Biomonitoring: Health, environment, personalized care.

Catherine Osei*

Department of Clinical Laboratory Science, University of Ghana, Accra, Ghana

Introduction

This comprehensive review explores the critical role of clinical biomonitoring in therapeutic drug management, highlighting its application in optimizing drug dosages to ensure efficacy and minimize toxicity. It details various analytical techniques and emphasizes the significant impact of personalized medicine approaches on improving patient outcomes and overall therapeutic success [1].

Recent advancements in biomonitoring environmental chemicals are summarized, discussing their clear association with various adverse human health outcomes. This paper particularly emphasizes the development of novel analytical methods and underscores the critical importance of understanding cumulative exposure risks for effective public health protection and policy-making [2].

This article focuses on the clinical biomonitoring of metal exposure, thoroughly discussing both the existing challenges and recent advancements in accurately assessing internal dose. It highlights the significant health risks associated with exposure to various metals and underscores the urgent need for improved monitoring tools and effective intervention strategies to mitigate these risks [3].

A systematic review details pesticide exposure biomonitoring across diverse populations, thoroughly assessing current methodologies, reported exposure levels, and associated health impacts. It underscores the observed variability in exposure patterns and highlights the critical need for standardized approaches in biomonitoring studies to ensure comparability and reliability of findings [4].

Current biomonitoring strategies for micro- and nanoplastics in various biological matrices are examined, discussing the significant analytical challenges involved. This review also outlines crucial future research directions necessary for a comprehensive understanding of human exposure pathways and potential health effects stemming from these ubiquitous particles [5].

This article explores how clinical biomonitoring integrates seamlessly with precision medicine, offering crucial insights into individualized therapeutic strategies. It discusses the transformative potential of 'omics' technologies to significantly refine and personalize patient care, moving towards more targeted and effective treatments [6].

Advanced biomonitoring techniques used for early disease detection and prognosis are deeply investigated, with a specific focus on highly sensitive and specific biomarkers. The paper highlights emerging technologies that significantly improve diagnostic accuracy and pave the way for earlier interventions, ultimately leading to better patient outcomes [7].

This review examines the complex landscape of occupational biomonitoring, discussing various methods for assessing exposure to workplace hazards. It also addresses the inherent challenges in designing and implementing effective surveillance programs that are vital for protecting worker health and ensuring safety in occupational settings [8].

The article addresses the complexities involved in biomonitoring engineered nanoparticles, highlighting the significant analytical hurdles in detecting and accurately quantifying these materials in biological samples. It also explores promising strategies for developing robust risk assessment frameworks to manage potential health impacts [9].

This comprehensive overview covers the crucial role of clinical biomonitoring in detecting and quantifying drugs of abuse. It discusses the various biological matrices and advanced analytical techniques commonly used to accurately assess exposure, monitor abstinence, or ensure treatment compliance in clinical and forensic settings [10].

Conclusion

Clinical biomonitoring serves as a cornerstone in diverse health and environmental applications, providing crucial insights into human exposure and physiological responses. In therapeutic drug management, it is indispensable for optimizing drug dosages, ensuring both efficacy and minimal toxicity through personalized medicine approaches and various analytical techniques. The scope extends to environmental health, where biomonitoring tracks the presence and impact of environmental chemicals, metal exposures, and pesticides. This includes addressing the health risks associated with

***Correspondence to:** Catherine Osei, Department of Clinical Laboratory Science, University of Ghana, Accra, Ghana. E-mail: catherine.osei@ug.edu.gh

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different metals, assessing methodologies for pesticide exposure across diverse populations, and emphasizing the importance of understanding cumulative exposure risks for public health.

The field is also advancing into novel areas like monitoring micro- and nanoplastics in biological samples, despite facing considerable analytical challenges, to comprehend human exposure and potential health effects. Biomonitoring's integration with precision medicine is transforming individualized therapeutic strategies through 'omics' technologies. It also supports early disease detection and prognosis by utilizing highly sensitive and specific biomarkers and leveraging emerging technologies for improved diagnostic accuracy. Occupational biomonitoring is key to assessing workplace hazards and implementing worker safety programs. Additionally, the discipline confronts the complexities of detecting engineered nanoparticles in biological matrices for robust risk assessment and plays a crucial role in forensic toxicology by identifying and quantifying drugs of abuse. These collective efforts highlight biomonitoring's broad utility in safeguarding public health and personalizing clinical care.

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