doi:10.22100/ijhs.v12i6.1661
Letter to Editor

SJMS 2026;12(6):80-82
sjms.shmu.ac.ir

SJMS
Shahroud Journal of Medical Sciences

From the Complete Exposome to an Actionable Exposure Profile in Occupational Health

Jamal Biganeh[1], Seyed Mohammad Mirrezaie[1], Mohammad Hossein Ebrahimi[2*]

[1] Center for Health Related Social and Behavioral Sciences Research, Shahroud University of Medical Sciences, Shahroud, Iran.
[2] Environmental and Occupational Health Research Center, Shahroud University of Medical Sciences, Shahroud, Iran.

Received: 17 October 2026
Accepted: 31 October 2026

[*]**Corresponding to:** MH Ebrahimi, **Email:** ebrahimi_mh@hotmail.com

Please cite this paper as: Biganeh J, Mirrezaie SM, Ebrahimi MH. From the Complete Exposome to an Actionable Exposure Profile in Occupational Health. Shahroud Journal of Medical Sciences 2026;12(6):80-82.

Letter to the Editor

Occupational health has traditionally focused on identifying and assessing individual hazards and examining their associations with specific health outcomes. This approach has generated valuable evidence for identifying and controlling occupational risks; however, it may not fully capture the complexity of workers' exposure environments. Growing attention to occupational co-exposures has prompted a shift from assessing single agents to considering multiple exposures simultaneously[1]. This approach can provide a more comprehensive understanding of the factors affecting workers' health and facilitate the investigation of cumulative or interactive effects of multiple exposures. Nevertheless, even assessments of multiple workplace exposures may not capture the full exposure context relevant to a worker's health. Beyond the workplace, individuals encounter environmental, behavioral, and social factors that may affect health independently or through interactions with occupational exposures[2]. This broader perspective brings the exposome concept into focus. The exposome encompasses an individual's non-genetic exposures throughout life and considers their relationships with biological responses and health over time[3]. In occupational health, the working-life exposome concept has also been introduced to capture a broader range of exposures and factors associated with working life, including the links between occupational and non-occupational exposures, and to move beyond narrowly defined "one exposure–one health outcome" frameworks[4].

Given the breadth of the exposome concept, its practical application in occupational health presents several challenges. Valuable initiatives, such as EPHOR[4], and studies drawing on surveillance networks, such as RNV3P[5], have adopted different approaches to characterizing the occupational exposome, incorporating sensors, biomonitoring, job-exposure matrices (JEMs), network-based approaches, and analytical tools. Nevertheless, an important challenge appears to remain in translating the exposome concept into occupational health practice: how can an inherently broad and complex concept be translated into an exposure profile that can inform a specific health question or preventive decision?

Comprehensiveness is a defining feature of the exposome; however, fully characterizing an individual's exposome poses substantial practical, financial, and analytical challenges[6]. Workers may encounter a wide range of occupational and non-occupational factors that vary in exposure intensity, duration, frequency, timing, and biological relevance[1, 2]. Attempting to measure all these exposures may be impractical and does not necessarily lead to better preventive decisions.

The challenge ahead, therefore, should extend beyond simply "measuring more exposures" to identifying which components of the exposome matter most for a specific health question or preventive decision.

As a pragmatic approach, we propose considering the concept of an Actionable Exposure Profile alongside ongoing efforts to achieve a more comprehensive characterization of the exposome. This concept does not represent an incomplete or merely simplified exposome. Rather, it refers to a targeted, prioritized set of exposure components selected based on the available evidence, their relevance to a specific health outcome, and the preventive objective. Within this framework, a broad range of exposures potentially relevant to the outcome of interest is considered first. Relevant exposures are then identified and prioritized based on scientific evidence and the individual's exposure circumstances, without seeking to measure every component of the exposome. The resulting Actionable Exposure Profile comprises selected exposures with the greatest practical relevance for targeted assessment and preventive action in relation to a specific health outcome.

For example, when the outcome of interest is hearing loss, a conventional assessment may focus primarily on measuring an individual's exposure to occupational noise. Under certain circumstances, however, other exposures, such as ototoxic chemicals in the workplace, recreational noise, or other sources of environmental noise, including traffic noise, may also contribute to the overall risk of hearing loss. In such cases, the objective is not necessarily to measure every possible exposure. Instead, exposures potentially relevant to the outcome should first be identified, after which priorities for assessment and action should be selected based on the evidence and their relevance.

This prioritization process may consider the strength and quality of the available evidence; exposure intensity, duration, and frequency; the biological plausibility and relevance of the association; the potential for interactions with other exposures;

CC BY NC

and the practical value of measurement. Expert judgment may also help identify and prioritize important exposures, but it should not replace empirical evidence when estimating exposure–outcome associations or effect sizes. The assessment of these associations and effects should remain grounded in epidemiological, toxicological, experimental, or other credible evidence.

Accordingly, a practical pathway can be proposed for translating the exposome concept into occupational health practice. The six-step framework presented in Figure 1 outlines how potentially relevant exposures can be identified and prioritized to develop an Actionable Exposure Profile that guides targeted exposure assessment and preventive action.

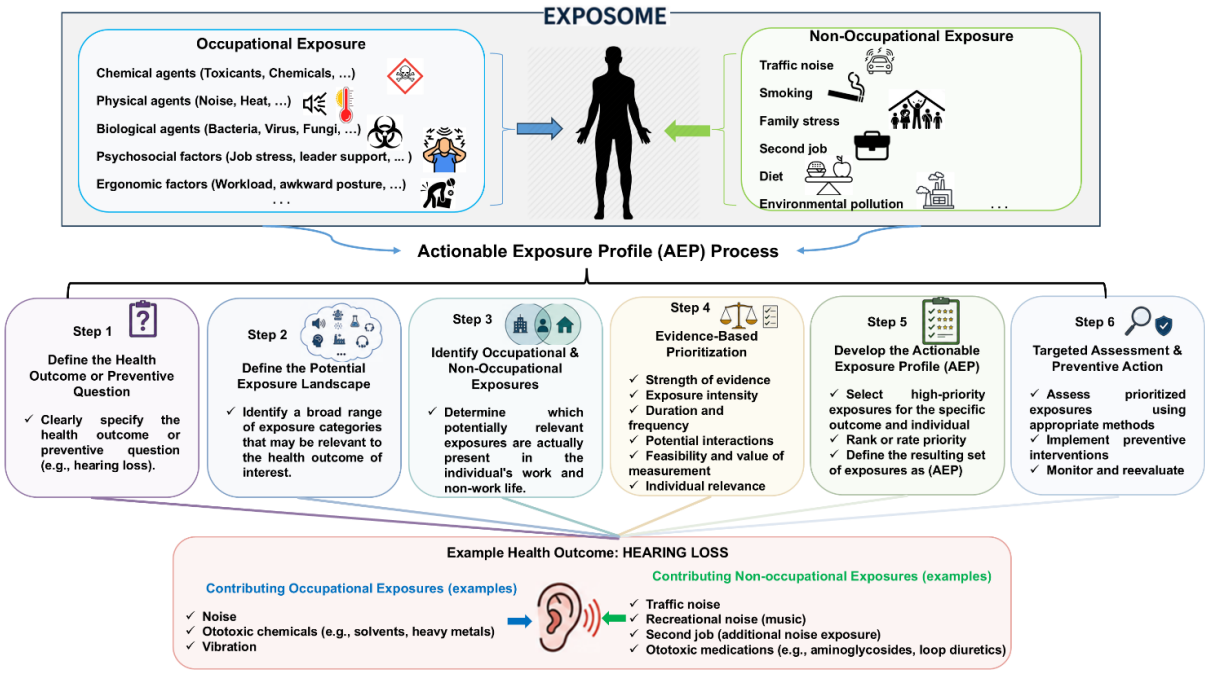


Figure1. From the exposome to an actionable exposure profile: a proposed conceptual framework for occupational health

This approach does not imply that all occupational health studies should become exposome studies. For many well-established relationships between exposures and health outcomes, conventional assessment approaches may remain appropriate and sufficient. The proposed approach is likely to offer greater value when multiple exposures may contribute to a health outcome, interactions between exposures are plausible, relevant exposures occur both within and outside the workplace, or attributing a health outcome to a single occupational exposure is difficult.

From this perspective, the ultimate goal should extend beyond measuring the exposome to making it actionable for prevention. Although comprehensive characterization of the exposome can support complex research and a broader understanding of exposure patterns, a targeted, prioritized Actionable Exposure Profile tailored to an individual's circumstances may offer greater practical value for decision-making in many occupational health settings.

The next step in advancing the exposome concept in occupational health may therefore involve more than increasing the number of exposures measured. It may require developing transparent, evidence-based methods to answer the following question:

Which components of an individual's exposome have the greatest practical relevance, for which health outcome, and for which preventive decision?

Such an approach could help bridge the gap between the conceptual comprehensiveness of the exposome and the practical needs of occupational health by translating broad exposure information into a more targeted basis for preventive decision-making.

Ethical Considerations

Nothing to be reported.

Acknowledgment

Nothing to be reported.

Conflict of Interest

Nothing to be reported.

Funding

Nothing to be reported.

References

1. Niemeier RT, Williams PRD, Rossner A, Clougherty JE, Rice GE. A Cumulative Risk Perspective for Occupational Health and Safety (OHS) Professionals. International Journal of Environmental Research and Public Health. 2020;17(17):6342. doi: 10.3390/ijerph17176342

2. Lentz TJ, Dotson GS, Williams PR, Maier A, Gadagbui B, Pandalai SP, et al. Aggregate Exposure and Cumulative Risk Assessment--Integrating Occupational and Non-occupational Risk Factors. Journal of Occupational and Environmental Hygiene. 2015;12 Suppl 1(sup1):S112-26. doi: 10.1080/15459624.2015.1060326

3. Wild CP. Complementing the genome with an "exposome": the outstanding challenge of environmental exposure measurement in molecular epidemiology. Cancer Epidemiology, Biomarkers and Prevention. 2005;14(8):1847-50. doi: 10.1158/1055-9965.EPI-05-0456

4. Pronk A, Loh M, Kuijpers E, Albin M, Selander J, Godderis L, et al. Applying the exposome concept to working life health: The EU EPHOR project. Environmental Epidemiology. 2022;6(2):e185. doi: 10.1097/EE9.0000000000000185

5. Faisandier L, Bonneterre V, De Gaudemaris R, Bicout DJ. Occupational exposome: a network-based approach for characterizing Occupational Health Problems. Journal of Biomedical Informatics. 2011;44(4):545-552. doi: 10.1016/j.jbi.2011.02.010

6. Vineis P, Chadeau-Hyam M, Gmuender H, Gulliver J, Herceg Z, Kleinjans J, et al. The exposome in practice: Design of the EXPOsOMICS project. International Journal of Hygiene and Environmental Health. 2017;220(2 Pt A):142-151. doi: 10.1016/j.ijheh.2016.08.001