

Short Communication

Open Access



FAIREHR: a novel online research registry platform to advance global environmental and occupational health research

Karen S. Galea¹, Finlay Brooker¹, Shahzad Rashid¹, Michael Bader², Yu Ait Bamai^{3,4}, Jos Bessems⁵, Embialle Mengistie Beyene⁶, Alison Connolly⁷, Carla Costa⁸, Pravina Deligannu⁹, Radu-Corneliu Duca^{10,11}, Kaoutar Chbihi^{11,12}, Kasahun Eba¹³, Manosij Ghosh¹¹, Melissa Gonzales¹⁴, Stuart Harrad¹⁵, Erin N. Haynes¹⁶, Nancy B. Hopf¹⁷, Po-Chin Huang¹⁸, Kate Jones¹⁹, Konstantinos M. Kasiotis²⁰, Ming Kei Chung^{21,22,23,24}, Jihyon Kil²⁵, Holger Koch²⁶, Jung-Hwan Kwon²⁷, Elizabeth Ziyang Lin²⁸, Henriqueta Louro²⁹, Kyriaki Machera²⁰, Barbara Magagna³⁰, Aziza Menouni¹¹, Yuki Mizuno³¹, An Van Nieuwenhuyse^{10,11}, Shoji F. Nakayama³², Robert Pasanen-Kase³³, Tyler Pollock³⁴, Lesliam Quirós-Alcalá³⁵, Tiina Santonen³⁶, Paul J. Scheepers³⁷, Ovnair Sepai³⁸, Emily Bird³⁸, Blanca Serrano Ramòn³⁹, Maria J. Silva²⁹, Gustavo Souza⁴⁰, Jeanette A. Stingone⁴¹, L. Susan Teitelbaum⁴², João Paulo Teixeira⁸, Giovanna Tranfo⁴³, Ana Maria Vekic⁴⁰, Susana Viegas⁴⁴, Yankai Xia⁴⁵, Masud Yunesian⁴⁶, Maryam Zare Jeddi⁴⁷

¹Institute of Occupational Medicine (IOM), Edinburgh EH14 4AP, UK.

²BASF SE, Corporate Health Management, Ludwigshafen 67056, Germany.

³Toxicological Center, University of Antwerp, Wilrijk 2610, Belgium.

⁴Center for Environmental and Health Sciences, Hokkaido University, Sapporo 060-0812, Japan.

⁵VITO Health, Flemish Institute for Technological Research (VITO), Mol 2400, Belgium.

⁶Department of Environmental Health, Hawassa University (HU), Hawassa 7000, Ethiopia.

⁷UCD Centre for Safety and Health at Work; School of Public Health, Physiotherapy, and Sports Science, University College Dublin, Dublin, D04 V1W8, Ireland.

⁸Department of Environmental Health, National Institute of Health, Porto 4000-055, Portugal.

⁹Department of Chemical Engineering, Faculty of Engineering Technology, Universiti Tun Hussein Onn Malaysia, Johor 86400, Malaysia.

¹⁰Department of Health Protection, Laboratoire national de santé, Dudelange L-3555, Luxembourg.

¹¹Department of Public Health and Primary Care, Environment and Health Unit, KU Leuven, Leuven 3000, Belgium.

¹²Human Epidemiology and Environmental Health Team, Faculty of Sciences, Moulay Ismail University, Meknes 50000, Morocco.

¹³Department of Environmental Health Sciences and Technology, Jimma University, Jimma 5000, Ethiopia.

¹⁴Department of Environmental Health Sciences, Celia Scott Weatherhead School of Public Health and Tropical Medicine, Tulane University, New Orleans, LA 70112, USA.

¹⁵School of Geography, Earth, and Environmental Sciences, University of Birmingham, Birmingham B15 2TT, UK.

¹⁶Department of Epidemiology and Environmental Health, College of Public Health, University of Kentucky, Lexington, KY 40536, USA.

¹⁷Unisanté, University Center for Primary Care and Public Health, University of Lausanne, Lausanne 1066, Switzerland.

¹⁸National Institute of Environmental Health Sciences, National Health Research Institutes, Miaoli 35053, Taiwan.

¹⁹Health and Safety Executive (HSE), Buxton, Derbyshire SK17 9JN, UK.

²⁰Laboratory of Pesticides' Toxicology, Scientific Directorate of Pesticides Control and Phytopharmacy, Benaki Phytopathological Institute, Athens 14561, Greece.

²¹The Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong 999077, China.

²²The Institute of Environment, Energy and Sustainability, The Chinese University of Hong Kong, Hong Kong 999077, China.

²³Li Ka Shing Institute of Health Sciences, The Chinese University of Hong Kong, Hong Kong 999077, China.



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, sharing, adaptation, distribution and reproduction in any medium or format, for any purpose, even commercially, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.



- ²⁴Department of Earth and Environmental Sciences, The Chinese University of Hong Kong, Hong Kong 000000, China.
- ²⁵Environmental Health Research Division, National Institute of Environmental Research, Ministry of Environment, Incheon 22689, Republic of Korea.
- ²⁶Institute for Prevention and Occupational Medicine of the German Social Accident Insurance, Institute of the Ruhr-University Bochum (IPA), Bochum 44789, Germany.
- ²⁷Division of Environmental Science and Ecological Engineering, Korea University, Seoul 02841, Republic of Korea.
- ²⁸Environmental Health Sciences Department, School of Public Health, Yale University, New Haven, CT 06510, USA.
- ²⁹National Institute of Health Doutor Ricardo Jorge, Department of Human Genetics, Lisbon and Comprehensive Health Research Center (CHRC), NOVA Medical School, Universidade NOVA de Lisboa, Lisbon 1749-016, Portugal.
- ³⁰GO FAIR Foundation, Leiden 2333 AA, the Netherlands.
- ³¹Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, New York, NY 10032, USA.
- ³²Exposure Dynamics Research Section, Health and Environmental Risk Division, National Institute for Environmental Studies, Ibaraki 305-8506, Japan.
- ³³State Secretariat for Economic Affairs SECO, Bern 3003, Switzerland.
- ³⁴Environmental Health Science and Research Bureau, Health Canada, Ottawa, ON K1A 0K9, Canada.
- ³⁵Department of Environmental Health and Engineering, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD 21205, USA.
- ³⁶Finnish Institute of Occupational Health, Helsinki 00250, Finland.
- ³⁷Radboud Institute for Biological and Environmental Sciences, Radboud University, Nijmegen 6525 HP, the Netherlands.
- ³⁸Toxicology Department, Radiation, Chemicals, Climate and Environmental Hazards Division, UK Health Security Agency, Didcot, OX11 0RQ, UK.
- ³⁹ECETOC, Brussels 1040, Belgium.
- ⁴⁰Department of Environmental and Occupational Health Surveillance, Secretariat of Health and Environment Surveillance, Ministry of Health, Brasília 70058-900, Brazil.
- ⁴¹Department of Epidemiology, Columbia University Mailman School of Public Health, New York, NY 10032, USA.
- ⁴²Icahn School of Medicine at Mount Sinai, Department of Environmental Medicine, New York, NY 10029, USA.
- ⁴³Italian Institute against accidents at work (INAIL), Department of Occupational and Environmental Medicine, Epidemiology and Hygiene, Rome 00078, Italy.
- ⁴⁴NOVA National School of Public Health, Public Health Research Centre, Comprehensive Health Research Center, CHRC, REAL, CCAL, NOVA University Lisbon, Lisbon 1169-056, Portugal.
- ⁴⁵Nanjing Medical University, Center for Global Health, School of Public Health, Nanjing, 211166, Jiangsu, China.
- ⁴⁶Department of Environmental Health Engineering, School of Public Health, Tehran University of Medical Sciences, Tehran 1417613151, Iran.
- ⁴⁷Shell Global Solutions International BV, The Hague 2596HR, the Netherlands.

Correspondence to: Dr. Maryam Zare Jeddi, Shell Global Solutions International BV, Carel van Bylandtlaan 16, 2596HR, The Hague 2596, the Netherlands. E-mail: maryam.zarejeddi@shell.com

How to cite this article: Galea, K. S.; Brooker, F.; Rashid, S.; Bader, M.; Bamai, Y. A.; Bessems, J.; Beyene, E. M.; Connolly, A.; Costa, C.; Deligannu, P.; Duca, R. C.; Chbihi, K.; Eba, K.; Ghosh, M.; Gonzales, M.; Harrad, S.; Haynes, E. N.; Hopf, N. B.; Huang, P. C.; Jones, K.; Kasiotis, K. M.; Chung, M. K.; Kil, J.; Koch, H.; Kwon, J. H.; Lin, E. Z.; Louro, H.; Machera, K.; Magagna, B.; Menouni, A.; Mizuno, Y.; Nieuwenhuyse, A. V.; Nakayama, S. F.; Pasanen-Kase, R.; Pollock, T.; Quirós-Alcalá, L.; Santonen, T.; Scheepers, P. J.; Sepai, O.; Bird, E.; Ramón, B. S.; Silva, M. J.; Souza, G.; Stingone, J. A.; Teitelbaum, L. S.; Teixeira, J. P.; Tranfo, G.; Vekic, A. M.; Viegas, S.; Xia, Y.; Yunesian, M.; Jeddi, M. Z. FAIREHR: a novel online research registry platform to advance global environmental and occupational health research. *J. Environ. Expo. Assess.* 2025, 4, 30. <https://dx.doi.org/10.20517/jeea.2025.35>

Received: 20 May 2025 **First Decision:** 11 Jul 2025 **Revised:** 1 Aug 2025 **Accepted:** 19 Aug 2025 **Published:** 17 Sep 2025

Academic Editor: Giulia Poma **Copy Editor:** Shu-Yuan Duan **Production Editor:** Shu-Yuan Duan

Abstract

The FAIREHR (Findable, Accessible, Interoperable, Reusable Environmental and Health Registry) platform is a state-of-the-art online registry for prospective harmonization of human biomonitoring (HBM). It was developed by the HBM working group of the Europe Regional Chapter of the International Society of Exposure Science (ISES Europe) and is supported by the HBM Global Network. FAIREHR is designed to harmonize HBM metadata and support the implementation of the FAIR (Findable, Accessible, Interoperable and Reusable) Guiding Principles throughout HBM studies or programs. The registry enables preregistration of HBM by capturing key metadata on study design, metadata management, and planned methods before participant recruitment. This process enhances transparency and reproducibility in environmental and occupational health research. FAIREHR includes both study-level and program-level metadata. Its harmonized metadata template facilitates the storage of results

(measurement data) in repositories such as IPCHEM and PEH. Here we outline the unique features of the FAIREHR platform, emphasizing its role in increasing research visibility, improving metadata comparability and harmonization, and strengthening the exchange of information. By supporting the effective use of HBM data, FAIREHR is expected to yield significant benefits for researchers, policymakers, and the broader fields of environmental and occupational health.

Keywords: FAIR principles, human biomonitoring, metadata interoperability, preregistration, exposure science, environmental and occupational health

INTRODUCTION

The growing complexity of environmental and occupational health issues requires a comprehensive approach to effectively manage, utilize, compare, and interpret research data. Human biomonitoring (HBM) plays a crucial role in exposure science, environmental epidemiology, and occupational health by providing integrative information on internal chemical exposure^[1]. However, the integration and reuse of HBM data are often hampered by inconsistencies in metadata collection and reporting standards^[2]. The FAIREHR (Findable, Accessible, Interoperable, Reusable Environmental and Health Registry) platform, developed by the Europe Regional Chapter of the International Society of Exposure Science (ISES Europe) HBM working group and supported by HBM Global Network, aims to address these challenges by improving the *FAIRification* of HBM data. Research data encompass the information, observations, or measurements collected or generated during a study, forming the basis for analysis, interpretation, and scientific conclusions.

FAIREHR is among the first protocol registries to apply FAIR principles in environmental and occupational health research. It ensures that valuable metadata on chemical exposures, environmental impacts, and health outcomes are systematically organized and made readily available to researchers, healthcare professionals, and policymakers^[3].

Mission and vision of the FAIREHR platform

FAIREHR is an independent, open platform dedicated to advancing environmental and occupational health research through prospective harmonization. It fosters a collaborative environment for improved data management, transparency, and accessibility. Rather than focusing solely on presenting final results, FAIREHR emphasizes enhancing the quality and comparability of HBM study or program from the outset.

Researchers worldwide can register their HBM protocols on the FAIREHR platform, which supports the research community from project conception to completion. This ensures the creation of reusable, high-quality metadata and provides visibility throughout the research lifecycle. The platform hosts study and program metadata and links to final results. Its harmonized metadata template/schema enables compatibility with several existing tools or platforms available for data exchange and calculation using HBM data, such as Personal Exposure and Health (PEH) Data Platform (<https://hbm.vito.be/peh-data-platform>) and Information Platform for Chemical Monitoring (IPCHEM - <https://ipchem.jrc.ec.europa.eu/>), and the Monte Carlo Risk Assessment (MCRA) platform (<https://www.rivm.nl/en/food-safety/chemicals-in-food/monte-carlo-risk-assessment-mcra>). By consolidating metadata on chemical exposure in a secure and FAIR-compliant central platform, FAIREHR enables policymakers and stakeholders to identify relevant research more efficiently.

By providing a unified view of global research records, the FAIREHR platform strengthens information exchange in environmental and occupational health, improves machine discoverability, and facilitates data reuse. Serving as a bridge between science, policy, industry, and other stakeholders, FAIREHR fosters innovative initiatives to address emerging monitoring challenges. Ultimately, it empowers informed decision making by improving the quality of exposure data used in chemical risk assessment. [Figure 1](#) summarizes the objectives of the FAIREHR platform.

Overview of the FAIREHR platform

At its core, the FAIREHR platform enables researchers to preregister their studies by detailing key aspects of their research, including study design, (meta)data management strategies, and planned methodological approaches [[Figure 2](#)]. The registration questions are crafted and implemented based on the Minimum Information Requirements for HBM (MIR-HBM), which was created in collaboration with global stakeholders^[4]. The MIR-HBM defines a set of criteria/parameters to guide the conceptualization, description, planning, and interpretation of HBM studies for exposure assessment. These criteria include (but are not limited to) population characteristics, sample and data collection procedures, potential exposure covariates, quality control measures, and data analysis strategies. Preregistration supports more consistent study design, enhances comparability across studies, reduces duplication of efforts, and facilitates the coordination of research (e.g., when similar studies are conducted across countries or groups). It also saves resources, builds trust in HBM studies and programs, combats publication bias, and fosters collaboration among researchers. Furthermore, the use of a harmonized metadata schema enhances the comparability and reusability of HBM data, thereby ensuring transparency and reproducibility in environmental and occupational health research. The platform will provide automated data quality assessment. Once registration is finalized, study protocols can be published through the platform after peer review, which increases visibility, promotes peer engagement, and supports reproducibility by documenting planned methods before results are available.

The FAIREHR platform also promotes the use of a Data Management Plan (DMP), as responsible research data management is a key component of good research practice that underpins scientific integrity and reproducibility^[5]. The FAIREHR DMP [[Figure 3](#)] provides a comprehensive framework for managing metadata and data throughout the research lifecycle, starting from the study concept and project planning stages. It includes strategies for metadata archiving, ensuring long-term storage and accessibility, and making metadata available to relevant stakeholders. While FAIREHR serves as a repository for study and program metadata, it also provides links to research results. Additionally, the platform emphasizes the importance of metadata discovery, which facilitates efficient retrieval and reuse of research data in future projects. Finally, the DMP addresses the repurposing of research data and the maintenance of documentation after publication, thereby ensuring transparency and reproducibility. This structured approach ensures effective data management and enhances their utility for ongoing and future research endeavors.

Metadata refers to information about the data itself, such as how it was collected, processed, and analyzed, which is crucial for interpreting raw data. The HBM metadata schema (templates used to generate metadata records) implemented in the FAIREHR platform addresses a major challenge in environmental health research: the lack of standardized and comprehensive metadata collection and reporting. Insufficient standards often result in datasets with missing metadata, incomplete annotations, or inconsistent variables, all of which hinder the broader repurposing of research data. The metadata schema in FAIREHR captures elements related to: (1) quality assurance and control (QA/QC), including laboratory external QA and internal QC statements, as well as extended method validation; (2) sample integrity protocols; and (3) plans for inter-laboratory comparisons, supporting external QA through robust schemes such as G-EQUAS (

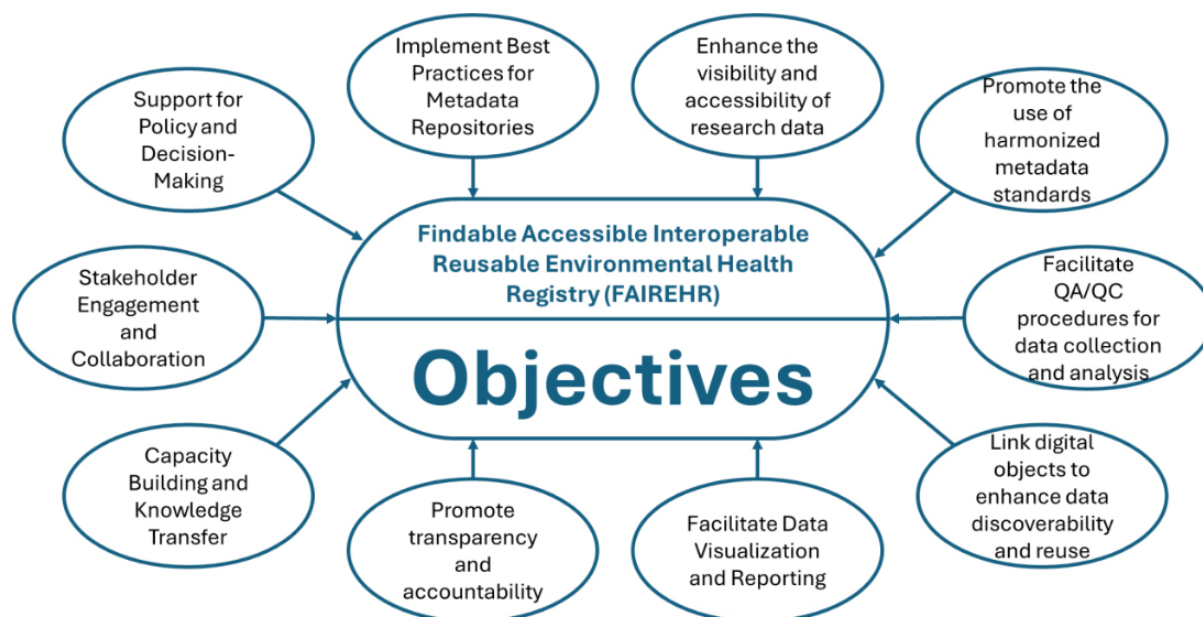


Figure 1. Objectives of the FAIREHR platform. FAIREHR: Findable, Accessible, Interoperable, Reusable Environmental and Health Registry.

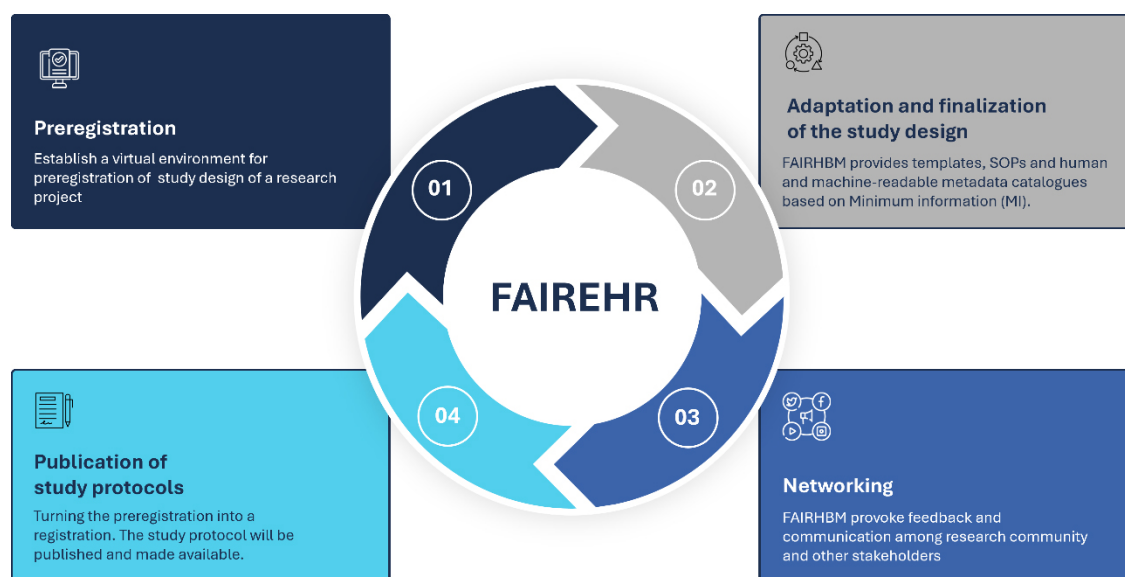


Figure 2. Overview of the FAIREHR platform. FAIREHR: Findable, Accessible, Interoperable, Reusable Environmental and Health Registry.

<https://app.g-equas.de/web/>). Future updates will further enhance QA/QC tracking by aligning metadata fields with international standards. By following the guidance offered in the FAIREHR platform, researchers can generate harmonized data in formats that allow research findings to be more easily compared, integrated, and reused across disciplines. Ultimately, this enables HBM data to support more robust exposure assessments, leading to more accurate evaluations of human exposure to environmental or occupational pollutants.

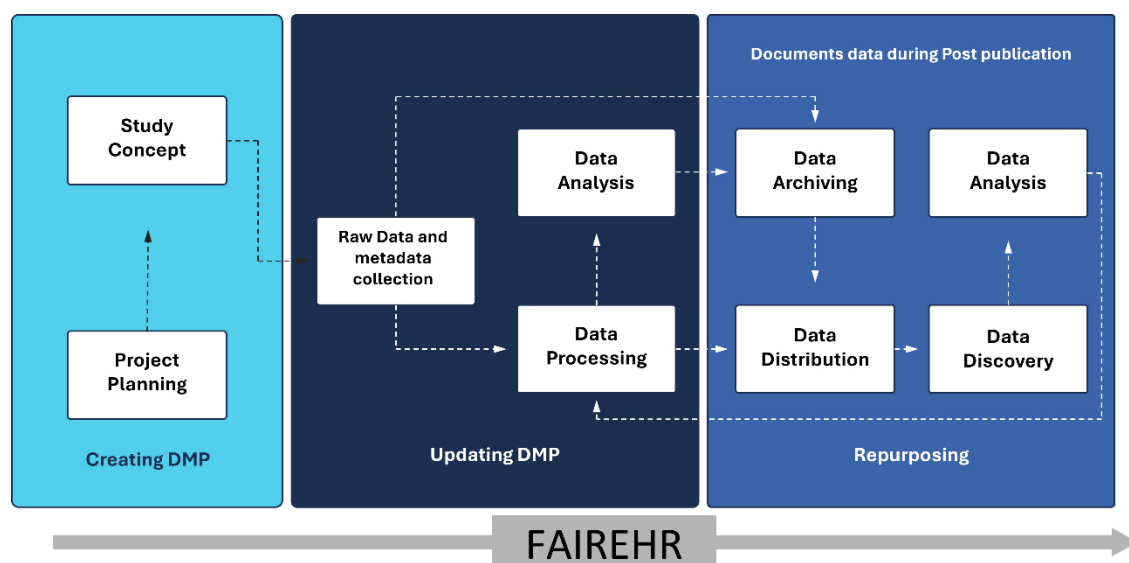


Figure 3. Data and metadata management in human biomonitoring within the FAIREHR platform. FAIREHR: Findable, Accessible, Interoperable, Reusable Environmental and Health Registry; DMP: Data Management Plan.

Metadata security considerations

The FAIREHR platform ensures strong metadata security and integrity through Cyber Essentials Plus accreditation and the use of secure cloud-based storage solutions. All metadata transfers are encrypted with SSL at every stage. An efficient data indexing system enables rapid access to large datasets. The platform uses NET Core, providing high performance, scalability, and a secure operating environment. The platform's servers are designed for high availability and secure operation, incorporating redundancy measures such as failover and load balancing. Regular cloud-based backups further safeguard data. The FAIREHR platform is fully compliant with the General Data Protection Regulation (GDPR), upholding the highest standards of privacy and data protection. All metadata associated with each dataset will be made openly accessible in the FAIREHR data repository under a standard open license (e.g., CC BY 4.0), ensuring discoverability and reusability in line with the FAIR principles. Metadata will describe the dataset, including methodology, variables, licensing, and access conditions, but will not contain any personally identifiable information, thereby maintaining GDPR compliance.

Future developments of the FAIREHR platform

The future development strategy of the FAIREHR platform revolves around enhancing its functionality, ensuring continued compliance with FAIR principles, upholding legal and ethical standards, and fostering wider adoption across the global research community.

The platform will include an automated system for harmonized chemical identification in research, enabling registrants to search for chemicals by CAS number or other identifiers. Users will be able to select chemicals and automatically retrieve related identifiers such as SMILE (Simplified Molecular Input Line Entry System), InChI (IUPAC International Chemical Identifier)^[6,7], and key physicochemical properties. InChI, by enhancing the discoverability of chemical structures, directly supports the FAIR principles. The system will also link parent compounds to their metabolites, providing researchers with available metabolite lists and identifying the most suitable matrices for monitoring these compounds in the human body. By leveraging this framework, the platform will ensure that chemicals and materials used in environmental and health studies are consistently identified, classified, and connected to authoritative databases. This

integration will strengthen data interoperability and accuracy, facilitating more efficient data sharing and analysis across different research initiatives. Incorporating resources such as the Norman Network database^[8], which provides comprehensive information on environmental pollutants, will further align the FAIREHR platform with international standards, supporting cross-study comparisons and enabling better integration of data from various sources.

The platform will also assign persistent identifiers (e.g., DOIs) to (meta)datasets, ensure metadata compliance with DataCite standards, and enhance searchability by indexing metadata both internally and in external repositories. Data accessibility will be supported through open protocols such as REST APIs (interfaces that enable secure information exchange between computer systems over the internet), while long-term metadata availability will be safeguarded. For interoperability, the FAIREHR platform will adopt open standards and integrate established ontologies such as Chemical Entities of Biological Interest (ChEBI - <https://www.ebi.ac.uk/chebi/beta/>), Ontology for Biomedical Investigations (OBI - <https://obi-ontology.org>), and Exposure Ontology (ExO)^[9]. Ontologies provide structured vocabularies with hierarchical and qualified relationships (object properties), which are essential for building a FAIR metadata schema^[5]. For annotating biological concepts, phenotypic traits, and experimental variables, the platform will implement I-ADOPT (<https://i-adopt.github.io/>), a Research Data Alliance (RAD) recommendation. Additionally, FAIREHR will employ web standards such as the Resource Description Framework (RDF)^[10] to link and process metadata in machine-readable formats. The platform will also provide detailed provenance tracking and transparent data usage licenses, while exploring tools such as FAIR Data Point^[11] for machine-readable metadata and or RO-Crate^[12] for bundling datasets with rich metadata and provenance. Together, these measures will enhance the discoverability, usability, and reproducibility of environmental and health data, ensuring long-term sustainability and broad accessibility for future research. Relevant metabolomics and exposure-related databases will also be mapped and linked to the registry.

The FAIREHR platform will further introduce open metrics and cataloging use cases, providing transparent, measurable, and practical demonstrations of its value and applicability. A help desk will also be integrated to assist users with technical issues and other inquiries.

As the platform evolves, the integration of advanced analytical tools such as artificial intelligence (AI) and machine learning is becoming increasingly important. These tools can analyze large and complex datasets, uncover hidden patterns, detect anomalies in biomarker data, impute missing values, and generate knowledge graphs and insights not easily derived from traditional methods.

To support users, FAIREHR will include a dedicated training component to build competencies in HBM data management and reuse. Through structured modules and hands-on exercises, the training will cover topics such as FAIR principles, ethical and legal considerations, metadata standards, and interoperability of environmental and health datasets. This program is designed to benefit researchers, public health professionals, and data stewards, particularly in low- and middle-income countries (LMICs), by promoting best practices for generating, curating, harmonizing, and responsibly sharing HBM data. In doing so, it will foster data quality, transparency, and global collaboration.

To facilitate adoption in LMICs, active engagement of research teams in these regions will be critical. Their participation will guide the co-development and contextualization of platform functionalities to align with local priorities, regulatory environments, and research infrastructures. In the medium term, LMIC partners will help refine metadata standards, governance frameworks, and ethical protocols tailored to diverse sociocultural and institutional contexts. Over the long term, they will serve as regional nodes for capacity

building, data stewardship, and collaborative research. This distributed model will promote the widespread adoption of FAIR data principles and ensure equitable access to FAIREHR.

To further strengthen harmonization, future versions of FAIREHR will provide references to validated analytical methods (e.g., GC-MS/MS, LC-MS/MS) for measuring environmental pollutants in biological matrices such as blood, urine, serum, and tissues, based on existing international guidelines. The platform will also offer access to chemical-specific Biomonitoring and Surveillance of Chemical Exposure in Occupational Settings (BASIC) Guides (<https://www.fairehr.com/BASICGuides>). These guides provide structured recommendations for conducting biomonitoring programs for various chemicals, including the identification of relevant biomarkers, procedures for collecting, handling, and analyzing biological samples, and guidance on results communication.

As part of its launch phase, expected in September 2025, FAIREHR will support pilot registrations from multiple academic and governmental HBM studies and programs. Preregistration of environmental and health research studies on the platform will enable scientists, regulators, policymakers (at EU, national, and regional levels), life sciences companies, occupational hygienists, publishers, journals, professional associations, Contract Research Organizations, meta-researchers, and funding bodies to track and identify planned, ongoing, and completed studies. Ultimately, the FAIREHR platform will make high-quality open metadata widely available, supporting more comparable and interpretable studies that can inform environmental and occupational health policies and regulatory decisions.

DECLARATIONS

Acknowledgments

The authors thank all members of the ISES Europe HBM Working Group and the HBM Global Network for their contributions and support in developing FAIREHR.

Authors' contributions

Made substantial contributions to the conceptualization and design of the FAIREHR platform: All authors
Lead the drafting of this short communication: Galea KS, Zare Jeddi M, Rashid S

Made substantial contributions to the development and technical implementation of the online FAIREHR platform: Rashid S, Brooker F, Zare Jeddi M

Commented on drafts of this short communication, reviewed and agreed with the contents of the final manuscript: All authors.

Availability of data and materials

The FAIREHR platform can be accessed by the following link: <https://fairehr.com/>.

Financial support and sponsorship

The development of the online FAIREHR platform was supported by ECETOC (European Centre for Ecotoxicology and Toxicology of Chemicals).

Conflicts of interest

IOM (Karen S. Galea, Finlay Brooker, Shahzad Rashid) received funding from ECETOC to develop the FAIREHR online platform. Stuart Harrad is Editor-in-Chief of *Journal of Environmental Exposure Assessment*. Maryam Zare Jeddi is Associate Editor of the journal and Guest Editor for this Special Issue. Yu Ait Bamai, Radu-Corneliu Duca, and Yankai Xia are Editorial Board members of the journal. Konstantinos M. Kasiotis is Guest Editor for this Special Issue. None of the above were involved in any steps of the editorial processing of this manuscript, notably including reviewer selection, manuscript handling, or

decision making. The other authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Copyright

© The Author(s) 2025.

REFERENCES

1. Zare, J. M.; Hopf, N. B.; Louro, H.; et al. Developing human biomonitoring as a 21st century toolbox within the European exposure science strategy 2020-2030. *Environ. Int.* **2022**, *168*, 107476. DOI
2. Zare, J. M.; Virgolino, A.; Fantke, P.; et al. A human biomonitoring (HBM) Global Registry Framework: Further advancement of HBM research following the FAIR principles. *Int. J. Hyg. Environ. Health.* **2021**, *238*, 113826. DOI
3. Zare, J. M.; Galea, K. S.; Viegas, S.; et al. FAIR environmental and health registry (FAIREHR)- supporting the science to policy interface and life science research, development and innovation. *Front. Toxicol.* **2023**, *5*, 1116707. DOI PubMed PMC
4. Zare, J. M.; Galea, K. S.; Ashley-Martin, J.; et al. Guidance on minimum information requirements (MIR) from designing to reporting human biomonitoring (HBM). *Environ. Int.* **2025**, *202*, 109601. DOI
5. Cunha-Oliveira, T.; Ioannidis, J. P. A.; Oliveira, P. J. Best practices for data management and sharing in experimental biomedical research. *Physiol. Rev.* **2024**, *104*, 1387-408. DOI PubMed PMC
6. Herres-Pawlis, S.; Blanke, G.; Brammer, J.; et al. Making the InChI FAIR and sustainable by moving to open-source on GitHub. Version: 2. ChemRxiv [Preprint] 2024. [16 P] DOI
7. Glüge, J.; McNeill, K.; Scheringer, M. Getting the SMILES right: identifying inconsistent chemical identities in the ECHA database, PubChem and the CompTox Chemicals Dashboard. *Environ. Sci.: Adv.* **2023**, *2*, 612-21. DOI
8. Mohammed Taha, H.; Aalizadeh, R.; Alygizakis, N.; et al. The NORMAN Suspect List Exchange (NORMAN-SLE): facilitating European and worldwide collaboration on suspect screening in high resolution mass spectrometry. *Environ. Sci. Eur.* **2022**, *34*, 104. DOI PubMed PMC
9. Mattingly, C. J.; McKone, T. E.; Callahan, M. A.; Blake, J. A.; Hubal, E. A. Providing the missing link: the exposure science ontology ExO. *Environ. Sci. Technol.* **2012**, *46*, 3046-53. DOI PubMed PMC
10. W3C. World Wide Web Consortium. Resource description framework (RDF): Concepts and abstract syntax. Available from: <https://www.w3.org/TR/rdf-concepts/> 2014 (accessed on 2025-8-25).
11. Silva Santos LOB, Burger K, Kaliyaperumal R, Wilkinson MD. FAIR Data Point: A FAIR-oriented approach for metadata publication. *Data. Intell.* **2023**, *5*, 163-83. DOI
12. Peroni, S.; Soiland-reyes, S.; Sefton, P.; et al. Packaging research artefacts with RO-Crate. *Data. Sci.* **2022**, *5*, 97-138. DOI