Commentary

Precision Nursing in the Context of Digital and Environmental Exposome Exposures: A Step Beyond Genomics and Toward Health Equity

Masoumeh Bagheri-Nesami[1], Fatemeh Ahmadi[2*]

1. Traditional and Complementary Medicine Research Center, Addiction Institute, Mazandaran University of Medical Sciences, Sari, Iran.
2. Department of Medical-Surgical Nursing, Faculty of Nursing and Midwifery, Mazandaran University of Medical Sciences, Sari, Iran.

Use your device to scan and read the article online

Citation Bagheri-Nesami M, Ahmadi F. Precision Nursing in the Context of Digital and Environmental Exposome Exposures: A Step Beyond Genomics and Toward Health Equity. Iranian Journal of Health Sciences. 2026; 14(3):207-210.http://dx.doi.org/10.22034/ijhs.14.3.1413.1

http://dx.doi.org/10.22034/ijhs.14.3.1413.1

The completion of the human genome project in 2003 marked a watershed moment in the history of health sciences and laid the foundation for the precision health paradigm. Since then, DNA sequencing and the personalization of interventions based on genetic profiles have steered the trajectory of public health toward precision medicine [1]. Precision medicine tailors diagnosis and treatment to individual genes, environment, and lifestyle. However, environmental and lifestyle factors are often treated as moderating variables at the periphery of genomic analyses rather than as an independent conceptual core [2]. In practice, genomics offers essential insights into disease susceptibility and treatment response; however, it does not fully capture environmental influences, such as the association between living near highways and childhood asthma, or divergent therapeutic outcomes among patients with identical genotypes. As a complementary framework, the exposome addresses these environmental and contextual dimensions of health. The exposome encompasses the totality of environmental exposures—including chemical, physical, biological, psychosocial, and behavioral factors—that individuals encounter throughout their lifespans [3]. Unlike genomics and other omics sciences, which focus on internal biological layers, the exposome captures health through continuous interaction between individuals and their environment. Hammer et al. position the exposome alongside omics as a central core in their precision health model, surrounded by ten domains, including demographic, clinical, behavioral, biological, psychological, social, economic, environmental, policy, and ethical factors that interact to shape health and disease across the lifespan [3].

Precision nursing draws on the same environmental and behavioral data as precision medicine and precision health; however, its true power lies not in the data itself but in how these data are brought to life. Grounded in a legacy of holistic care and continuous bedside presence, it transforms clinical, genetic, and environmental information into personalized, preventive, and participatory care that fits each patient's real-life context [4]. Built on the nurse-patient relationship, it turns this knowledge into everyday actions, from environmental counseling and symptom management to psychosocial support, operating where care meets life: At the bedside, in the home, and in the community.

*** Corresponding Author:**
Fatemeh Ahmadi
Address: *Department of Medical-Surgical Nursing, Faculty of Nursing and Midwifery, Mazandaran University of Medical Sciences, Sari, Iran.*
Tel: *+98 (011) 3368918*
E-mail: *fatemehahmadi998@gmail.com*

Copyright © 2026 The Author(s);
This is an open access article distributed under the terms of the Creative Commons Attribution License (CC-By-NC 4.0: https://creativecommons.org/licenses/by-nc/4.0/legalcode.en), which permits use, distribution, and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

Nurses can systematically collect environmental exposure histories, including housing conditions, air quality, noise, occupational hazards, and psychosocial stressors, during routine assessments to identify modifiable risks and guide interventions. However, these data require advanced analytics to become clinically useful. Artificial intelligence can process such data to detect patterns, predict outcomes, and tailor interventions. The performance of these algorithms depends critically on the quality, diversity, and representativeness of input data. Incomplete or non-representative datasets can introduce systematic biases, leading to the overestimation or underestimation of health risks and inaccurate predictions of treatment responses or disease trajectories among marginalized or understudied populations.

Nevertheless, environmental hazards and access to exposome tools are not equitably distributed. Marginalized communities are disproportionately exposed to pollutants and heat stress while having less access to green spaces and clean water. Digital inequalities exclude older adults, rural residents, and low-income populations from exposome databases, leading to algorithmic predictions that are biased against them. Moreover, subjective patient narratives, such as descriptions of mold or pesticide exposure, provide valuable data that sensors cannot measure. Mixed-methods approaches, integrating quantitative assessments with qualitative interviews, can generate rich, contextually grounded data in underserved communities.

Precision nursing must address these three dimensions of inequality to ensure that exposome-based care reduces health disparities rather than widens them. This demands structural justice, transparent algorithms, and a genuine commitment to patient-centered data. As frontline architects of care, nurses are uniquely positioned to translate exposome science into real-world health gains.

In everyday practice, this vision takes shape. An elderly patient with uncontrolled hypertension who lives near a busy highway is not a case to be managed out of context. Using exposome data, the nurse identifies noise and air pollution as contributing factors and then develops personalized interventions, ranging from indoor air filtration to tailored adherence support. Families are guided on reducing exposure risks. Communities benefit from aggregated data that reveal unequal patterns of environmental burden, thereby informing resource allocation and policy. In this way, exposome-based precision nursing connects the individual, the family, and the community in a shared pursuit of health and justice.

The success of this paradigm depends not only on technology but also on health systems' ability to meaningfully integrate patients' narratives, exposures, and lived experiences into everyday care. Although no country has yet fully implemented exposome-based precision health, initiatives, such as the Geoscience and Health Cohort Consortium (GECCO) in the Netherlands demonstrate that the foundational infrastructure, linking environmental data to health cohorts, is already achievable [5]. These efforts offer a roadmap for policymakers to invest in locally adapted models of precision nursing that reduce inequalities and make care more personalized and equitable.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interpretation of the results, and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflict of interest.

References

[1] Khoury MJ, Bowen MS, Clyne M, Dotson WD, Gwinn ML, Green RF, et al. From public health genomics to precision public health: A 20-year journey. Genetics in Medicine. 2018; 20(6):574-82. [DOI:10.1038/gim.2017.211] [PMID] [PMCID]

[2] Delpierre C, Lefèvre T. Precision and personalized medicine: What their current definition says and silences about the model of health they promote. Implication for the development of personalized health. Frontiers in Sociology. 2023; 8:1112159. [DOI:10.3389/fsoc.2023.1112159] [PMID] [PMCID]

[3] Hammer MJ, Conley YP, Henderson WA, Lukkahatai N, Miaskowski C, Starkweather A, et al. Breaking the code: Using the Precision Health Model to guide research and clinical care. Nursing Outlook. 2025; 73(3):102396. [DOI:10.1016/j.outlook.2025.102396] [PMID]

[4] Fu MR, Kurnat-Thoma E, Starkweather A, Henderson WA, Cashion AK, Williams JK, et al. Precision health: A nursing perspective. International Journal of Nursing Sciences. 2020; 7(1):5-12. [DOI:10.1016/j.ijnss.2019.12.008] [PMID]

[5] Lakerveld J, Wagtendonk A, Vaartjes I, Karssenberg D, Lakerveld J, Penninx B, et al. Deep phenotyping meets big data: the Geoscience and hEalth Cohort COnsortium (GECCO) data to enable exposome studies in The Netherlands. International Journal of Health Geographics. 2020; 19(1):49. [DOI:10.1186/s12942-020-00235-z] [PMID] [PMCID]

This Page Intentionally Left Blank