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PREVALENCE OF SHOULDER PAIN AMONG LONG-TERM MANUAL WHEELCHAIR USERS: A CROSS-SECTIONAL STUDY

Original Research (ID: 1705)

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ABSTRACT

Background: Shoulder pain is a common musculoskeletal problem among manual wheelchair users because the upper limbs are repeatedly used for propulsion, transfers, pressure relief, and daily mobility. Continuous loading of the shoulder joint may lead to pain, disability, and reduced independence over time. In local rehabilitation settings, limited evidence is available regarding the burden of shoulder pain among long-term manual wheelchair users, making this issue important for clinical screening and preventive care.

Objective: To determine the prevalence of shoulder pain among long-term manual wheelchair users and to assess its association with the duration of wheelchair use.

Methods: An observational cross-sectional study was conducted among 159 manual wheelchair users recruited from Mayo Hospital, Ghurki Hospital, Sheikh Zayed Hospital, and Services Hospital, Lahore. Participants were selected through a non-probability convenience sampling technique. Male and female participants aged 20–40 years who had used a manual wheelchair as their primary means of mobility for at least one year were included. Shoulder pain and disability were assessed using the Shoulder Pain and Disability Index. Data were analyzed using SPSS version 29.0. Frequencies and percentages were calculated for categorical variables, while mean and standard deviation were used for continuous variables. Chi-square test was applied to determine the association between duration of wheelchair use and shoulder pain severity, with $p < 0.05$ considered statistically significant.

Results: The mean age of participants was 30.0 ± 5.5 years. Among 159 participants, 85 (53.5%) were male and 74 (46.5%) were female. Shoulder pain was reported by 132 (83.0%) participants, while 27 (17.0%) had no shoulder pain. Mild pain was reported by 40 (25.2%) participants, moderate pain by 60 (37.7%), and severe pain by 32 (20.1%). A statistically significant association was found between duration of wheelchair use and shoulder pain severity ($\chi^2 = 26.06$, $p = 0.002$).

Conclusion: Shoulder pain was highly prevalent among long-term manual wheelchair users and was significantly associated with duration of wheelchair use. Routine screening, early rehabilitation, ergonomic wheelchair training, and preventive shoulder care may help reduce pain and preserve functional independence.

Keywords: Cross-Sectional Studies; Disabled Persons; Musculoskeletal Pain; Prevalence; Rehabilitation; Shoulder Pain; Wheelchairs.

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INTRODUCTION

Shoulder pain is one of the most frequent and disabling musculoskeletal problems experienced by long-term manual wheelchair users. Unlike the general population, individuals who depend on manual wheelchairs rely heavily on their upper limbs not only for mobility, but also for transfers, pressure relief, repositioning, and many routine activities of daily living. As a result, the shoulder joint is repeatedly exposed to mechanical loading, weight bearing, and repetitive propulsion forces that it is not anatomically designed to tolerate as a primary locomotor joint (1). Over time, this continuous demand can contribute to soft tissue irritation, overuse injuries, rotator cuff pathology, impingement, degenerative joint changes, and functional limitation (2). Previous studies have reported a high burden of shoulder pain among manual wheelchair users, with prevalence estimates ranging from approximately 40% to 80% in different populations (3). This wide variation may be explained by differences in age, diagnosis, level of physical activity, duration of wheelchair use, transfer frequency, wheelchair ergonomics, and the methods used to assess pain. Despite these differences, the evidence consistently suggests that shoulder pain is not an occasional complaint in this group; rather, it is a common long-term consequence of repeated upper-limb loading. The risk appears to increase further when wheelchair propulsion is combined with poor posture, muscle imbalance, prolonged sitting, frequent transfers, and increased body weight supported through the arms (4).

The shoulder complex is particularly vulnerable because it provides a large range of motion at the cost of reduced bony stability. In manual wheelchair users, the muscles around the shoulder must generate repeated force for propulsion while also stabilizing the joint during transfers and weight-bearing activities. People with spinal cord injury, especially those with tetraplegia and paraplegia, may depend even more on the upper limbs because of weakness or loss of lower-limb function (5-8). This altered functional demand may lead to progressive strain on the rotator cuff and surrounding structures. Conditions such as rotator cuff tears, subacromial impingement, osteolysis, degenerative changes, and shoulder instability have been associated with long-term wheelchair use (9,10). Biomechanical changes also play an important role in the development of shoulder pain. Manual wheelchair users often spend many hours seated each day, frequently in a forward-flexed posture. This position may encourage rounded shoulders, scapular protraction, downward rotation, anterior scapular tilt, increased thoracic kyphosis, and compensatory lumbar postural changes (11-13). These postural adaptations may shorten the pectoralis major and alter scapulohumeral rhythm, increasing the likelihood of shoulder impingement and pain during propulsion or transfers (14). Repeated daily transfers, which may occur many times per day, further increase the cumulative load on the upper extremities and may accelerate tissue fatigue and microtrauma.

Degenerative shoulder problems are known to become more common with increasing age in the general population, but this process appears to occur earlier and more frequently among manual wheelchair users because of prolonged upper-limb dependence (10). Evidence suggests that wheelchair users may have a substantially higher risk of rotator cuff tears compared with age-matched individuals who do not use wheelchairs (11). This increased risk highlights the difference between ordinary age-related degeneration and the additional mechanical stress faced by people who depend on their arms for mobility and independence. The impact of shoulder pain extends beyond physical discomfort. For manual wheelchair users, shoulder function is closely linked with independence, participation, and quality of life. Pain can reduce propulsion efficiency, limit transfers, disturb sleep, restrict social participation, and increase dependence on caregivers. Even mild shoulder pain may gradually affect confidence in movement and daily activity performance. Therefore, identifying the frequency of shoulder pain in this population is clinically important, as early recognition may help clinicians introduce preventive strategies, ergonomic education, strengthening programs, posture correction, wheelchair adjustment, and pain management before disability becomes more severe.

Although shoulder pain has been investigated among athletes, wheelchair basketball players, and individuals with spinal cord injury, limited local evidence is available regarding its prevalence among chronic manual wheelchair users from the general community (5). In Pakistan, this gap is particularly relevant because many wheelchair users may have limited access to rehabilitation services, customized wheelchairs, regular follow-up, and preventive musculoskeletal screening (6). As a result, shoulder pain may remain under-recognized until it significantly interferes with mobility and daily function. Moreover, the relationship between duration of wheelchair use and severity or presence of shoulder pain has not been sufficiently explored in local clinical and community settings (7). Existing literature indicates that wheelchair users are at high risk of upper-limb musculoskeletal pain due to repetitive propulsion, frequent transfers, and sustained weight-bearing demands (15). Shoulder pain is reported as the most common site of pain, although discomfort may also involve the neck, elbow, wrist, hand, and lower back (16). These findings support the need for focused assessment of shoulder pain among long-term manual wheelchair users, particularly in settings where routine preventive care may be limited.

The present study was therefore designed to address the research question: what is the prevalence of shoulder pain among long-term manual wheelchair users, and is shoulder pain associated with the duration of manual wheelchair use? It was hypothesized that shoulder pain would be common among long-term manual wheelchair users and that a longer duration of wheelchair use would be associated with a higher occurrence of shoulder pain. Establishing this relationship is important because it may help clinicians, physiotherapists, and rehabilitation teams identify high-risk individuals and plan timely preventive and therapeutic interventions. Therefore, the objective of this study was to determine the prevalence of shoulder pain among long-term manual wheelchair users and to evaluate its association with the duration of manual wheelchair use.

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METHODOLOGY

An observational cross-sectional study was conducted to determine the prevalence of shoulder pain among long-term manual wheelchair users and to assess its association with the duration of wheelchair use. The study was carried out in Lahore, Pakistan, and data were collected from Mayo Hospital, Ghurki Hospital, Sheikh Zayed Hospital, and Services Hospital. The study was completed over a period of four months after synopsis approval. Ethical approval was obtained from the Institutional Research Ethics Board (IREB), The University of Lahore before the start of data collection. All participants were informed about the purpose and procedure of the study, and written informed consent was obtained before enrolment. The sample size was calculated as 159 participants using G*Power software at a 95% confidence level. Participants were recruited through a non-probability convenience sampling technique from the selected hospital settings (17). Both male and female manual wheelchair users aged 20 to 40 years were considered eligible for inclusion. Participants were included if they used a manual wheelchair as their primary means of mobility, had a diagnosis of spinal cord injury, amputation, or cerebral palsy, had been using a manual wheelchair for at least one year, and voluntarily agreed to participate in the study. Participants were excluded if they had shoulder pain due to a fall after spinal cord injury, referred shoulder pain related to cardiac or pancreatic conditions, serious systemic illness, mental health disorders that could affect response reliability, or incomplete data.

Data were collected using a structured approach. Eligible participants were first screened according to the predefined inclusion and exclusion criteria. After obtaining informed consent, demographic and clinical information was recorded, including age, gender, diagnosis, duration of manual wheelchair use, and relevant mobility-related details. Shoulder pain and disability were assessed using the Shoulder Pain and Disability Index (SPADI), a commonly used clinical instrument for measuring shoulder-related pain and functional limitation. The SPADI consists of two subscales: the pain subscale, which includes items 1 to 5, and the disability subscale, which includes items 6 to 13. The questionnaire may be completed using either a visual analogue scale or a numeric rating scale; the numeric rating format was considered more convenient for participants in this study. The tool was simple to administer and generally required approximately five minutes to complete (18). Participants completed the questionnaire under supervision to ensure that all items were understood and answered appropriately. The researchers checked each form for completeness at the time of data collection to minimize missing responses. The collected data were then used to estimate the prevalence of shoulder pain and to examine the perceived impact of shoulder pain on daily functional activities among manual wheelchair users.

Data were entered and analyzed using SPSS version 29.0. Continuous variables were assessed for distribution and presented as mean ± standard deviation for normally distributed data, while non-normally distributed data were presented as median with percentiles or interquartile range, as appropriate. Categorical variables were summarized as frequencies and percentages. The prevalence of shoulder pain was calculated as the proportion of participants reporting shoulder pain among the total study sample. Chi-square test was applied to assess associations between categorical variables, while Pearson correlation was used to determine the strength and direction of association between continuous normally distributed variables. Where assumptions of normality were not met, non-parametric alternatives such as Spearman correlation were considered appropriate. A p-value of less than 0.05 was taken as statistically significant.

RESULTS

A total of 159 long-term manual wheelchair users were included in the study. The mean age of the participants was 30.0 ± 5.5 years, with an age range of 20 to 40 years. Among the participants, 85 (53.5%) were male and 74 (46.5%) were female. Regarding marital status, 92 (57.9%) participants were married, while 67 (42.1%) were single. Right-hand dominance was reported by 115 (72.3%) participants, whereas 44 (27.7%) participants were left-hand dominant. The duration of manual wheelchair use varied across the study population. Among all participants, 26 (16.4%) had used a manual wheelchair for 1–5 years, 46 (28.9%) for 6–10 years, 58 (36.5%) for 11–20 years, and 29 (18.2%) for more than 20 years. The largest proportion of participants belonged to the 11–20 years duration group.

Shoulder pain was reported by 132 participants, giving an overall prevalence of 83.0%. The remaining 27 (17.0%) participants reported no shoulder pain. Based on pain severity, 40 (25.2%) participants had mild shoulder pain, 60 (37.7%) had moderate shoulder pain, and 32 (20.1%) had severe shoulder pain. Overall, moderate pain was the most frequently reported category, while moderate-to-severe shoulder pain was present in 92 (57.9%) participants. When shoulder pain severity was analyzed according to the duration of manual wheelchair use, among participants using wheelchairs for 1–5 years, 9 (34.6%) had no shoulder pain, 4 (15.4%) had mild pain, 13 (50.0%) had moderate pain, and none had severe pain. In the 6–10 years group, 7 (15.2%) participants had no shoulder pain, 13 (28.3%) had mild pain, 20 (43.5%) had moderate pain, and 6 (13.0%) had severe pain. Among those using wheelchairs for 11–20 years, 4 (6.9%) had no shoulder pain, 14 (24.1%) had mild pain, 22 (37.9%) had moderate pain, and 18 (31.0%) had severe pain. In participants using wheelchairs for more than 20 years, 7 (24.1%) had no shoulder pain, 9 (31.0%) had mild pain, 5 (17.2%) had moderate pain, and 8 (27.6%) had severe pain.

A statistically significant association was found between duration of manual wheelchair use and severity of shoulder pain. The chi-square test showed $\chi^2 = 26.06$ with a p-value of 0.002. The strength of association, calculated using Cramer's V, was 0.234, indicating a weak-to-moderate association between duration of wheelchair use and shoulder pain severity.

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Table 1. Demographic Characteristics of Participants (n = 159)

Variable	Frequency (n)	Percentage (%)
Male	85	53.5
Female	74	46.5
Married	92	57.9
Single	67	42.1
Right-hand dominance	115	72.3
Left-hand dominance	44	27.7

Table 2. Duration of Manual Wheelchair Use (n = 159)

Duration of Wheelchair Use	Frequency (n)	Percentage (%)
1–5 years	26	16.4
6–10 years	46	28.9
11–20 years	58	36.5
More than 20 years	29	18.2
Total	**159**	**100**

Table 3. Prevalence and Severity of Shoulder Pain (n = 159)

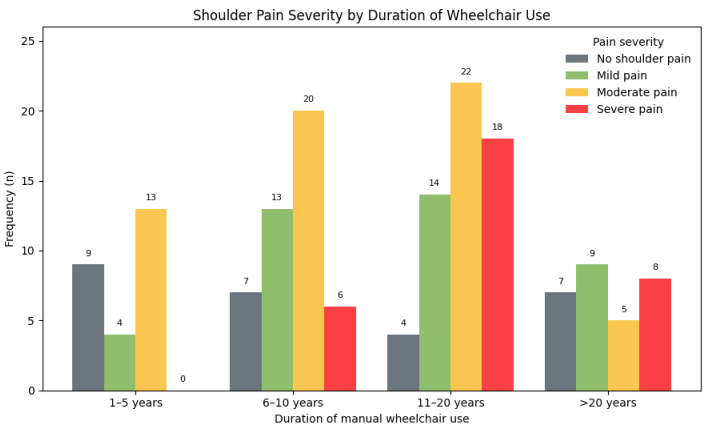
Variable	Frequency (n)	Percentage (%)
No shoulder pain	27	17.0
Mild pain	40	25.2
Moderate pain	60	37.7
Severe pain	32	20.1
Total	**159**	**100**

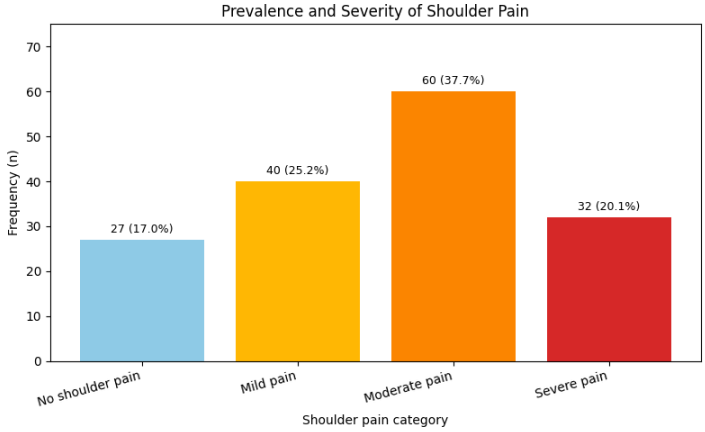
Overall prevalence of shoulder pain = 132 (83.0%)

Table 4. Association Between Duration of Wheelchair Use and Severity of Shoulder Pain (n = 159)

Severity of Shoulder Pain	1–5 Years	6–10 Years	11–20 Years	>20 Years	Total
No shoulder pain	9	7	4	7	27
Mild shoulder pain	4	13	14	9	40
Moderate pain	13	20	22	5	60
Severe pain	0	6	18	8	32
Total	**26**	**46**	**58**	**29**	**159**

Chi-square test: $\chi^2 = 26.0$, $p = 0.002$





DISCUSSION

The present study was conducted to determine the prevalence of shoulder pain among long-term manual wheelchair users and to assess its association with the duration of wheelchair use. The findings showed that shoulder pain was highly prevalent in this population, as 132 out of 159 participants reported shoulder pain, giving an overall prevalence of 83.0%. This finding indicated a considerable burden of shoulder-related musculoskeletal problems among individuals who depended on manual wheelchairs for mobility. The high prevalence observed in this study supported the view that the shoulder joint remained one of the most vulnerable regions in manual wheelchair users because the upper limbs were repeatedly used for propulsion, transfers, pressure relief, and daily functional activities. The prevalence reported in the current study was comparable to previous literature, in which shoulder pain had been frequently reported among manual wheelchair users. A previous study reported shoulder pain in nearly 78% of manual wheelchair users and also showed that longer wheelchair use was associated with greater shoulder pain and disability. Other published evidence reported shoulder pain as one of the most common musculoskeletal complaints among wheelchair users, although the reported prevalence varied across studies. This variation may have been related to differences in sample characteristics, duration of wheelchair use, underlying diagnosis, age range, physical activity level, wheelchair design, transfer frequency, and the method used to assess pain. The slightly higher prevalence in the current study may have been influenced by the inclusion of participants who had used wheelchairs for longer durations and relied extensively on their upper limbs for mobility and routine activities (12).

The study also found a statistically significant association between duration of manual wheelchair use and severity of shoulder pain. Participants with longer durations of wheelchair use, particularly those using wheelchairs for 11–20 years and more than 20 years, showed a greater burden of moderate-to-severe shoulder pain. This finding was clinically important because it suggested that cumulative exposure to repetitive loading may contribute to progressive shoulder symptoms over time. However, the relationship was not completely linear, as severe pain was most frequent in the 11–20 years group and slightly lower in the group using wheelchairs for more than 20 years. This pattern may have reflected differences in activity level, adaptation of movement patterns, survival bias, reduced mobility in older users, or variability in access to rehabilitation and assistive devices. Therefore, the findings supported an association between duration of wheelchair use and shoulder pain severity, but they did not establish a direct causal relationship (18). The findings were consistent with previous research showing that repeated wheelchair propulsion, weight-bearing transfers, and upper-limb loading placed substantial biomechanical stress on the shoulder complex. The shoulder joint is anatomically designed for mobility rather than continuous weight bearing, and repeated mechanical demand may increase the risk of overuse injury, impingement, rotator cuff pathology, degenerative changes, and chronic pain (19). Manual wheelchair users may also develop altered posture, reduced trunk stability, muscle imbalance, and inefficient propulsion mechanics, all of which may further increase shoulder strain. Previous studies also suggested that physical inactivity, poor propulsion technique, and reduced trunk control were associated with shoulder pain among manual wheelchair users (20). These factors may explain why shoulder pain remained common even among younger adults in the current study.

The clinical implications of these findings were important for rehabilitation practice. Shoulder pain in manual wheelchair users may reduce propulsion efficiency, limit transfers, interfere with self-care, restrict community participation, and increase dependence on caregivers. Since the upper limbs are essential for independence in this population, even mild shoulder symptoms may progress into meaningful functional limitations if not addressed early. The high prevalence observed in this study supported the need for routine shoulder screening as part of regular assessment for manual wheelchair users. Early identification of pain, weakness, reduced range of motion, poor posture, or faulty propulsion mechanics may help clinicians intervene before symptoms become chronic (11,19). Preventive rehabilitation should be considered an essential component of care for manual wheelchair users. Strengthening exercises targeting the rotator cuff, scapular stabilizers, and upper back muscles may help improve shoulder stability and reduce excessive load on vulnerable structures. Flexibility training, posture correction, wheelchair adjustment, and education regarding safe transfer and propulsion techniques may also reduce shoulder overload. Ergonomically appropriate wheelchair prescription, including correct seat height, axle

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position, wheel alignment, and user-specific adjustments, may further decrease repetitive strain. These strategies may improve functional independence and reduce the long-term risk of shoulder-related disability (21).

One of the strengths of this study was that it included a relatively adequate sample of manual wheelchair users from multiple hospital settings, which provided useful local data on an under-researched population. The study also focused on a clinically relevant problem that directly affected mobility, independence, and quality of life. The use of a structured outcome measure for shoulder pain and disability added value to the assessment process and allowed a more organized evaluation of symptoms. Despite these strengths, some limitations were present. The cross-sectional design limited the ability to determine causality between duration of wheelchair use and shoulder pain severity. Convenience sampling may have introduced selection bias and reduced the generalizability of the findings. The study was limited to participants aged 20–40 years, which excluded older wheelchair users who may have had a higher risk of degenerative shoulder conditions. The study also did not provide diagnosis-wise analysis, although shoulder pain may differ among individuals with spinal cord injury, amputation, and cerebral palsy. In addition, important clinical and biomechanical variables, such as wheelchair type, daily duration of wheelchair use, number of transfers per day, level of physical activity, trunk control, body mass index, propulsion technique, and history of rehabilitation, were not analyzed in detail. These factors could have influenced both the prevalence and severity of shoulder pain.

Another limitation was that imaging or clinical examination findings were not included to confirm the underlying shoulder pathology. Therefore, the study described the burden of shoulder pain but could not identify whether the pain was due to rotator cuff tendinopathy, impingement, instability, degenerative disease, or another musculoskeletal cause. Future studies should include clinical examination, functional assessment, and, where feasible, ultrasound or magnetic resonance imaging to better understand the structural causes of shoulder pain in this population. Longitudinal studies with larger and more diverse samples should also be conducted to examine how shoulder pain develops over time and which factors predict progression. Overall, the findings highlighted shoulder pain as a highly prevalent and clinically meaningful problem among long-term manual wheelchair users. The significant association between wheelchair-use duration and shoulder pain severity emphasized the need for early screening, preventive rehabilitation, ergonomic wheelchair prescription, and patient education. Future research should focus on longitudinal follow-up, diagnosis-specific analysis, biomechanical assessment, and intervention-based studies to determine the most effective strategies for preventing shoulder pain and preserving independence among manual wheelchair users.

CONCLUSION

The study concluded that shoulder pain was a common and clinically important problem among long-term manual wheelchair users. The findings supported the study objective by showing that shoulder pain was associated with the duration of wheelchair use, suggesting that prolonged dependence on manual wheelchairs may increase the burden of shoulder-related discomfort and functional limitation. These findings highlight the importance of routine shoulder screening, early rehabilitation, ergonomic wheelchair use, and preventive education to protect upper-limb function and maintain independence in manual wheelchair users.

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AUTHOR CONTRIBUTION

Author	Contribution
Ayesha Asghar	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Iqra Waseem	Methodology, Investigation, Data Curation, Writing - Review & Editing
Nibaat Hafeez	Investigation, Data Curation, Formal Analysis, Software
Erum Naz	Software, Validation, Writing - Original Draft