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# Epidemiological Insights into Work-Related Low Back Pain Among Industrial Laborers of Khyber Pakhtunkhwa, Pakistan

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## KEYWORDS

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## DECLARATIONS

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## ABSTRACT

**Background:** Low back pain is among the most common occupational health problems worldwide, yet its burden among industrial laborers in Khyber Pakhtunkhwa, Pakistan, remains underexplored. **Objective:** To explore epidemiological insights into work-related low back pain among industrial laborers of Khyber Pakhtunkhwa, Pakistan. **Methodology:** A descriptive cross-sectional study was conducted for a 1-year of time period from May 2024 to May 2025 among 330 male industrial laborers from three industries in Gadoon Industrial Estate, Swabi, Khyber Pakhtunkhwa. Participants were recruited using convenience sampling, and data were collected using a Nordic Musculoskeletal Questionnaire. Workers who had a previous history of spinal trauma or surgery, or any congenital deformities of the spine, systemic musculoskeletal or neurological diseases such as rheumatoid arthritis, ankylosing spondylitis, or multiple sclerosis were excluded from the study. Descriptive analysis was performed using SPSS version 27 to calculate prevalence, frequencies, and percentages were calculated. **Results:** The prevalence of low back pain was 233(70.6%). The most affected age group was 40-55 years (97.4%), followed by 25-40 years (80.1%). Longer work duration was strongly associated with low back pain; workers with 15-20 years of experience reported a 100% prevalence. Daily working hours also influenced outcomes, with the highest prevalence among those working ≥12 hours (81.8%). Standing was the most frequently reported position contributing to pain (38.8%), followed by sitting (34.8%). Low back pain significantly interfered with personal care (41.6%), traveling (59.2%), sitting/standing (74.2%), and lifting objects (74.2%). Most affected workers reported mild (46.4%) or moderate (37.3%) pain, while 15.5% experienced severe pain. **Conclusion:** Low back pain is highly prevalent among industrial workers in Khyber Pakhtunkhwa, particularly among older workers, those with longer work histories, and extended hours. Standing posture and prolonged sitting are key occupational risk factors.

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## INTRODUCTION

Low back pain (LBP) is a major cause of pain, disability, and productivity loss in the world. It causes hundreds of millions of people to have their years lived with disability annually and is the largest contributor to years lived with disability in the world.[1] The population growth and ageing have led to an absolute increase in the burden of LBP, and the LBP is among the public-health issues in high- and low-income environments that should be given priority in prevention and rehabilitation.[2,3] The estimates of the epidemiological size of the affected populations are very high: point and period prevalence estimates across the world vary widely by method and setting, but a recent global burden of disease analysis has found hundreds of millions of prevalent cases of LBP and similar estimates as to LBP being at the very top of the disability list.[2]

Working-age populations have a significant contribution to LBP through occupational exposures; systematic reviews and recent meta-analysis of occupational studies show that the overall prevalence of work-related LBP is high (usually >50% in most labor intensive occupations), and that heavy manual handling, protracted standing or sitting, repetitive flexion/rotation of the trunk, and extended hours of work are strongly related to LBP.[4,5] LBP is multidimensional, and the combination of physical/ergonomic factors, psychosocial factors, lifestyle factors, and individual variables determines the risk and consequences. Lifting heavy items numerous times, awkward movements (bending, twisting), vibration of the whole body, and lengthy standing or sitting in one position are repeatedly involved in industrial cohorts.[6,7] Risk and worse outcomes are aggravated by non-occupational factors that include smoking, lack of physical fitness, comorbidities, and psychosocial stressors.[8,9]

Although the majority of high-quality LBP epidemiology is based on high-income nations, low- and middle-income countries (LMICs), and South Asia, in particular, evidence indicates that burdens are equally high, which in most cases are supplemented by strenuous informal and formal industrial labor, weaker occupational health regulation, and access to rehabilitation and ergonomics interventions.[3,10] A recent systematic review of occupational LBP indicated pooled prevalence estimates of more than 50% in most worker groups, which highlights the extent of the problem at the global level across the various economic settings.[4] In Pakistan, epidemiological research about LBP among industrial workers is lacking, but the available material indicates that the incidence of the condition is quite high among all occupational groups. LBP has prevalence rates of approximately 50-75% as per a cross-sectional study of Pakistani workers (tailors, coal miners, construction workers, health workers, drivers, and other types of workers and laborers) and there are occupational correlates of LBP, which are mainly manual handling, long working hours, long standing/sitting and poor ergonomic conditions at the workplace.[8,9,11-14]

A case in point is a survey of Punjab coal mine workers, which indicated that there exists a strong correlation between heavy manual load and lower-back symptoms.[9] In construction and other manual trades in Pakistan, LBP is among the most common complaints being reported; therefore, the burden of musculoskeletal disorders is high.[11] Similar studies in the region (Bangladesh, India, Thailand) support the claim that task repetition, awkward postures, and extended working hours in industrial and production-line environments in South Asia have increased the prevalence and risk of LBP due to these factors, and this is also evident in the Pakistani industrial estates.[5,15,16]

According to the literature on the Pakistan context, poor ergonomics, low awareness of occupational health, and excessive shifts are prevalent and can likely be altered.[11,12] Many occupational LBP surveys use standardized instruments such as the Nordic Musculoskeletal Questionnaire (NMQ), which has been translated and cross-culturally adapted in multiple settings and remains a pragmatic, validated tool for symptom prevalence and region-specific burden in workplace studies.[17] International comparability has been achieved using the NMQ (or local adaptations that have been validated) before and can be used to assist in occupational surveillance and intervention planning. Khyber Pakhtunkhwa (KP) has significant industrial estates and a high number of male industrial labor force that have not been adequately represented in published epidemiology.

The industries in and around the Gadoon Industrial Estate and Tarbela Industrial State, Swabi, KP, use the services of a high number of manual laborers who carry out repetitive and physically challenging

roles. Local data will be needed to measure burden, determine which occupational exposures prevail in this environment, and serve to inform specific ergonomic and occupational health interventions that can be practiced in the industrial environments of Pakistan. This research was therefore conducted to determine the prevalence of work-related low back pain in industrial workers in the three main industries in Gadoon Industrial estate, Swabi, Khyber Pakhtunkhwa, and to establish demographic and workplace risk factors (work history, daily working hours, posture, and activity-related limitations) in relation to LBP in this group.

## METHODOLOGY

This was a descriptive cross-sectional study, carried out for the period of one year from May 2024 to May 2025. Three major industries located at the Gadoon Industrial State were selected, namely Gadoon Textile Mills, Taj Syringes, and Tarbela Industries, Swabi, KP. These sites were chosen because they employ large numbers of manual workers in the study area engaged in physically demanding tasks. The target group was the male workforce in the industries who were actively working in these industries. The sample size was determined with a 95% confidence level, 5% margin of error, and an extra 10% to accommodate the non-response. The required sample size was calculated as 300, using a 95% confidence level and a 5% margin of error. To account for potential non-response, 10% was added to the total sample size, bringing the final target to 330 participants using convenience sampling.

The target population was male industrial workers between the ages of 18 and 55 years who were actively working in the aforementioned industries. Only those workers who had at least six months of continuous employment were included to get enough exposure to occupational risk factors. Every participant must be willing to participate and capable of making an informed consent. Workers were excluded from the study who had a previous history of spinal trauma or surgery, or any congenital deformities of the spine, such as scoliosis and kyphosis. People who had systemic musculoskeletal or neurological diseases such as rheumatoid arthritis, ankylosing spondylitis, or multiple sclerosis were also excluded to prevent confounding. No recruiting was done of those on long-term medical leave or absent during the data collection period. The study did not incorporate female workers since they were extremely underrepresented in the chosen industries and would not be able to participate in any significant subgroup analysis.

The valid and reliable musculoskeletal symptoms assessment tool, NMQ, was used to collect data. The questionnaire was modified to address occupational and demographic data related to the study population, such as age, work history, and working hours per day, prevalence and severity of LBP, postures and physical activities that cause pain, effect of LBP on daily activities (personal care, sitting/standing, lifting, traveling, walking). The questionnaire was conducted in English with the Urdu translation and in simplified words for smooth understanding. The questionnaires were administered face-to-face to the workers in their respective workplaces, and they were gathered once they were completed. This was a voluntary participation, and confidentiality was guaranteed to the respondents. The data were entered, coded, and analyzed with SPSS version 27. Descriptive statistics, like frequencies, percentages, and means, were analyzed to establish the prevalence and distribution of LBP.

## RESULTS

A total of 330 male industrial workers participated in the study, with a response rate of 100%. All participants, who were equally selected from each industry among 3 (110 each), for generalizability, responded to the study. The participants were aged between 18-55 years. The mean age of the participants was 29.5 ± 8.4 years. Among the total population, 140 participants were in the age range 18-25 years, 152 in 25-40 years, and 39 in 40-55 years. Figure 1 shows that the overall prevalence of LBP was 233(70.61%), while 97(29.39%) reported no current history of LBP, whereas Figure 2 illustrates that the prevalence of LBP increased as the age increased. The 40-55 years age group had the highest prevalence, 38(97.4%), followed by the 25-40 years age group, 121(80.1%), and the 18-25 years age group, 72(52.9%), as shown in Table 1.

All workers with 15-20 years of experience reported LBP (100%), followed by those with >20 years (94.7%) and 10-15 years (88.9%). In contrast, workers with less than 5 years of experience had a lower prevalence (57.3%). Longer daily working hours were associated with a higher prevalence, as depicted in Figure 2. Workers

with 12-hour shifts reported the highest prevalence (81.8%), followed by 10-hour shifts (80%) and 8-hour shifts (70.7%). Workers with 6-hour shifts reported no LBP. Among workers with LBP 233, mild pain was felt by 46.4% (108), moderate pain by 37.3% (87), and 16.31% (38) were in severe pain (Table 1).

Figure 4 indicates that prolonged standing was the most frequently reported posture associated with LBP (38.8%), suggesting that extended periods on one's feet may place significant strain on the lumbar region. Sitting was the second most common contributing posture (34.8%), highlighting the impact of sustained sedentary positions, particularly when ergonomic support is inadequate. Stooped or bending postures accounted for 25.3% of cases, reflecting the role of repetitive or awkward movements in aggravating back discomfort. A small proportion (1.1%) of respondents were uncertain about the specific posture linked to their pain. These results emphasize the importance of proper posture, frequent breaks, and ergonomic adjustments in preventing or reducing the burden of LBP.

Results show that LBP has a considerable impact on essential daily activities. Among the 233 participants, the most commonly affected function was lifting objects, with 74.2% reporting difficulty. This was followed by limitations in sitting or standing for prolonged periods (64.2%) and traveling (59.2%), highlighting how LBP disrupts both static and dynamic postures required in daily routines. Personal care activities, such as washing, dressing, and grooming, were affected in 41.6% of individuals, reflecting how pain interferes with basic self-care tasks. Similarly, walking and running abilities were impaired in 40.8% of participants, indicating a restriction in mobility and physical independence. The results emphasize that LBP is not just a source of discomfort but a major contributor to functional disability, limiting personal independence, productivity, and quality of life. The high prevalence of limitations in physically demanding activities such as lifting and standing suggests the need for workplace ergonomics, early rehabilitation, and preventive strategies.

## DISCUSSION

The present study found a high prevalence of work-related LBP of 70.6% among industrial laborers in Gadoon Industrial Estate, KP, Pakistan. This aligns with other findings in South Asia and globally, which report prevalence in similar worker populations of 50-65% or higher.[1,2,3] Occupational risk factors like prolonged working hours, standing posture, and greater years of work experience were strongly associated with LBP in our study, consistent with patterns seen in industrial settings elsewhere.[4,5] Age emerged as a strong correlate: workers aged 40-55 had nearly universal LBP in our sample. This mirrors findings from Pakistan's coal mining sector, where older age and longer exposure are associated with higher prevalence of LBP.[6]

Similarly, meta-analytic evidence shows that work duration increases risk: e.g., a meta-analysis found that workers with ≥5 years of service had significantly higher odds of LBP compared to those with <5 years.[7] Functional limitations (lifting, sitting/standing, travel) due to LBP were also substantial in our findings. These effects underscore the real-life impact of LBP, not just its prevalence, but how it disrupts daily and work life

**Figure 1: Prevalence of LBP in participants**

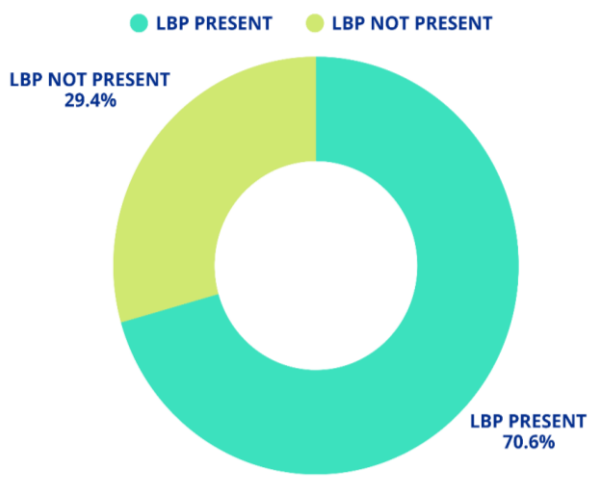



**Figure 2: Prevalence of LBP and working hours per day**

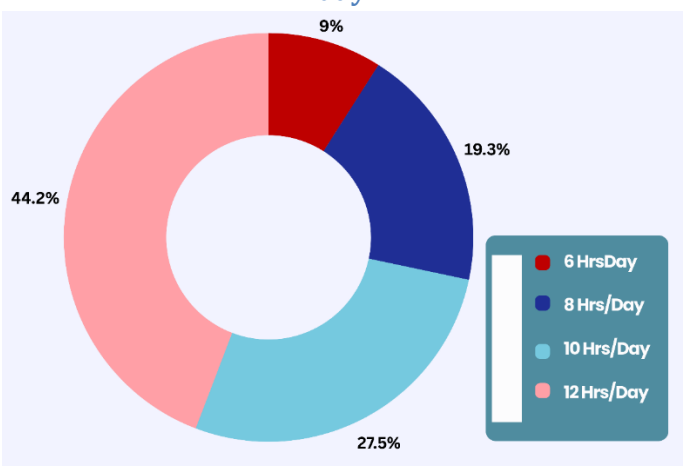


**Figure 3: Prevalence of LBP by age group**

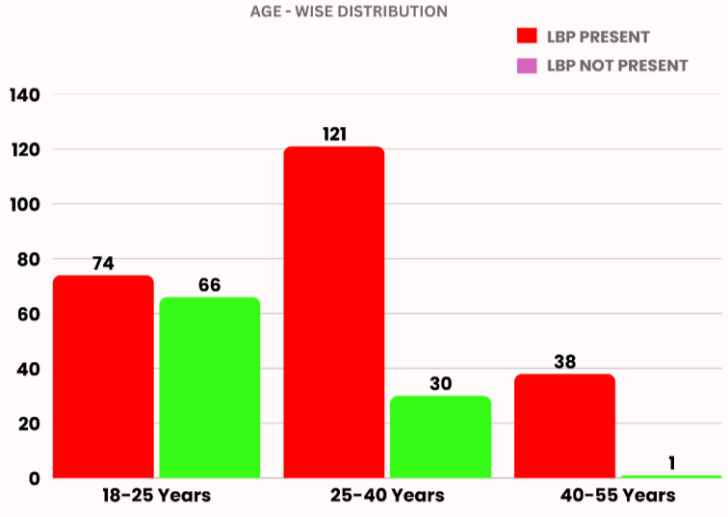
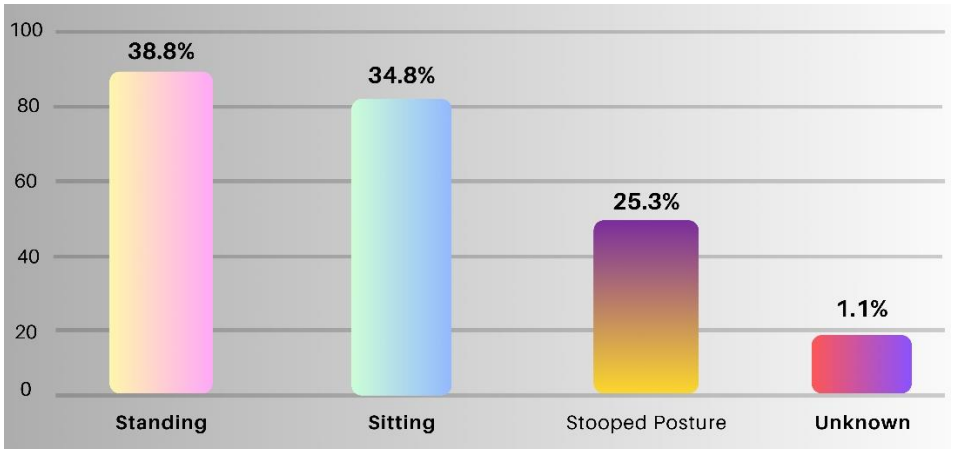



**Table 1: Frequency and percentages**

| Variables | | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Work Experience | <5 years | 102/178 | 57.3 |
| | 5-10 years | 55/70 | 78.6 |
| | 10-15 years | 40/45 | 88.9 |
| | 15-20 years | 18/18 | 100 |
| | >20 years | 18/19 | 94.7 |
| Pain score | Mild pain (1-3) | 108 | 46.4 |
| | Moderate pain (4-7) | 87 | 37.3 |
| | Severe pain (7-10) | 38 | 16.3 |
| | No Pain Reported | 97 | 29.4 |
| Functional Limitation | Personal care | 97 | 41.6 |
| | Traveling | 138 | 59.2 |
| | Sitting/standing | 150 | 64.2 |
| | Lifting objects | 173 | 74.2 |
| | Walking/running | 95 | 40.8 |

functions. Similar functional impairments have been reported in industrial worker studies in Bangladesh and other LMIC contexts.[5,8] Our observed prevalence (70.6%) is somewhat higher than the prevalence reported among industrial workers in Dhaka, Bangladesh, which was about 62% in a 2023 cross-sectional study.[5] That might be due to differences in workplace ergonomics, shift durations, or local practices in Pakistan vs Bangladesh. Moreover, in Pakistan, studies in coal mines found LBP prevalence between 60-75%, which is close but slightly lower.[6] Differences may be due to variation in physical exposures, rest breaks, or regulatory oversight. The association of prolonged standing posture as a risk is well supported. The narrative review of Pakistani workers identified static positions and prolonged working hours as common risk factors across professions in Pakistan.[9] The association of standing and sitting postures with LBP is also verified in recent global literature, including scoping reviews showing that sitting behavior (poor posture, fewer breaks) correlates strongly with LBP.[10]

**Figure 4: Body postures associated with LBP**




In our study, working 12-hour days was associated with a higher prevalence. Similarly, the Bangladesh study[5] showed that working more than 8 hours was a significant risk, as did meta-analytic studies where longer sitting or working durations were linked to increased odds of LBP.[7,11] The results highlight that there is an urgent requirement for ergonomic modification in industries in Pakistan. The redesign of workstations, offering adjustable tools, and encouraging proper postures with training can be instrumental in the elimination of the burden of work-related low back pain. Specifically, the close relationship between the long hours of work and LBP reveals the cruciality of organizational practices like establishing the maximum length of working hours or changing the working activities to eliminate physical effects.

Provision of training to workers on posture, safe lifting methods, and the importance of getting a good rest must be incorporated into the normal training in workplaces, with the supervisors and managers being central in promoting these practices. Also, access to physiotherapy and preventive care in industrial estates, especially in Khyber Pakhtunkhwa, could be improved, which would make it possible to treat musculoskeletal complaints early and prevent the development of chronic disability.

This study is subject to several limitations that should be acknowledged. First, its cross-sectional design restricts the ability to infer causal relationships, allowing only the identification of associations between variables. Second, the use of convenience sampling may have introduced selection bias, as individuals experiencing more severe or milder pain might have been disproportionately represented. Third, the reliance on self-reported measures increases the potential for recall bias and misclassification of pain severity and exposure factors, such as posture and working hours. Additionally, the study did not account for important psychosocial variables, including mental stress, job satisfaction, and other related factors, which have been shown in previous research to significantly influence the risk of low back pain.

## CONCLUSION

The findings of this study reveal a troubling and urgent reality: low back pain has become a deeply rooted and widespread problem among industrial workers in Khyber Pakhtunkhwa, affecting more than two-thirds of the workforce. This is not a marginal issue; it reflects a significant burden on individuals, workplaces, and the broader economy. Factors such as age, years of service, extended working hours, and postural strain, especially prolonged standing and sitting, emerged as powerful contributors to the onset and worsening of this condition. Behind these statistics are workers who live with daily pain that limits their ability to sit, stand, lift, travel, or even carry out personal care.

These functional restrictions highlight how low back pain disrupts not only work but also the basic rhythms of everyday life, making it a personal and social challenge, not merely an occupational one. If left unaddressed, this burden will continue to grow, silently eroding the health and productivity of the labor force. Real change will require more than surface-level measures; it calls for a deliberate shift toward ergonomic workplace design, regulated working hours, structured rest breaks, and consistent worker education on posture, safe lifting techniques, and self-care strategies. Strengthening workplace health services and developing national occupational

health guidelines are equally critical. Collaboration between industries, government agencies, and labor representatives can ensure these changes are practical and lasting. Finally, future research must dig deeper into psychosocial influences, gender perspectives, and the real-world impact of targeted interventions to reduce the risk and consequences of low back pain. A healthier, more resilient workforce depends on recognizing and addressing this issue with urgency and commitment.

## DECLARATIONS

**Consent to participate:** Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

**Availability of Data and Materials:** Data will be made available upon request. The corresponding author will submit all dataset files.

**Competing interests:** None

**Funding:** No funding source involved.

**Authors' contributions:** All authors had read and approved the final manuscript.

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