

# Suggested Work Modifications for Patients with Environmental and Occupational Risk Factors in Hidradenitis Suppurativa

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## Abstract

Hidradenitis suppurativa (HS) is a chronic, inflammatory skin condition characterized by painful nodules, abscesses, and scarring, primarily affecting areas rich in apocrine glands. Environmental and occupational risk factors, including prolonged exposure to heat, friction, and certain chemicals, have been identified as exacerbating conditions for HS. Yet, there remains a lack of tailored recommendations for modifying work environments to alleviate these triggers. This review presents novel suggestions for work modifications to reduce HS flare-ups, such as implementing breathable, friction-reducing workwear, ergonomic adjustments to minimize pressure on affected areas, and introducing low-irritant hygiene protocols in workplaces with chemical exposure. These recommendations are grounded in emerging evidence linking specific occupational exposures to the exacerbation of HS symptoms. The novelty of this approach lies in its proactive stance, shifting from reactive management of HS symptoms to preventative environmental modifications. Future studies should explore the long-term efficacy of these modifications and investigate the potential for personalized work environment adjustments based on individual patient profiles. Targeted workplace interventions may significantly improve the quality of life for HS patients, highlighting the need for multidisciplinary collaboration between dermatologists, occupational health specialists, and employers.

## Keywords

Hidradenitis Suppurativa, Occupational Risk Factors, Work Environment Modifications, Heat and Friction Exposure, Ergonomic Adjustments, Chemical Irritants, Preventative Strategies, Workwear for HS, Environmental Triggers, Dermatology and Occupational Health Collaboration

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## 1. Introduction

Hidradenitis suppurativa (HS) is a chronic and debilitating skin condition characterized by painful nodules, abscesses, and progressive scarring. This inflammatory disorder primarily affects areas rich in apocrine glands, such as the axillae, groin, and under the breasts. The disease manifests through recurrent, painful lumps and nodules that can become abscesses, eventually leading to sinus tract formation and scarring. Hidradenitis suppurativa is thought to result from a combination of genetic, immunologic, and environmental factors, including follicular occlusion, dysregulation of the immune system, and inflammatory pathways [1]. Contributing factors such as obesity, smoking, hormonal fluctuations, and genetic predisposition can exacerbate the condition by promoting chronic inflammation and abscess formation. The impact of HS on patients is profound, often causing significant physical discomfort and psychological distress. Understanding the nature of hidradenitis suppurativa, including its symptoms and affected areas, is crucial for developing effective environmental and occupational management strategies and improving patient quality of life.

The prevalence of hidradenitis suppurativa varies significantly across different populations and studies, ranging between 0.1% and 4% globally. HS commonly manifests between the ages of 18 and 39 years, with the highest incidence in young adults. In the United States, HS affects women approximately 2.4 times more often than men [2]. This discrepancy with women being more commonly affected than men may be explained by hormonal influences of the apocrine glands and eccrine glands in intertriginous areas, including higher androgen sensitivity and menstrual cycle fluctuations [3]. However, men tend to experience more severe disease manifestations, often with deeper lesions and higher rates of sinus tract formation. A significant racial disparity exists for HS, with Black patients three times more likely to be diagnosed with HS compared to White patients in the United States [4]. Obesity is also strongly correlated with the presence and severity of HS [5]. Patients with obesity have increased skin folds and intertriginous areas, creating more areas of friction and moisture retention, which is an environment conducive to the development and exacerbation of hidradenitis suppurativa.

Management of hidradenitis suppurativa involves a combination of pharmaceutical, procedural, and surgical approaches. Topical clindamycin is commonly used for mild cases, while oral antibiotics such as tetracyclines (doxycycline,

minocycline) are favored for their dual antimicrobial and anti-inflammatory properties. For more severe or refractory cases, systemic biologics are integral to treatment, with TNF- $\alpha$  inhibitors like adalimumab being FDA-approved and commonly used, while newer biologics targeting IL-17 (secukinumab) and IL-12/23 (ustekinumab) show promise in reducing inflammation and lesion formation. Hormonal therapies, such as spironolactone and combined oral contraceptives, are useful for HS patients with hormonal involvement, especially women. Oral retinoids, including acitretin and isotretinoin, are employed in some chronic or recalcitrant cases due to their ability to modulate follicular keratinization. Systemic corticosteroids (e.g., prednisone) are sometimes used in short courses for acute flares, but their long-term use is avoided due to side effects. Intralesional corticosteroid injections (triamcinolone) are frequently used to reduce inflammation and pain in active nodules and abscesses. Additional therapies include zinc gluconate, which has anti-inflammatory and antimicrobial properties, and metformin, particularly in patients with metabolic syndrome or insulin resistance. Surgical interventions such as deroofing, wide excision, and carbon dioxide laser therapy may be required in advanced stages to manage sinus tracts and scarring [6]. Novel approaches like laser hair removal (Nd:YAG laser) and photodynamic therapy have also been explored as adjunct treatments to reduce follicular occlusion and inflammation. Research suggests that the Nd:YAG laser may be effective in treating HS by reducing inflammation and preventing the formation of new lesions [6] [7]. This method holds promise as a targeted, non-invasive treatment option with a favorable safety profile, offering improved patient satisfaction and quality of life.

Environmental and occupational factors have been increasingly recognized as significant contributors to the exacerbation of hidradenitis suppurativa. Studies have demonstrated regional and seasonal variance in HS flares, with more frequent occurrence in warmer climates and during hotter times of the year [8] [9]. Additionally, demanding occupational conditions, which may involve the use of occlusive uniforms, participation in sweat-inducing activities, and limited access to hygienic products, have been shown to contribute to the exacerbation of HS [10]. Key risk factors include prolonged exposure to heat, friction, and various chemicals, which can aggravate the condition [11]. Heat and humidity create a conducive environment for sweat and moisture buildup, leading to increased friction and irritation of affected skin areas. Moreover, exposure to certain chemicals, particularly in occupational settings, can further irritate the skin and trigger flare-ups. These environmental stressors exacerbate HS symptoms, leading to more frequent and severe episodes, thereby complicating the management of the disease and highlighting the need for targeted preventive measures.

This paper aims to critically review and propose innovative work modifications to mitigate the impact of environmental and occupational risk factors on hidradenitis suppurativa flare-ups. By examining the current understanding of how specific workplace exposures contribute to the exacerbation of HS, this review seeks

to identify actionable modifications that can be implemented in work environments to reduce these triggers. The focus will shift from reactive symptom management to a more proactive approach that emphasizes environmental adjustments to prevent disease progression and improve patient outcomes.

This review aims to fill a crucial gap in the current literature by presenting novel recommendations for work modifications tailored to hidradenitis suppurativa patients. These recommendations include the adoption of breathable, friction-reducing workwear, ergonomic adjustments to minimize pressure on affected areas, and implementing low-irritant hygiene protocols in environments with chemical exposure. By advocating for these preventative strategies, the paper seeks to contribute to a shift in how HS is managed in occupational settings, emphasizing the importance of environmental modifications in enhancing patient care and potentially reducing the frequency and severity of hidradenitis suppurativa flare-ups.

## 2. Discussion

The relationship between environmental risk factors and the exacerbation of hidradenitis suppurativa has been well-documented in the scientific literature. Several studies have highlighted the role of heat and humidity in aggravating HS symptoms. High temperatures and excessive moisture are known to exacerbate inflammation, leading to an increased incidence of flare-ups [9]. These conditions promote bacterial overgrowth in damp, warm intertriginous areas, further contributing to skin irritation and triggering exacerbations [12]. Heat and sweat may also damage eccrine structures, and dysbiosis may induce an inflammatory reaction, leading to HS flares. This may explain the geographic predominance of summer flares in the southern regions of the United States, where humidity is higher. Supporting this, a national study on emergency department visits due to HS found that the majority of these visits occur during the summer, particularly in the South, underscoring the impact of environmental factors like humidity [8]. Furthermore, friction from repetitive motion or tight clothing can cause continuous irritation of affected skin areas, worsening HS symptoms by creating a cycle of irritation and inflammation [13]. These environmental conditions create a compounding effect, underscoring the need for comprehensive management strategies to mitigate the risks associated with hidradenitis suppurativa.

While direct studies specifically linking chemical exposure to hidradenitis suppurativa are limited, there is growing recognition that environmental factors, including contact with certain chemicals in occupational settings, can exacerbate inflammatory skin conditions like HS. Constant exposure to harmful substances increases the risk of developing conditions like contact dermatitis, which can further aggravate HS [14]. The cumulative effect of these exposures weakens the skin's barrier function, making it more susceptible to frequent and severe flare-ups, underscoring the need for stringent protective measures in the workplace [15]. Chemicals such as industrial cleaners, solvents, and detergents are particularly concerning, as they can cause skin irritation and promote inflammation [16].

Occupational exposure to substances such as polycyclic aromatic hydrocarbons, known to disrupt the microbiome, may be implicated in HS exacerbation [17]. While the role of chemical exposure in HS has been theorized, further investigation into this relationship is essential. Developing targeted interventions to reduce these potential occupational hazards may be critical in managing hidradenitis suppurativa.

Current work modifications and management strategies aimed at mitigating hidradenitis suppurativa symptoms include the use of specialized clothing and adherence to rigorous workplace hygiene protocols. Breathable, loose, and friction-reducing clothing, such as bamboo or cellulose-derived rayon, can help alleviate physical triggers associated with HS by minimizing skin irritation, microbial colonization, and moisture retention [18]. Additionally, moisture-wicking clothing, such as those made from soybean protein, may further reduce microbial colonization and benefit individuals who experience excessive sweating, a common trigger for HS [19]. For a more affordable and widely available option, 100% cotton clothing is a gentle alternative that remains kind to the skin [18]. Finally, workplace hygiene protocols that emphasize the use of low-irritant cleaning agents and maintaining clean, dry work environments are essential in preventing further skin irritation and flare-ups. Together, these strategies provide a comprehensive approach to managing hidradenitis suppurativa in the workplace, ensuring that individuals with hidradenitis suppurativa can maintain their comfort and productivity.

Despite the importance of tailored interventions, many workplaces lack specific protocols aimed at addressing the needs of individuals with hidradenitis suppurativa, leading to considerable workplace impairment, particularly in those with severe disease or higher levels of depression and anxiety [20]. This underscores the importance of establishing comprehensive workplace hygiene and clothing protocols to limit work absences and reduce productivity loss among individuals with HS. Although these practices can help reduce exposure to irritants, their effectiveness is often limited, as they do not fully address all the factors contributing to HS exacerbations. Therefore, individuals with HS must proactively discuss workplace modifications with their employers. More personalized adjustments and comprehensive preventive measures tailored to each individual's unique needs and job demands are necessary to manage HS effectively [21]. Collaboration between healthcare providers, employers, and employees is crucial for developing effective, individualized management plans that significantly improve workplace functioning and overall quality of life for those with hidradenitis suppurativa.

### **2.1. Novel Recommendations for Work Modifications**

Adopting breathable, friction-reducing workwear emerges as a crucial intervention to address the exacerbation of hidradenitis suppurativa due to environmental factors. To minimize friction and irritation, loose-fitting, breathable clothing without tight bands or straps should be prioritized for HS patients [18]. Thus,

tight-fitting shirts and pants, along with garments with seams, should be avoided. The selection of fabric is equally as significant as the structural elements of workwear. Fabrics composed of bamboo fiber contain hollow cross-sections and micro-cracks and grooves that allow for breathability and moisture wicking, and studies have shown that bamboo has antimicrobial properties due to present bioagents [22]. This could implicate natural blends and fabrics that contain bamboo as ideal materials for workwear garments, as they provide a drier, cooler environment, further reducing friction and irritation. The antimicrobial properties of bamboo may help minimize bacterial growth in abscesses and reduce the unpleasant odor, which can be troubling for individuals with HS. Properly designed workwear can substantially mitigate the physical stressors contributing to hidradenitis suppurativa flare-ups, providing a more comfortable and supportive option for affected individuals.

Ergonomic adjustments in the workplace are critical in managing hidradenitis suppurativa, particularly in sensitive areas like the thighs and buttocks. Studies have shown that prolonged mechanical pressure on the skin leads to tissue deformities and blood and lymphatic flow disruptions, which are associated with pressure ulcer formation [23]. For individuals with HS, extended pressure on already compromised areas can worsen symptoms and increase the risk of ulcers, while reduced blood flow can impede the healing of HS abscesses, prolonging discomfort. Standing desks, which allow employees to alternate between sitting and standing, can help relieve irritation in these areas. Research on seat cushions has shown that foam and air cushions reduce interface pressure, whereas gel cushions were found to be ineffective [24]. When standing desks are not practical, providing these seat cushions offers an alternative to reduce HS aggravation. Customizing workstations to fit individual needs and incorporating cushioning materials can decrease the risk of exacerbation by minimizing direct pressure and friction. While these accommodations are not yet standard practice, they represent an important opportunity to improve the work environment for individuals with HS. Implementing such adjustments could lead to reduced flare-ups and greater productivity.

The adoption of low-irritant hygiene protocols is critical in workplaces with significant chemical exposure. Protective measures such as switching to low-irritant cleaning agents, providing protective barriers, and maintaining clean, dry environments should be implemented to minimize skin irritation and reduce the risk of HS flare-ups. Handling chemicals and washing hands can damage the skin barrier and lead to irritant contact dermatitis (ICD), making gloves a recommended protective measure to reduce the risk [25]. Gloves can help safeguard the already vulnerable skin barrier of people with HS from the disruptive chemicals implicated in ICD while also limiting their contact with bacteria that could cause secondary infections. Despite their protective nature, prolonged glove-wearing can cause occlusive effects by inhibiting sweat evaporation, increasing exposure to harmful chemicals, and impairing skin barriers. Using liners made of cotton,

Sympatex, or other synthetic and natural fibers is recommended to reduce potential harm [26]. It is essential for those impacted by HS to reduce possible skin irritations while maintaining a dry environment for their hands to minimize flare-ups. Cotton liners, specifically, offer a soft barrier between the skin and the glove, minimizing friction and skin discomfort caused by the material of the outer glove. These recommendations emphasize a proactive approach to managing hidradenitis suppurativa through environmental and procedural modifications.

## 2.2. Emerging Evidence and Mechanisms

Recent research has shed light on the specific occupational and environmental exposures that contribute to the exacerbation of hidradenitis suppurativa. As previously discussed, workers in industries with high heat, humidity, and chemical exposure are particularly at risk for worsened HS symptoms. Meanwhile, smoking has been well recognized as a significant contributing factor to the pathogenesis of HS, with active smokers showing more affected areas and weaker treatment responses [27]. One cross-sectional study identified that more than half (58.73%) of patients with HS were exposed to second-hand smoke within a 12-month period as compared to a significantly lower percentage of patients with other skin conditions [28]. Those who work in transportation and warehousing industries and workers with services and blue-collar occupations had a significantly higher prevalence of exposure to workplace secondhand smoke than those with white-collar occupations [29]. The disparity in workplace exposure emphasizes the importance of accommodations to protect workers from immediate health risks and mitigate the exacerbations of chronic conditions like hidradenitis suppurativa.

Workers in industries such as manufacturing, agriculture, and cleaning services are frequently exposed to chemicals and irritants such as solvents, detergents, pesticides, fuels, and exhaust. Studies have shown that hundreds of chemicals in virtually every industry have been associated with direct and immune-mediated effects on the skin and flare-ups for chronic skin conditions [30]. Additionally, high physical exertion and tight clothing or equipment in these occupations can further aggravate HS by increasing friction and damaging the skin barrier. Repeated mechanical stress, friction, and pressure make the skin susceptible to inflammation and infection, exacerbating HS symptoms [31]. The Koebner phenomenon, observed in HS, suggests that trauma or friction at affected areas may cause new lesions, particularly in individuals with obesity [32]. Workplace modifications that minimize chemical exposure and physical stressors are crucial for preventing work-related exacerbations.

Environmental factors are known to influence hidradenitis suppurativa flare-ups through mechanisms involving complex inflammatory pathways and skin barrier disruptions. The pro-inflammatory cytokines such as IL-1, IL-6, IL-17, and TNF- $\alpha$  are up-regulated with HS and contribute to immune cell infiltration [33]. Disruption of the microbiome of the skin surface can also activate pattern recognition receptor pathways, leading to a chronic inflammatory response with

resultant HS exacerbation. In addition, the aberrant host immune response in HS creates a chronic positive feed-forward loop, perpetuating inflammation, tissue destruction, and disease exacerbation [34]. Environmental factors, such as changes in humidity and temperature, can disrupt the skin barrier, leading to increased keratinocyte proliferation, inflammation, and susceptibility to mechanical stress, all contributing to worsening symptoms [35]. These environmental fluctuations weaken the skin's protective barrier and create a more favorable environment for colonizing pathogenic bacteria, further fueling the inflammatory cycle and exacerbating the severity of hidradenitis suppurativa lesions.

Workplace modifications show promise for managing hidradenitis suppurativa symptoms and preventing work-related exacerbations. As discussed, breathable and absorbent materials are recommended to reduce microbial colonization, sweat retention, and irritation in workplace settings [18]. Emerging research suggests that functional textiles with anti-microbial properties, such as silver-coated fabrics, may offer additional benefits by reducing bacterial growth and supporting skin barrier protection [36]. Incorporating these innovative textiles into work attire could help minimize bacterial colonization and prevent skin barrier disruption. However, additional studies are needed to fully understand their impact on managing hidradenitis suppurativa.

The theoretical benefits of these modifications offer the potential for significant improvement in hidradenitis suppurativa symptoms, a reduction of the frequency of HS exacerbations, and an overall improvement in the quality of life of patients with HS. Targeted environmental and workplace adjustments can substantially improve patient outcomes and reduce the time lost at work due to flare-ups, associated pain, and other complications. These modifications represent crucial advancements in the treatment and management of HS, promoting equitable and fair treatment for employees affected by this chronic condition. By integrating these occupational health strategies into the workplace, employers can contribute to a more supportive work environment, helping to positively impact productivity and the overall well-being of patients with hidradenitis suppurativa.

### **2.3. Implementation and Future Directions**

Implementing work modifications to manage hidradenitis suppurativa involves several practical considerations that must be addressed to ensure effective integration into workplace settings. Employers and employees need clear guidelines for adopting these modifications, such as selecting appropriate workwear and redesigning workstations. Part of this process should involve consulting with a dermatologist to confirm that suitable measures are implemented, with nuances of the condition in mind. Practical steps include training staff on the benefits of breathable fabrics and ergonomic adjustments and establishing protocols for maintaining low-irritant hygiene practices. Employers should develop policies that incorporate low-irritant hygiene protocols and ensure compliance with health and safety regulations guided by occupational health experts. Occupational

health experts can assist with this aspect of plan development. Clear communication and ongoing support are essential for successful adoption and compliance.

The practicality of these modifications largely depends on the specific work environment, requiring careful consideration to ensure appropriate application. Administrators should establish adaptable approaches in accordance with workplace guidelines. For instance, using low-irritant cleaning agents may not be feasible, particularly in settings such as healthcare, where sanitation protocols necessitate exposure to harsh chemicals. In such cases, alternative modifications, such as using personal protective equipment (PPE), should be considered. Another example is hair salon workers, who may be vulnerable to airborne and direct contact exposure to chemicals such as formaldehyde and ammonia in salons [37]. Contact with these chemicals can irritate the skin and exacerbate inflammatory skin conditions without ease of avoidance. In this situation, special consideration should be given to PPE and workwear. Addressing the needs of employees with hidradenitis suppurativa requires proper planning with modifications that are both creative and flexible.

A thorough cost-benefit analysis is essential to evaluate the feasibility of implementing workplace modifications for hidradenitis suppurativa. While initial expenses may include investments in specialized workwear, ergonomic equipment, and low-irritant cleaning agents, long-term savings can offset these costs through reduced absenteeism, lower healthcare costs, and improved employee productivity. Studies show that patients with HS miss significantly more work days than those without the condition, which increases company costs and reduces patient income [38]. Implementing appropriate modifications for individuals with hidradenitis suppurativa can mitigate these risks and facilitate company functionality and efficiency, leading to a positive return on investment.

Additionally, enhancing employee well-being and reducing the incidence of hidradenitis suppurativa flare-ups can increase job satisfaction and retention rates. When companies cultivate a positive culture, and employees feel valued, they are more motivated to invest effort into their work, leading to increased productivity and higher-quality output [39]. This, in turn, enhances overall company efficiency. Additionally, employee turnover can impose tremendous expenses on companies [40]. Companies can strengthen workplace loyalty by improving employee satisfaction, thereby diminishing these indirect costs. Analyzing these factors will help employers make informed decisions about the financial implications of implementing work modifications.

Delayed benefits and the existing resources for employees with other medical conditions may justify accommodation costs. Access to specialized workwear can become cost-effective if companies collaborate with suppliers to secure bulk-purchasing discounts and reduce overall costs. As mentioned, ergonomic equipment, such as standing desks and padded chairs, may have financial merit. Research predictions have indicated that ergonomic interventions can yield a return on investment of two to three dollars for every dollar spent [41]. Additionally, transitioning

to low-irritant cleaning agents would be unlikely to profoundly impact costs, as these products are available at competitive prices. Overall, the proposed workplace modifications are not expected to burden company expenses substantially and may produce long-term gains. A thorough cost-benefit analysis should be performed at the individual workplace level to determine the specific impact.

Future research should focus on the long-term efficacy of these work modifications to ensure they provide sustained benefits for hidradenitis suppurativa management. Studies assessing the durability and impact of these interventions over extended periods will be essential for validating their effectiveness. Personalized workplace adjustments are crucial for ensuring that modifications address HS patients' specific needs and triggers, and ongoing support is necessary for successful integration. This requires partnership with the patient to assess their expectations and concerns in order to develop individualized modifications. Furthermore, interdisciplinary research involving dermatologists, occupational health specialists, and workplace safety experts is vital. While dermatologists provide insights into HS considerations and management, occupational health specialists and workplace safety experts can ensure appropriate accommodations are met without compromising safety measures. Collaborative efforts will ensure a comprehensive approach to developing and implementing effective workplace interventions, fostering a better understanding of how environmental modifications can be optimized for individuals with hidradenitis suppurativa and potentially improving the overall quality of life for affected workers.

### 3. Conclusion

This review highlights the pressing need for targeted work modifications to manage hidradenitis suppurativa effectively by addressing environmental and occupational risk factors that exacerbate the condition. The proposed strategies—incorporating breathable, friction-reducing workwear, implementing ergonomic adjustments to minimize pressure, and adopting low-irritant hygiene protocols—represent a transformative shift from reactive symptom management to a proactive approach focused on preventing flare-ups. By mitigating the adverse effects of heat, friction, and chemical exposure through these modifications, significant improvements in symptom management and overall quality of life for individuals with HS can be achieved. Implementing these recommendations will require careful consideration of practical guidelines, economic feasibility, and clear communication to ensure successful integration into workplace settings. A comprehensive cost-benefit analysis will be essential to balance the initial investments against the long-term savings associated with reduced healthcare costs and enhanced productivity. Future research should focus on evaluating the long-term efficacy of these interventions and exploring personalized adjustments based on individual patient profiles. Additionally, interdisciplinary collaboration among dermatologists, occupational health specialists, and workplace safety experts will be crucial to develop and refine these strategies, ultimately advancing the management of

hidradenitis suppurativa through evidence-based and patient-centered workplace modifications.

## Conflicts of Interest

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

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