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METHODS FOR ELIMINATING RISK IN EMERGENCY SITUATIONS

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Annotation. Public health emergencies can arise from chemical, biological and radio-nuclear as well as natural or man-made environmental hazards. These events can pose a threat to human health, especially with some biological hazards. Therefore, a key role for public health authorities is to identify risks early, assess them quickly, evaluate them and communicate them to decision-makers for prevention or rapid action. While rapid risk assessment for acute public health events has been in practice for decades, there is still room for standardization and improvement of its process and outcomes by taking advantage of new opportunities, especially digitalization and cross-sectoral collaboration. Risk management methods need to be fundamentally improved.
Keys words. public health, global health, risk assessment, man-made risk, automation.

Introduction. A range of chemical, biological and radio-nuclear, as well as natural, technological and environmental hazards, pose national and global health risks and can lead to emergencies [1]. Risk assessments can be conducted systematically for medium- or long-term threats (e.g. seasonal, recurrent) or rapidly to address short-term acute health emergencies. It is essential to develop and disseminate rapid risk assessments of identified or potential acute health threats. RRAs should provide an assessment of the situation and evidence-based recommendations with adequate and timely options for risk reduction and response measures [2;3;4]. RRAs should guide policymakers in making decisions and implementing measures that take into account the specific context and potential impacts. Risk communication options and guidance are also important aspects. Although anthropogenic risk assessments are typically conducted over a limited period of time with limited data, they are dynamic and need to be repeated as new data or evidence becomes available. During the anthropogenic risk assessment process, it is essential to identify the populations at risk, assess their potential exposure and vulnerability, assess the characteristics of the hazard that may be posed by the event, and consider the context of the event, as well as the potential adverse health consequences [5;6;7]. It is important to note that the terminology of hazard, risk, threat, and event of interest varies in definition and may be used differently by different agencies.

To report on the current global, regional, and national rapid risk assessment methods and tools, along with a discussion of current challenges, areas for improvement, and opportunities for development.

Methods. This study applies a systematic and interdisciplinary methodological framework to analyze methods for eliminating and reducing risks in emergency situations. The methodology integrates qualitative and quantitative research approaches to assess the effectiveness of risk

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elimination strategies across different types of emergencies, including natural, technological, and human-induced hazards. The study focuses on hierarchical risk control methods, prioritizing elimination and substitution strategies. The following methods were analyzed:

- Engineering controls, including structural reinforcement, automation, and safety system integration;
- Administrative controls, such as emergency planning, standard operating procedures, and training programs;
- Technological solutions, including early warning systems, real-time monitoring, and decision-support tools;
- Organizational measures, including inter-agency coordination and resource management.

These methods were evaluated in terms of efficiency, feasibility, and sustainability under emergency conditions.

Results. The analysis revealed that risk elimination methods significantly reduce the probability and severity of emergency consequences when applied systematically. Engineering measures, such as structural reinforcement and automated safety systems, were found to be highly effective in eliminating technical risks at early stages.
Organizational and administrative measures, including emergency planning, staff training, and clear communication protocols, demonstrated strong effectiveness in reducing human-related risks. Technological solutions, such as early warning systems and real-time monitoring, improved response speed and decision accuracy. The results indicate that integrated application of engineering, organizational, and technological measures provides the highest level of risk reduction in emergency situations.
Discussion. The findings highlight the scientific importance of adopting a hierarchical approach to risk elimination, prioritizing preventive and elimination measures over reactive responses. Risk elimination at the source was shown to be more effective and economically efficient than mitigation after emergency onset. The discussion emphasizes that risk elimination methods must be adapted to specific types of emergencies and local conditions. Interdisciplinary cooperation, data integration, and continuous improvement of emergency management systems are essential for achieving sustainable safety outcomes. From a scientific standpoint, the results support the development of predictive models and decision-support systems based on reliable risk assessment and monitoring data.
Conclusion. Effective risk elimination in emergency situations is a fundamental component of modern safety and emergency management systems. The study confirms that systematic risk identification, comprehensive assessment, and integrated application of engineering, organizational, and technological measures significantly enhance emergency preparedness and resilience. Strengthening risk elimination strategies contributes to reducing human, economic, and environmental losses and supports sustainable development. Future research should focus on the integration of digital technologies and artificial intelligence to further improve risk elimination and emergency response capabilities.

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