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Letter to Editor

A Data-Driven and Technological Framework for Managing Psychosomatic Disorders in Working Women: A Biostatistical Perspective

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1. Dear Editor

Psychosomatic disorders in working women are a growing occupational and public health concern. These disorders have consistently been reported more frequently in women than in men, a disparity that has been linked to factors such as work–family conflict, demanding jobs with little autonomy, gender discrimination, and the glass ceiling (1, 2). As more women enter the workforce while continuing to bear substantial family and social responsibilities, these disorders are no longer merely an individual clinical concern; rather, they constitute a significant occupational and public health problem (3). If left unaddressed, these disorders can impair quality of life, accelerate burnout, reduce productivity, and impose substantial costs on society.

Psychosomatic disorders stem from the complex interplay between psychological stress and physiological regulation, involving an overactive hypothalamic–pituitary–adrenal axis, autonomic imbalance, inflammation, and hormonal changes (4, 5). In working women, these mechanisms are further complicated by an ongoing interaction of biological, psychological, occupational, and socioeconomic factors, particularly in the presence of chronic work–family conflict and organizational pressures (1, 6). Yet despite growing awareness of the biological, psychological, occupational, and socioeconomic factors involved, much of the current research still depends on cross-sectional surveys, self-report measures, and relatively uniform interventions (1, 3). Such approaches often fail to capture how psychosomatic symptoms fluctuate over time, the substantial individual differences among women, and the influence of factors operating at different levels. Therefore, there is a clear need for more integrated, data-driven approaches to understanding these conditions.

We believe that integrating biostatistics and computer engineering offers a practical way forward. This perspective proposes a unified framework that integrates longitudinal statistical modeling, continuous monitoring using wearable devices, and workplace decision-support tools. The framework addresses psychosomatic disorders at the individual, family, and organizational levels at once. Reactive models recognize stress symptoms only once they have become clinically obvious. In contrast, this approach focuses on early risk identification, tailored intervention, and evidence-based occupational health planning.

The proposed framework could also help bridge the persistent gap between epidemiological research and routine occupational health practice. Longitudinal and real-time data can do more than simply identify high-risk individuals; they can also reveal modifiable workplace factors, such as excessive workloads, insufficient recovery time, and inadequate managerial support. Interventions can then be continuously adjusted based on real-world data rather than being established once and applied uniformly. An adaptive system of this kind may support more targeted prevention while recognizing the important role of established clinical, psychological, and organizational measures.

From a biostatistical perspective, the rigorous assessment of these stress-reduction strategies,

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including psychological programs, stress management training, workplace modifications, flexible arrangements, and organizational policies, requires carefully planned research. While systematic reviews and meta-analyses of controlled trials offer the highest level of evidence regarding the efficacy of specific individual-level interventions (7, 8), addressing complex occupational health determinants also calls for primary longitudinal research, such as prospective cohort studies and controlled trials. In such designs, multilevel models can examine individual factors (coping and resilience), family influences (social support and the division of domestic duties), and organizational conditions (workload, job security, and managerial support) simultaneously. Furthermore, survival analysis can help identify predictors of remission or recurrence of psychosomatic symptoms while accounting for dynamic variables such as sleep quality, workload intensity, and physiological stress markers.

Digital technologies provide the means to put this data-driven approach into practice through continuous, real-time data collection. Non-invasive wearable devices can now track stress-related indicators, such as heart rate, heart rate variability, and sleep (9). When connected through the Internet of Things and supported by artificial intelligence, these data may allow warning signs to be recognized earlier, before physical symptoms develop. Mobile health applications designed for stress management can then adapt to each woman's behavioral and physiological profile, offering personalized suggestions such as relaxation exercises or better time management (10). At the organizational level, aggregated and anonymized digital indicators could help employers identify collective patterns of stress and take preventive action, for example by adjusting workloads or running targeted training programs.

This approach is not without challenges, and these challenges must be addressed openly. Integrating digital tools into everyday practice raises questions of informed consent, data ownership, privacy, and security; it also requires making wearable technologies accessible across socioeconomic groups, building transparent and explainable AI systems, and guarding against gender bias in algorithms trained on data that poorly represent women's health. Unless these challenges, particularly gender bias in algorithms, unequal access to wearable technologies, and inadequate protection of women's data, are addressed, digital solutions risk reproducing or even widening, the very inequalities in women's occupational health that they are intended to reduce.

Advanced statistical methods and new digital technologies may together support a more comprehensive, adaptive, and ethically grounded approach to psychosomatic disorders in working women. Importantly, these tools should be seen as a complement to, not a replacement for, established psychological, organizational, and public health interventions—they add timelier and more individualized evidence. If designed with equity, privacy, and transparency in mind, such an integrated approach could ease the personal, occupational, and societal burden of these disorders while supporting the health and productivity of the female workforce. Realizing this will depend on close interdisciplinary collaboration among biostatisticians, clinicians, and technology developers, as well as careful empirical validation in real-world occupational health settings.

In conclusion, combining longitudinal statistical modeling, wearable-based monitoring, and workplace decision-support tools may allow earlier risk identification and more tailored prevention of psychosomatic disorders in working women. These tools should complement, not replace, established clinical, psychological, and organizational interventions. Their benefits will depend on protecting privacy, ensuring equity and transparency, and validating them in real occupational health settings.

Declaration of AI

The authors acknowledge the use of AI-assisted tool (ChatGPT) for language editing. All content was manually reviewed and edited by the authors to ensure its accuracy and academic integrity; the authors take full responsibility for the final content of the manuscript.

Authors' Contribution

Shima Azadian: Contribution to the conception and design of the study; drafting the work and reviewing it critically for important intellectual content. Sulmaz Ghahramani: Contribution to the conception of the work; reviewing the work

critically for important intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work, such that the questions related to the accuracy or integrity of any part of the work.

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