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Review

Patterns of Physical Inactivity and Their Association With Musculoskeletal Complaints

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Abstract

Musculoskeletal complaints have become a major public health concern, with physical inactivity emerging as a consistent and modifiable risk factor. Sedentary behavior, particularly prolonged sitting, contributes to biomechanical stress, muscular imbalance, and postural decline, which in turn influence the development of pain in regions such as the neck, back, and shoulders. These complaints appear not only in older adults but increasingly in adolescents and working-age populations, where screen time and desk-bound routines dominate daily life. Studies across different age groups confirm that both the intensity and duration of inactivity play a role in symptom severity. The distribution of musculoskeletal pain varies across demographic lines. Adolescents experience symptoms linked to school-based inactivity and poor ergonomic practices, while adults show patterns shaped by occupational sitting and multitasking between work and domestic duties. Gender and socioeconomic differences further influence pain outcomes. Women, for example, are more likely to report upper-body discomfort under the same sedentary conditions. In lower-income populations, a lack of access to active environments and postural support tools increases vulnerability despite high physical workloads. Preventive strategies have shown promise in reducing the effects of inactivity. These include workplace adaptations like sit-stand desks, classroom movement breaks, and urban planning that promotes walking. Mobile health technologies and personalized coaching also provide low-cost ways to track behavior and prompt movement throughout the day. When prevention is aligned with environmental and behavioral change, the potential to reduce long-term pain and disability becomes greater. Findings from current literature suggest that the musculoskeletal impact of physical inactivity is both measurable and preventable when approached through diverse, sustained interventions. Recognizing the variation in how pain presents across demographics can guide more targeted and equitable prevention efforts that support musculoskeletal health across the lifespan.

Keywords*: physical inactivity, musculoskeletal pain, sedentary behavior, preventive strategies, demographic differences*

Introduction

Musculoskeletal complaints are among the most common causes of long-term pain and physical limitation across populations. Conditions such as chronic lower back pain, neck strain, and shoulder dysfunction are frequently reported in both clinical and community settings. These symptoms often emerge gradually, with lifestyle patterns playing a significant role in their development. A large prospective study from Norway found that individuals with consistently low levels of physical activity experienced a greater frequency of musculoskeletal complaints over an 11-year period (1). Rather than isolated episodes, these issues appear to evolve silently over time, gradually interfering with mobility and daily routines.

In younger populations, reduced physical activity has been linked to early signs of musculoskeletal dysfunction. Adolescents who do not meet recommended levels of movement or exercise commonly report discomfort in the spine and limbs, often without any injury or pathology. A 2019 study conducted among Turkish adolescents found that those with low activity levels had higher rates of reported musculoskeletal symptoms, particularly in the back and neck regions (2). These early signs may reflect the body's response to long hours of sedentary behavior during critical years of growth and physical development.

The presence of other health factors can intensify the link between inactivity and musculoskeletal problems. In older adults or individuals with obesity and chronic diseases, the effects of inactivity on the body are often amplified. A clinical study evaluating patients with musculoskeletal conditions found that physical inactivity was closely associated with multiple comorbidities and lower quality of life scores (3). Physical pain in these cases becomes part of a broader landscape of declining health, affecting both physical independence and psychosocial well-being.

Low physical activity is not only associated with physical symptoms but also interacts with behavioral and physiological systems such as sleep regulation. Poor sleep quality and musculoskeletal discomfort frequently appear together, and inactivity may play a role in linking the two. Cross-sectional data from Danish workers showed that people with both low physical activity and musculoskeletal pain also experienced more severe sleep problems (4). This overlap suggests that inactivity might act as a hidden variable in complaints that extend beyond the musculoskeletal system, influencing rest, recovery, and mental performance.

Review

Physical inactivity has emerged as a critical factor influencing musculoskeletal health across various populations. Beyond its known associations with cardiovascular and metabolic diseases, evidence increasingly supports its role in the onset and persistence of musculoskeletal complaints. A systematic review by Sitthipornvorakul et al. highlighted the relationship between physical inactivity and increased risk of neck and lower back pain, particularly in working-age adults engaged in sedentary occupations (5). In adolescent populations, the patterns of inactivity also appear to mirror the development of musculoskeletal symptoms. Paulis et al. found that children with higher body weight and reduced physical activity levels showed signs of musculoskeletal complaints at early ages, indicating that inactivity-related strain begins well before adulthood (6). This underscores the importance of addressing physical activity habits early in life, as musculoskeletal structures are still forming and are highly responsive to movement. The combined findings from adult and pediatric populations point to a need for long-term strategies that promote movement across the lifespan to reduce the physical and economic burden of musculoskeletal disorders.

Sedentary Behavior and Pain

The persistence of musculoskeletal pain in modern populations often traces back to behavior patterns deeply rooted in contemporary lifestyles. Sedentary behavior, defined as low-energy expenditure activities in seated or reclined positions, has grown substantially with the rise of digital work environments, automated transportation, and

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screen-based leisure. Rather than being offset by intermittent bouts of exercise, prolonged sedentary time exerts cumulative strain on the musculoskeletal system, particularly the spinal and postural muscles. In a study focusing on occupational sitting time, Shrestha et al. demonstrated that longer durations of sitting during work hours were consistently associated with an increased risk of developing low back pain, regardless of overall physical activity levels during leisure time (7). This points to the independent role sedentary behavior plays, separate from exercise frequency or intensity.

As urbanization and digitalization accelerate, younger demographics are also experiencing the consequences of prolonged sitting. High school and college students, spending hours in front of screens or studying in fixed positions, commonly report pain in the neck, upper back, and shoulders. The study by Szulc et al. found that sedentary behavior in university students, even in the absence of underlying pathologies, was significantly correlated with postural dysfunctions and recurring spinal pain (8). These symptoms did not arise from trauma or mechanical injury, but from a gradual erosion of muscular endurance and imbalanced loading on the spine due to static positioning.

Biomechanically, inactivity limits the functional capacity of stabilizing muscle groups, especially those supporting the lumbar and cervical spine. Without regular muscle engagement, postural control weakens and compensatory patterns emerge, placing uneven pressure on discs, ligaments, and joints. This can lead to discomfort that fluctuates based on the time spent in fixed positions rather than external exertion. Research from van den Heuvel et al. supports this mechanism, showing that even short-term changes in sitting posture at work had measurable effects on reported pain levels in the lower back and shoulders (9). It is also important to consider how sedentary behavior interacts with psychosocial stressors, especially in work environments. Static physical postures often co-exist with cognitive overload, deadlines, and reduced social interaction. A study by Magnavita and Garbarino identified a pattern in healthcare professionals, where sedentary work settings and high mental workload coincided with higher musculoskeletal pain complaints, particularly in the cervical region (10).

Demographic Variations

The prevalence and presentation of musculoskeletal complaints shaped by physical inactivity differ across age, gender, and socioeconomic lines. These differences are not only numerical but also behavioral, with varying thresholds of tolerance, coping strategies, and occupational exposure contributing to how inactivity translates into physical discomfort. A population-based analysis by Straker et al. compared musculoskeletal symptoms among children and adolescents, revealing that older adolescents spent significantly more time sitting and reported more frequent spinal discomfort compared to younger peers (11). Patterns of device usage, academic pressure, and declining school physical activity programs were all found to intersect with this rise in self-reported musculoskeletal issues during teenage years.

Among adults, gender influences not only the distribution of musculoskeletal complaints but also the types of activities contributing to sedentary time. In a study by Baradaran Mahdavi et al., women reported more musculoskeletal pain than men, particularly in the neck and upper back, despite similar durations of sedentary behavior (12). The research suggested that occupational and domestic task differences might account for this discrepancy, as women often combined desk-based jobs with static household responsibilities. This overlap between formal and informal work was especially apparent in populations where ergonomic support at home was minimal, reinforcing the physical toll of multitasking in restricted physical spaces.

Socioeconomic status contributes to its own layer of complexity. Lower-income groups are more likely to engage in physically demanding jobs yet still experience sedentary-related pain due to non-work environments characterized by limited recreational spaces, crowded housing, or reliance on long hours of passive transport. An analysis by Paley et al. highlighted that individuals in economically deprived areas reported higher rates of

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musculoskeletal pain, particularly in the lumbar spine, regardless of their total occupational activity levels (13). The mismatch between physical strain at work and lack of access to physical relief or structured exercise during personal time shaped a distinct risk pattern for chronic discomfort.

Older adults represent a demographic that sits at the crossroads of physiological vulnerability and lifestyle adaptation. As mobility naturally decreases with age, sedentary routines can accelerate muscle weakening and joint stiffness. Yet retirement and reduced work-related movement also change the way older individuals accumulate sedentary time. A study by Tsuji et al. found that prolonged sitting in older populations was more fragmented compared to working adults, with more frequent breaks, yet still strongly correlated with hip and lower back complaints (14). This suggests that even when sedentary time is distributed differently across the day, its impact on joint structures remains significant if movement lacks sufficient intensity or purpose.

Preventive Strategies

Shifting daily habits to counteract the effects of sedentary behavior requires more than encouragement to "move more." Structured preventive strategies, especially those embedded within work, school, and healthcare settings, are gaining traction. Evidence from randomized trials indicates that interventions combining movement reminders, adjustable workstations, and education on posture significantly reduce musculoskeletal discomfort. Chu et al. tested a sit-stand desk intervention in office environments and found that workers who used adjustable desks and received behavioral prompts reported reduced upper back and neck pain after just four weeks (15). These results held even when total physical activity outside work remained unchanged, underscoring the effectiveness of modifying the immediate sedentary context.

Short breaks with light activity woven into daily routines appear especially impactful. In educational settings, classroom-based movement sessions have been introduced to interrupt long sitting periods without compromising learning time. A study by Watson et al. introduced short, guided exercise routines for middle school students and recorded lower reports of neck and shoulder discomfort by the end of the semester (16).

Beyond formal environments, community-based efforts often focus on building sustainable access to physical activity. Urban planning plays a subtle but pivotal role here. Without safe and accessible walking paths, parks, or recreation centers, attempts to increase daily movement lose momentum. Foster and Hillsdon's review of environmental interventions found that neighborhoods with walkable infrastructure, traffic calming, and green spaces led to higher physical activity levels and fewer musculoskeletal complaints over time (17).

Digital health tools are emerging as scalable supports in prevention. Smartphone apps, wearable trackers, and personalized feedback platforms allow users to monitor posture, receive real-time alerts, and track prolonged periods of sitting. For individuals in remote or underserved areas, this tech offers continuous support without needing in-person services. Koster et al. studied the impact of mobile health coaching on older adults with sedentary lifestyles and reported not only improved physical activity but decreased reports of lower back stiffness and discomfort over a 10-week period (18). The intervention relied on gentle nudges, tailored activity suggestions, and simple feedback loops rather than intensive instruction or expensive gear.

Conclusion

Reducing physical inactivity is essential for addressing the rising burden of musculoskeletal complaints across age groups. Evidence shows that prolonged sedentary behavior directly contributes to pain and dysfunction, especially in the spine and joints. Demographic patterns reveal varying risk levels, shaped by gender, age, and socioeconomic context. Preventive strategies, both structural and behavioral, offer promising paths to mitigate these effects when implemented early and consistently.

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Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

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