, J.F., Greitemann, B., Kladny, B., Petzke, F., Pfingsten, M. and Schorr, S.G. (2017) Non-Specific Low Back Pain. *Deutsches Ärzteblatt International*, **114**, 883-890. https://doi.org/10.3238/arztebl.2017.0883

[38] Nygaard, I.E. and Shaw, J.M. (2016) Physical Activity and the Pelvic Floor. *American Journal of Obstetrics and Gynecology*, **214**, 164-171. https://doi.org/10.1016/j.ajog.2015.08.067

[39] Padoa, A., Braga, A., Brecher, S., Fligelman, T., Mesiano, G. and Serati, M. (2025) Pelvic Organ Prolapse: Current Challenges and Future Perspectives. *Journal of Clinical Medicine*, **14**, Article 7313. https://doi.org/10.3390/jcm14207313

[40] Koyuncu, A., Kadota, J.L., Mnyippembe, A., Njau, P.F., Sijali, T.R., McCoy, S.I., *et al.* (2021) Heavy Load Carrying and Symptoms of Pelvic Organ Prolapse among Women in Tanzania and Nepal: An Exploratory Study. *International Journal of Environmental Research and Public Health*, **18**, Article 1279. https://doi.org/10.3390/ijerph18031279

[41] Masenga, G.G., Shayo, B.C. and Rasch, V. (2018) Prevalence and Risk Factors for Pelvic Organ Prolapse in Kilimanjaro, Tanzania: A Population Based Study in Tanzanian Rural Community. *PLOS ONE*, **13**, e0195910. https://doi.org/10.1371/journal.pone.0195910

[42] Tinelli, A., Malvasi, A., Rahimi, S., Negro, R., Vergara, D., Martignago, R., *et al.* (2010) Age-Related Pelvic Floor Modifications and Prolapse Risk Factors in Postmenopausal Women. *Menopause*, **17**, 204-212. https://doi.org/10.1097/gme.0b013e3181b0c2ae

[43] Gufue, Z.H., Hailu, H.T., Atsbaha, A.H., Kiros, B.M., Tsegay, E.W. and Mengesha, M.B. (2024) Lived Experiences of Intimate Partner Violence Survivors during Pregnancy and Who Had Spontaneous Abortions: A Phenomenological Study to Inform Survivor-Centered Strategies. *Women's Health*, **20**. https://doi.org/10.1177/17455057241305069

[44] Wang, B., Li, Q., Li, C. and Li, S. (2025) The Trends of Changes in Monitoring Indicators Related to the Risk of Recurrent Spontaneous Abortion. *Medicine*, **104**, e43604. https://doi.org/10.1097/md.0000000000043604

[45] Alberman, E. (1992) Spontaneous Abortions: Epidemiology. In: Stabile, I., Grudzinskas, J.G. and Chard, T., Eds., *Spontaneous Abortion*, Springer, 9-20. https://doi.org/10.1007/978-1-4471-1918-0_2

[46] MacDonald, L.A., Waters, T.R., Napolitano, P.G., Goddard, D.E., Ryan, M.A., Nielsen, P., *et al.* (2013) Clinical Guidelines for Occupational Lifting in Pregnancy: Evidence Summary and Provisional Recommendations. *American Journal of Obstetrics and Gynecology*, **209**, 80-88. https://doi.org/10.1016/j.ajog.2013.02.047

[47] Juhl, M., Strandberg-Larsen, K., Larsen, P.S., Andersen, P.K., Svendsen, S.W., Bonde, J.P., *et al.* (2012) Occupational Lifting during Pregnancy and Risk of Fetal Death in a Large National Cohort Study. *Scandinavian Journal of Work, Environment & Health*, **39**, 335-342. https://doi.org/10.5271/sjweh.3335

[48] Islamiah Zahroh, R., Bohren, M. and Pilar Betrán, A. (2025) Responses to Increased

Rates of Caesarean Births. *Bulletin of the World Health Organization*, **103**, 799-806. https://doi.org/10.2471/blt.25.293141

[49] Wilson, A., Kaur, H., Hassan, A.A., Mbwele, B., Sobhy, S., Calvo, G.R., *et al.* (2025) Variations in Caesarean Section Outcome Reporting in Low- and Middle-Income Countries: A Systematic Review. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, **307**, 61-70. https://doi.org/10.1016/j.ejogrb.2025.01.039

[50] Gialdini, C., Chamillard, M., Diaz, V., Pasquale, J., Thangaratinam, S., Abalos, E., *et al.* (2024) Evidence-Based Surgical Procedures to Optimize Caesarean Outcomes: An Overview of Systematic Reviews. *eClinicalMedicine*, **72**, Article ID: 102632. https://doi.org/10.1016/j.eclinm.2024.102632

[51] Ologunde, R., Vogel, J.P., Cherian, M.N., Sbaiti, M., Merialdi, M. and Yeats, J. (2014) Assessment of Cesarean Delivery Availability in 26 Low- and Middle-Income Countries: A Cross-Sectional Study. *American Journal of Obstetrics and Gynecology*, **211**, 504.e1-504.e12. https://doi.org/10.1016/j.ajog.2014.05.022

[52] Bettaieb, H., Ben Ayed, H., Boudokhane, M., Rim, B., Wiem, H., Dougui, M., *et al.* (2023) Facteurs associés à la survenue d'une lombalgie en post-partum. *Revue du Rhumatisme*, **90**, A297-A298. https://doi.org/10.1016/j.rhum.2023.10.462

[53] Knapik, J.J. and Reynolds, K. (2015) Load Carriage-Related Injury Mechanisms, Risk Factors, and Prevention. In: Gefen, A. and Epstein, Y., Eds., *The Mechanobiology and Mechanophysiology of Military-Related Injuries*, Springer, 107-137. https://doi.org/10.1007/8415_2014_182

[54] Wang, R., Ru, N., Liu, Q., Zhang, F., Wu, Y., Guo, C., *et al.* (2024) Risk Factors Analysis and Predictive Model of Degree I Degenerative Lumbar Spondylolisthesis. *Journal of Orthopaedic Surgery and Research*, **19**, Article No. 831. https://doi.org/10.1186/s13018-024-05346-y

[55] Farshad, M., Cornaz, F., Spirig, J.M., Sutter, R., Farshad-Amacker, N.A. and Widmer, J. (2022) Spondylophyte Classification Based on Biomechanical Effects on Segmental Stiffness. *The Spine Journal*, **22**, 1903-1912. https://doi.org/10.1016/j.spinee.2022.06.001

[56] Ramirez, V.J., Bazrgari, B., Gao, F. and Samaan, M. (2022) Low Back Biomechanics during Repetitive Deadlifts: A Narrative Review. *IISE Transactions on Occupational Ergonomics and Human Factors*, **10**, 34-46. https://doi.org/10.1080/24725838.2021.2015642

[57] WHO Scientific Group on the Burden of Musculoskeletal Conditions at the Start of the New Millennium (2003) The Burden of Musculoskeletal Conditions at the Start of the New Millennium: Report of a WHO Scientific Group (No. 919). World Health Organization.

[58] Hauser, R.A., Matias, D., Woznica, D., Rawlings, B. and Woldin, B.A. (2022) Lumbar Instability as an Etiology of Low Back Pain and Its Treatment by Prolotherapy: A Review. *Journal of Back and Musculoskeletal Rehabilitation*, **35**, 701-712. https://doi.org/10.3233/bmr-210097

[59] Sobczyk, M.K., Faber, B.G., Southam, L., Frysz, M., Hartley, A., Zeggini, E., *et al.* (2024) Causal Relationships between Anthropometric Traits, Bone Mineral Density, Osteoarthritis and Spinal Stenosis: A Mendelian Randomisation Investigation. *Osteoarthritis and Cartilage*, **32**, 719-729. https://doi.org/10.1016/j.joca.2023.12.003

[60] Kechagias, V.A. and Grivas, T.B. (2024) Hip-Spine and Knee-Spine Syndrome: Is Low Back Pain Improved after Total Hip and Knee Arthroplasty? *Cureus*, **16**, e57765. https://doi.org/10.7759/cureus.57765

[61] Chang, C.C., Kuo, F.C., Yang, F.S., Chang, C.Y., Hsu, C.C., Lu, M.L., *et al.* (2026)

Specialty-Related Differences in Diagnosing Hip-Spine Syndrome: A Multi-Center Retrospective Cohort Study. *BMC Musculoskeletal Disorders*, **27**, Article No. 154. https://doi.org/10.1186/s12891-025-09479-x

[62] Kouyoumdjian, P. (2024) How the Hip-Spine Relationship Influences Total Hip Arthroplasty. *Orthopaedics & Traumatology: Surgery & Research*, **110**, Article ID: 103773. https://doi.org/10.1016/j.otsr.2023.103773

[63] Oshima, Y., Watanabe, N., Takeoka, T., Kajikawa, Y., Yotsumoto, T. and Majima, T. (2025) Preoperative Abnormal Posture Improves after Total Knee Arthroplasty: Knee-Hip-Spine Syndrome. *The Journal of Arthroplasty*, **40**, 416-422. https://doi.org/10.1016/j.arth.2024.08.028

[64] Govil, G., Tomar, L. and Dhawan, P. (2022) Knee-Spine Syndrome: Management Dilemma When Knee Osteoarthritis Coexists with Spine Degeneration. *Cureus*, **14**, e24939. https://doi.org/10.7759/cureus.24939

[65] Musa, G., Barrientos Castillo, R.E., Slabov, M.V., Chirwa, K., Chmutin, G.E., Ramirez, M.D.J.E., *et al.* (2022) Degenerative Grade 3 Spondylolisthesis Management: A Case Report and Literature Review. *Cureus*, **14**, e29374. https://doi.org/10.7759/cureus.29374

[66] Koslosky, E. and Gendelberg, D. (2020) Classification in Brief: The Meyerding Classification System of Spondylolisthesis. *Clinical Orthopaedics & Related Research*, **478**, 1125-1130. https://doi.org/10.1097/corr.0000000000001153

[67] Lin, L.H., Lin, T.Y., Chang, K.V., Wu, W.T. and Özçakar, L. (2024) Effectiveness of Lumbar Segmental Stabilization Exercises in Managing Disability and Pain Intensity among Patients with Lumbar Spondylolysis and Spondylolisthesis: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Spine*, **49**, 1512-1520. https://doi.org/10.1097/brs.0000000000004989