IPRPD
International Journal of Business & Management Studies
ISSN 2694-1430 (Print), 2694-1449 (Online)
Volume 06; Issue no 09: September, 2025
DOI: 10.56734/ijbms.v6n9a9

A LITERATURE REVIEW: THE INFLUENCE OF AI ON LOW BACK PAIN (LBP) AMONG WOMEN IN GOVERNMENT SECTOR OFFICES

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Abstract

Low Back Pain (LBP) represents a rising public health issue that affects women in desk-bound government office work more frequently than other groups. Technological advancement in work practices leads to increased spinal strain, which speeds up disc deterioration and raises the risk of LBP, particularly among women aged 49–50 who face additional hormonal and anatomical challenges.

This paper reviews how the implementation of Artificial Intelligence (AI) in public administration workflows creates conditions that lead to increased sedentary behaviors, which subsequently cause LBP in female office workers. The combination of extended static work at desks with AI technology adoption through automated scheduling systems, document processing software, and digital communication platforms results in reduced movement, task variety, and postural change for government employees. It applies Cumulative Load Theory to explore how AI-driven automation increases occupational and ergonomic risks, leading to musculoskeletal disorders through prolonged low-level biomechanical stress. The discussion demonstrates that AI will unintentionally perpetuate dangerous sedentary behaviors in public sector workplaces unless organizations implement proactive workplace redesign and health-informed policy changes.

The review synthesizes 45 scholarly articles, emphasizing the importance of workplace ergonomic solutions that cater to gender differences, including adjustable furniture, task rotation, and AI-based wellness platforms. This review supports the emerging field of knowledge that promotes digital transformation strategies aligned with occupational health priorities in government institutions that employ a large number of female administrative staff.

Keywords

Low Back Pain (LBP), Sedentary Behavior, Artificial Intelligence (AI), Government Office Workers, Ergonomic Risk Factors

Introduction

Low Back Pain (LBP) affects global health, impacting multiple domains of society, including individuals, families, communities, and workplaces (Arundell et al., 2018; Shrestha et al., 2018; Coenen et al., 2017; Hoy et al., 2010). Globally, the number of years people lived with disability due to LBP increased by 54% between 1990 and 2015 (Hartvigsen et al., 2018). This rise is linked to repetitive movements, physical demands, and ergonomic challenges encountered in modern office environments (Safari et al., 2024). Research suggests that individuals spend approximately 80 to 90 percent of their daily lives within built environments (Dianat et al., 2025).

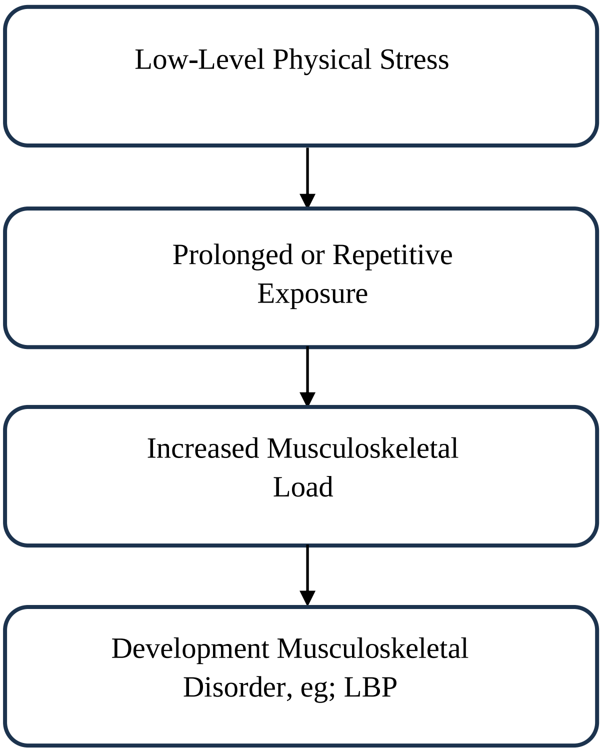
LBP affects sedentary workers, especially women aged 49–50 years, in government offices, as they spend most of their time sitting and engaging in minimal physical activity (Wáng et al., 2016; Manchikanti et al., 2014; O'Keeffe et al., 2013; Spyropoulos et al., 2007). In the United States, 25.7% of workers report experiencing LBP, with women showing higher risks, especially those working 41 to 45 hours weekly, and younger employees who work more than 60 hours per week (Yang et al., 2016). LBP reduces productivity, work quality, and contributes to job dissatisfaction and work stress in public institutions (Wáng et al., 2016; Spyropoulos et al., 2007).

Artificial Intelligence (AI) tools, such as automated scheduling systems, document processing software, and virtual communication platforms, are increasingly promoted to streamline public sector operations (Erik et al., 2025; Ejjami, 2024). However, these tools reduce physical movement, task variety, and interpersonal interaction, which are essential for encouraging postural changes (Huang et al., 2020). Studies confirm that long-lasting sitting, especially with poor posture and infrequent breaks, significantly contributes to LBP among women in government office workers (Alaca et al., 2025; Baradaran et al., 2021; Spyropoulos et al., 2007).

This study argues that AI implementation in government offices may intensify sedentary behaviors, increasing the risk and severity of LBP, particularly for women in desk-based administrative roles. The review examines the intersection between AI automation, sedentary work, and musculoskeletal health to identify emerging workplace health risks and inform ergonomic strategies.

Cumulative Load Theory will be used as the theoretical lens for this paper. It suggests that repeated exposure to low-level stressors, such as static posture or physical inactivity, leads to discomfort and musculoskeletal disorders over time (Coenen et al., 2013; Kumar, 2001). The scope of this review is limited to office-based AI technologies for workflow automation and does not extend to machine learning models or generative artificial intelligence.

Figure 1 ***Cumulative Load Theory Process Diagram***



Note. Figure 1 illustrates how repeated static postures and limited movement can lead to cumulative physiological stress, contributing to the development of low back pain over time.

Table 1 ***Definition of Terms***

Term	Definition	Citation
Low Back Pain (LBP)	A condition characterized by discomfort, muscular tightness, or stiffness in the lower back region between the rib cage and the gluteal folds.	Wu et al., 2020; J. Wáng et al., 2016
Prolonged Sitting	Continuous sitting for six or more hours during the workday with limited movement or posture change.	O'Keeffe et al., 2013; Owen et al., 2010; Katzmarzyk et al., 2009)
Artificial Intelligence (AI)	AI refers to computational systems capable of mimicking human intelligence, such as learning, decision-making, and task automation.	Turing, 2009; Russell & Norvig, (1995); Zhai et al., 2021
Sedentary Behavior	A behavioral pattern characterized by extended periods of physical inactivity or minimal movement during waking hours.	Lis et al., 2007; Govindu & Babski-Reeves, 2014; Owen et al., 2010; Hanna et al., 2019
Government Sector Employees	Employees working within public institutions typically engage in administrative or clerical roles with fixed desk-based routines.	Spyropoulos et al., 2007; Lis et al., 2007
Cumulative Load	The accumulation of physical stress or strain on the musculoskeletal system over time due to repetitive or sustained postures or actions.	Coenen et al., 2013; Kumar, 2001
AI-Induced Sedentariness	The increase in sedentary behavior due to reliance on AI technologies that minimize physical movement in daily tasks.	Huang et al., 2020; Lewis et al., 2017; Owen et al., 2010
Workplace Automation	The use of AI systems to automate repetitive, data-driven, or routine office tasks that were previously performed manually.	Jain et al., 2022; Erik et al., 2025; Safari et al., 2024

Methodology

Literature Search Strategy

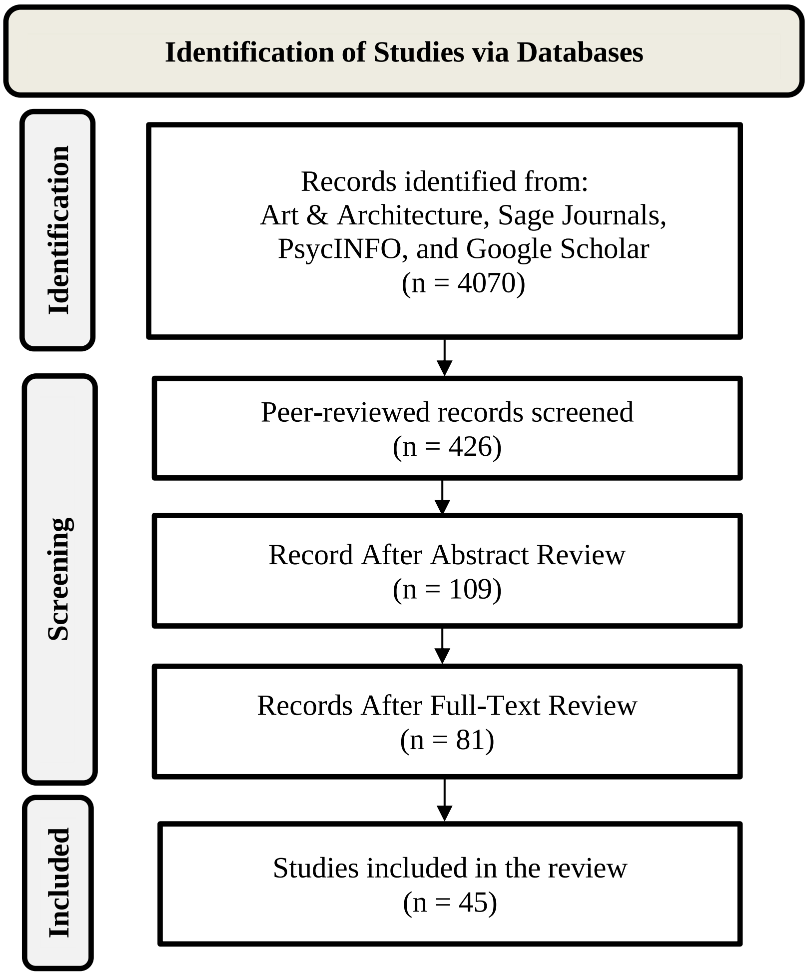
This literature review employed a rigorous five-stage methodology (identification, screening, eligibility, inclusion, synthesis) to investigate AI's impact on sedentary behavior and LBP among women government employees. A comprehensive literature search was conducted across Art & Architecture Source, Sage Journals, PsycINFO, and Google Scholar, targeting literature published between 2000 and 2025. Boolean operators were used to refine the search, applying the following string: ("Artificial Intelligence" OR "AI") AND ("Sedentary Behavior" OR "Prolonged Sitting") AND ("Low Back Pain" OR "Musculoskeletal Disorders") AND ("Government Employees" OR "Workplace") AND "Women". The initial search yielded 4070 records, which were screened. After removing duplicates and non-peer-reviewed material, 426 articles remained. These papers were then further screened based on abstracts and titles, using the following inclusion criteria: (a) empirical focus on the AI-sedentary LBP relationship and (b) specific relevance to women in government employment. This process yielded 109 potentially relevant articles, all of which were English-language articles.

Literature Analysis and Synthesis

From these, 81 articles were selected for in-depth, full-text review, prioritizing methodological quality, citation relevance, and applicability to Cumulative Load Theory. Ultimately, 45 studies were retained for in-depth synthesis. Data were extracted using a standardized evidence-mapping framework and organized by key themes. Thematic analysis explored how AI-related automation affects physical strain and LBP risk, with particular focus on women in sedentary administrative roles. The review addressed two core research questions:

1. How does AI integration exacerbate sedentary behaviors and LBP severity in female government employees?
2. What ergonomic and policy interventions mitigate AI-induced sedentariness and LBP?

Figure 2 ***Flow Chart illustrating key steps in the literature review and analysis***



Note. This PRISMA-style diagram has been provided to enhance clarity and transparency. The current study did not involve a systematic literature review.

Literature Review

Background

LBP is a condition marked by discomfort, muscular tightness, or stiffness in the area below the rib cage and above the lower buttock creases (Wáng et al., 2016). It is a complex condition with multiple contributors to both pain and related disability, including psychological factors, social factors, biophysical factors, comorbidities, and pain treatment mechanisms (Hartvigsen et al., 2018). LBP is a prevalent symptom experienced by people of all ages (Hoy et al., 2012). The lifetime prevalence of LBP was estimated to be about 60–90% (Bell & Burnett, 2009). The World Health Organization classifies LBP as the sixth leading cause of global disease burden (Hoy et al., 2014). LBP stands as the world's primary cause of Years Lived with Disability (YLDs) while research indicates that workforce aging will elevate its burden (Wu et al., 2020; Hoy et al., 2014).

In the context of the workplace, this can be caused by repeated exposure of the body to low-level stressors, such as static posture or physical inactivity, which accumulates over time, ultimately leading to discomfort, injury, or musculoskeletal disorders (Safari et al., 2024; Coenen et al, 2013; Kumar, 2001). Extended periods of sitting have been identified as a factor contributing to LBP in individuals in sedentary jobs like government sector employees (O'Keeffe et al., 2013; Spyropoulos et al., 2007). LBP directly affects productivity and presenteeism in the workplace (Wáng & Káplár, 2016), with chronic back pain resulting in 16.7 minutes lost per employee per day and a total of $1.21 billion in lost productivity (Allen et al., 2018).

LBP affects women more frequently, especially those between 49 and 50 years old, due to accelerated disc degeneration resulting from estrogen deficiency (Wáng et al., 2016; Manchikanti et al., 2014). Women in their postmenopause experience the highest risk of LBP because estrogen deficiency accelerates spinal disc degeneration and weakens bone structure (Wáng et al., 2016). According to Wáng et al. (2016), the protective nature of estrogen for intervertebral disc hydration and structural integrity leads to higher risks of vertebral disc herniation and chronic musculoskeletal pain. The combination of wider pelvises and different spinal curvatures, along with less muscle mass in the lumbar area, creates higher biomechanical stress during prolonged sitting (Hoy et al., 2010; Wáng et al., 2016), which is typical of the case for office settings (Manchikanti et al., 2014; Lis et al., 2007).

Female workers in the government sector often occupy administrative roles that involve repetitive administrative work (Al-Harthy & Al-Rahbi, 2021), while facing minimal autonomy of movement and extended periods of sitting (Huang et al., 2020; O'Keeffe et al., 2013; Lis et al., 2007; Spyropoulos et al., 2007). These environments often lack ergonomic customization, and women are less likely to request support in shared or outdated workspaces (Spyropoulos et al., 2007; Arundell et al., 2018). The fear of job instability, along with perceptions of weakness and concerns about appearing less competent, drives female employees to minimize reporting musculoskeletal discomfort, especially within hierarchical public institutions (Alaca et al., 2025). The combination of psychosocial stress, biological susceptibility, and restrictive workplace conditions leads to higher LBP rates among female government employees (Punnett & Herbert, 2021).

Prolonged Sitting & Sedentariness

Prolonged sitting, defined as being seated for more than 6 hours, has been directly linked to LBP among government workers (O'Keeffe et al., 2013; Spyropoulos et al., 2007). Sedentary behavior is distinct from general physical inactivity and is characterized by minimal physical movement and energy expenditure of less than 1.5 metabolic equivalent units (Hanna et al., 2019; Walsh et al., 2015; Owen et al., 2010). Prolonged static sitting reduces spinal disc nutrition and increases intradiscal pressure, which is associated with degeneration of the lumbar spine (Kumar, 2001).

Work is a significant contributor to sedentary behavior among adults in a growing number of occupational sectors (Safari et al., 2024; Church et al., 2011). Administrative coordination, data entry, and document processing tasks require office workers to spend long periods sitting, providing limited opportunities for physical activity (Huang et al., 2020; Lis et al., 2007). Government sector employees who spend long periods sitting face a high risk of musculoskeletal disorders, especially when their work involves little physical activity or task variation (Arundell et al., 2018; O'Keeffe, 2013; Spyropoulos et al., 2007).

The consequences of LBP extend beyond discomfort and have broader implications for organizational structure, resulting in decreased productivity and overall work quality (Wáng & Káplár, 2016). LBP contributes to employee job dissatisfaction and work stress among government workers (Spyropoulos et al., 2007), and some research has shown that individuals with back pain are more likely to experience depression (Hanna et al., 2019). Ergonomic interventions, such as sit-stand desk, have proven effective in reducing prolonged sitting and its associated risks (Edwardson et al., 2022).

Occupational and Ergonomic Contributors to LBP

Occupational variables play a crucial role in the development and persistence of LBP (Safari et al., 2024; Govindu & Babski-Reeves, 2014). Multiple research studies have established that sustained poor posture, together with repetitive tasks and prolonged static sitting and suboptimal ergonomic conditions, serve as primary factors that cause musculoskeletal strain and lead to LBP development (Alaca et al., 2025; Norha et al., 2024; Safari et al., 2024; Baradaran et al., 2021; Arundell et al., 2018). The nature of the job in the government sector makes employees susceptible to LBP (Shrestha et al., 2018). Most of these positions require employees to spend extended periods performing tasks from a seated position, including data entry, report writing, public service correspondence, and policy analysis (Huang et al., 2020). The public sector office environment features strict schedules, repetitive workflows, and fixed seating arrangements that restrict biomechanical variability and result in spinal loading over time (Huang et al., 2020; Arundell et al., 2018).

The risk worsens due to outdated office furniture combined with inadequate ergonomic interventions (Lis et al., 2007), which include non-adjustable chairs, improperly aligned desks, and shared workstations lacking lumbar support or flexibility (Baradaran et al., 2021; Govindu & Babski-Reeves, 2014). The physical arrangements in these setups force users to adopt kyphotic postures, which leads to spinal misalignment and speeds up musculoskeletal fatigue and spinal degeneration (Wáng et al., 2016; Kumar, 2001). Performance is often evaluated on visible output or time at the desk, reinforcing sedentary behaviors even when breaks would be ergonomically beneficial (Norha et al., 2024; Kumar, 2001).

Even though ergonomic interventions, such as sit-stand desks, lumbar-supportive chairs, and posture training, have proven effective in reducing LBP symptoms (Lis et al., 2007), intervention trials show that even modest reductions in daily sitting (e.g., ~40 minutes) over six months can significantly prevent the progression of LBP (Norha et al., 2024). However, without systemic changes in workplace norms and physical setups, government employees remain at elevated risk of developing and maintaining LBP (Govindu & Babski-Reeves, 2014).

As studies have shown, women are more likely to report work-related musculoskeletal disorders, including LBP, due to a combination of biological and occupational factors (Wáng et al., 2016; Manchikanti et al., 2014). These include hormonal influences that affect disc health (Wáng et al., 2016), as well as occupational role assignments that may involve extended durations of screen work or clerical tasks with minimal variation or relief (Huang et al., 2020).

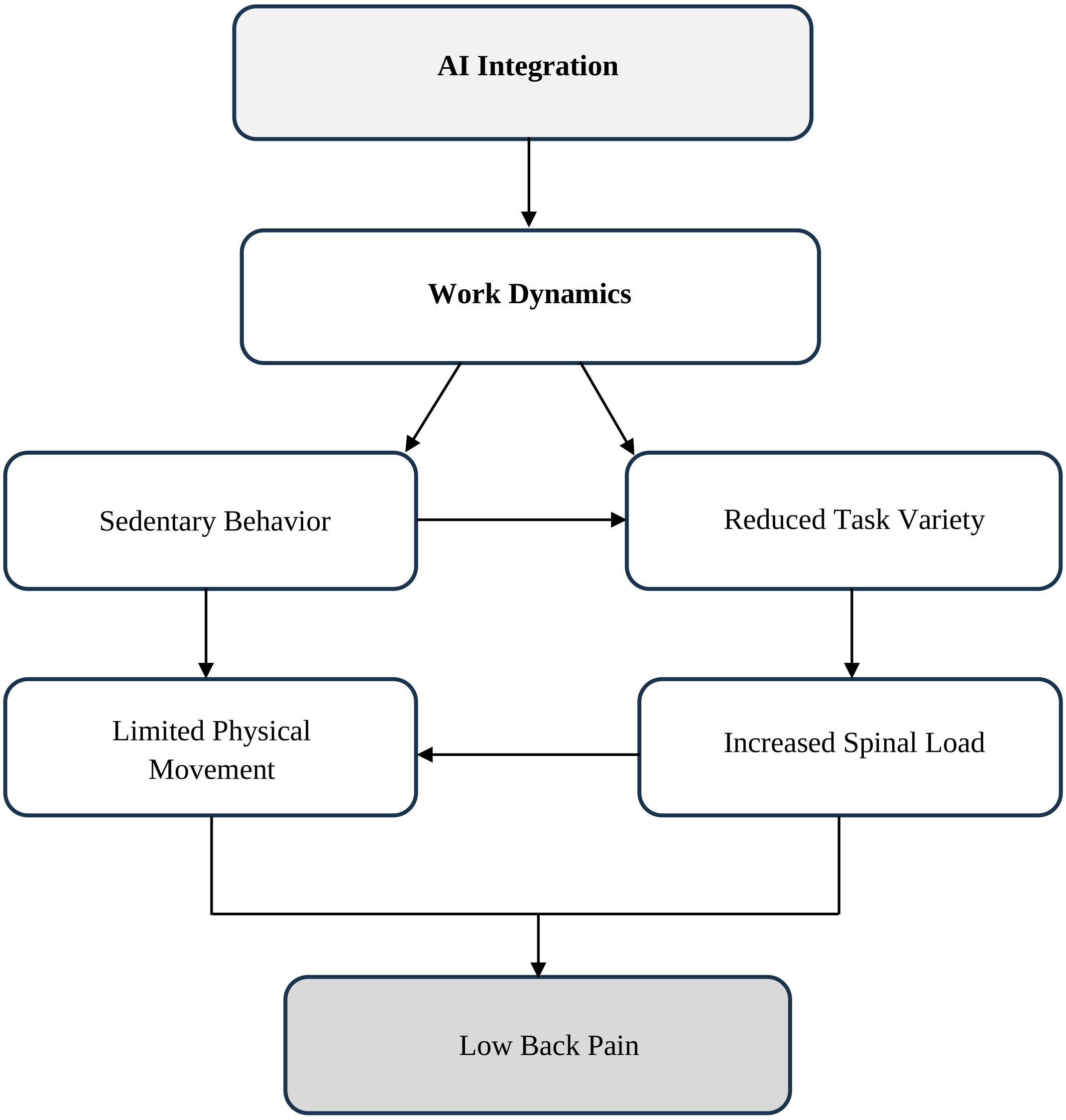
AI and Sedentariness in the Workplace

Work has become a primary driver of sedentary behavior among adults, primarily due to the advancement in labor-saving technologies that have significantly reduced the need for physical activity in the workplace (Walsh et al., 2015; Church et al., 2011). Workplace AI tools, including intelligent scheduling systems, document automation, and virtual communication platforms, are being increasingly implemented to boost efficiency (Javaid et al., 2022; Erik et al., 2025; Ejjami, 2024). However, these technologies lead to increased sedentary behavior because they decrease physical activity levels, face-to-face interactions, and task variety (Huang et al., 2020; Lewis et al., 2017; Owen et al., 2010). The implementation of AI-enabled systems in government offices optimizes workflows while eliminating spontaneous movements that occur when employees walk to meetings or retrieve documents (Erik et al., 2025; Ejjami, 2024; Huang et al., 2020). Consolidates tasks into long uninterrupted desk sessions, resulting in harmful postural patterns (Alaca et al., 2025; Baradaran et al., 2021; Spyropoulos et al., 2007).

Moreover, AI-powered monitoring tools may contribute to heightened surveillance and stress, discouraging microbreaks and movement, even among employees already experiencing LBP symptoms (Brougham & Haar, 2018). The implementation of AI through smart offices and health platforms enables better employee engagement and flexibility, but can also create new stressors, depending on how organizations deploy these systems (Soulami et al., 2024). Smart offices and AI-driven health platforms provide promising solutions to customize workstations and encourage movement, which benefits employee well-being (Soulami et al., 2024; Safari et al., 2024; Fukumura et al., 2021; Shrestha et al., 2018). According to Fukumura et al. (2021), office workers expressed their willingness to use AI systems for promoting healthy behavior and reducing sedentary time when these systems are non-intrusive and personalized to individual needs.

Interventions such as mobile or wearable prompts, sitting reminders, and posture feedback systems have demonstrated effectiveness in reducing sitting time and improving physical activity during the workday (Safari et al., 2024; Gabarron et al., 2024; Shrestha et al., 2018).

Figure 3 ***AI Impact Pathway Model***



Note. This model illustrates the potential pathway by which AI-enabled automation and monitoring in government offices may intensify sedentary behavior.

Discussion

The review suggests a potential association that AI integration in government workplaces leads to increased sedentary behaviors, which intensify LBP mainly among female workers. Government administrative work typically involves extended screen time, data entry, and virtual communication, tasks usually requiring extended periods of sitting and minimal physical activity. The implementation of AI tools for scheduling automation, document workflow optimization, and digital communication tools reduces the frequency of tasks that naturally interrupt prolonged sitting. The research employs Cumulative Load Theory to explain how repetitive, low-level physical stress can lead to long-term musculoskeletal strain. The combination of static postures with aging leads to increased spinal pressure, which speeds up disc deterioration in older women because their bodies undergo natural changes from reduced estrogen levels during menopause. A combination of inflexible work patterns, outdated office furniture, and insufficient ergonomic support can further exacerbate this biological vulnerability. Additionally, female workers in these roles face restricted movement, repetitive tasks, and often lack the autonomy to modify their postures or take frequent breaks.

Further compounding the problem is the underreporting of musculoskeletal discomfort among female employees due to workplace culture and perceived stigma, especially in hierarchical public institutions. This is compounded by presenteeism behaviors reinforced by surveillance-oriented AI systems, which monitor activity and create pressure to remain seated and “visible” during work hours. Although some studies advocate AI as a vehicle for promoting physical activity through alerts and smart feedback systems, these health-supportive applications are not yet widespread in public sector offices. Most AI deployments continue to prioritize efficiency over holistic well-being, missing the opportunity to incorporate features that encourage movement and reduce musculoskeletal risks. Ergonomic interventions such as sit-stand desks, lumbar-supportive seating, and task rotation have shown significant promise in alleviating LBP. These interventions are often absent or inconsistently applied across government agencies, particularly in low-resource departments with an aging infrastructure.

The research demonstrates that organizations need to develop a unified workplace strategy that unites ergonomic design improvements with AI-based behavioral alerts and organizational policy transformations. Public sector leaders should recognize AI as a tool for automation and a platform to enhance worker health through features that include movement alerts and posture guidance, and flexible workflows that prevent prolonged sitting periods. The development of practical and equitable solutions requires occupational health experts to co-create tools with employees, seeking their input throughout the process.

Conclusion

This review underscores the complex interplay between AI-driven workplace automation, sedentary behavior, and LBP among women in government sector offices. The implementation of AI technologies offers administrative benefits; however, it leads to decreased physical movement and prolonged periods of static positions, which can contribute to the development of LBP. The Cumulative Load Theory suggests that AI-enhanced work environments can increase long-term musculoskeletal strain from static sitting, particularly for female employees who work at desks. The research demands that public sector workplaces transform their AI implementation strategy from a productivity-focused approach to a comprehensive one that prioritizes occupational health. AI adoption in government workplaces should follow evidence-based ergonomic strategies, complemented by gender-sensitive reforms. The implementation of sit-stand workstations, together with AI-enabled health prompts and flexible scheduling policies, can help reduce sedentary risks and promote better work habits. A holistic approach that integrates technology with ergonomics and inclusive workplace design remains essential for improving both health and productivity in digital government work environments.

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