

REVIEWER
Frontiers in Public Health (Q1)
ISSN: [2296-2565](https://doi.org/10.3389/fpubh.2026.1824250)
Frontiers

<https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2026.1824250/full>



TYPE: Systematic Review
PUBLISHED: 23 April 2026
DOI: [10.3389/fpubh.2026.1824250](https://doi.org/10.3389/fpubh.2026.1824250)



OPEN ACCESS

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RECEIVED 06 March 2025
REVISED 07 April 2025
ACCEPTED 10 April 2025
PUBLISHED 23 April 2025

CITATION
Abdullah WPA-AW, Arifin K, Juhari ML,
Alyub K and Abas A (2026) Occupational
safety in coal logistics: a systematic
review of systemic risks and human
factors.
Front. Public Health 14:1824250.
doi: [10.3389/fpubh.2026.1824250](https://doi.org/10.3389/fpubh.2026.1824250)

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Occupational safety in coal logistics: a systematic review of systemic risks and human factors

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Background: Occupational safety research in the coal industry has traditionally prioritized extraction hazards. Consequently, the complex, interconnected risk landscape of the post-extraction supply chain, encompassing transportation, handling, and storage, remains fragmented. Addressing this gap requires a shift from isolated risk assessments to a more holistic approach. This study adopts a systemic perspective to systematically identify occupational accident risks and synthesize risk management practices specifically within coal logistics operations. **Methods:** Guided by the PRISMA 2020 framework, a systematic review of 68 peer-reviewed articles published between 2004 and 2025 was conducted to map these systemic interdependencies.

Results: Thematic analysis indicates that 'Human and Organizational Risk Factors' constitute the predominant hazard category (51%), followed by 'Mechanical and Operational Failures' (31%) and 'Environmental and Geological Hazards' (18%). Crucially, a systemic synthesis of the findings challenges the conventional linear attribution of accidents to individual negligence. Results demonstrate that recurrent 'unsafe acts' are frequently symptoms of deeper systemic deficiencies within the socio-technical environment, including excessive workload and psychosocial stress. Furthermore, the review identifies a significant geographical concentration of research in China (66%), which influences the dominant risk management narrative toward top-down safety management systems and state-led intelligent automation.

Conclusion: While technical hazards such as conveyor deviation and spontaneous combustion are universally applicable, organizational strategies require systemic adaptation across different regulatory contexts. The study concludes that effective accident prevention necessitates a paradigm shift from traditional

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2023

Diah Pranitasari

Official record for review ho9jW8qD

- Pre-publication review
 - Canonical URL: <https://publons.com/wos-op/review/author/ho9jW8qD/>
 - Code: ho9jW8qD
 - Performed for: Frontiers in Public Health (journal)
 - Verification: YES. Verified by email receipt
- Date
 - Date of review: 2026
- Manuscript
 - Unavailable
 - Review content: Unavailable

<https://www.scimagojr.com/journalsearch.php?q=21100798718&tip=sid&clean=0>

Frontiers in Public Health ³

Switzerland | Universities and research institutions | Media Ranking

Country

Switzerland



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SCImago Media Rankings

Subject Area and Category

Medicine

Public Health,
Environmental and
Occupational Health

Publisher

Frontiers Media SA



SCIMAGO INSTITUTIONS RANKINGS

SJR 2025

1.103

Q1

H-index

138

Publication type

Journals

ISSN

22962565

Coverage

2013-2026