Title: Evaluating the Comprehensiveness of the Threat and Hazard Identification and Risk Assessment (THIRA) Tool in Assessing Hazard-Related Risks

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Dear Editor,

Risk assessment is recognized as the foundational strategy for reducing and managing disaster risk arising from both natural and man-made hazards. It plays a crucial role in shaping disaster risk management policies by enabling stakeholders, including governments, emergency organizations, and the public, to make informed decisions across all phases of disaster risk management, including risk reduction, preparedness, response, and recovery (1–5).

Comprehensive risk assessment requires an in-depth understanding of vulnerability, exposure, capacity, and the nature of hazards, particularly in complex and multi-hazard environments (1–4,6). To support this, a variety of assessment tools have been developed, such as FMEA, Hazop, STAR, and THIRA (7–9). Among them, the **Threat and Hazard Identification and Risk Assessment (THIRA)** tool, developed by FEMA, stands out as a key and practical tool specifically tailored for disaster risk management in the U.S. context (9).

THIRA is a scenario-based, three-step process that helps communities identify hazards and threats, contextualize them, and determine required capabilities to manage them. This is aligned with core capabilities in the form of five mission areas: prevention, protection, mitigation, response, and recovery(9–11). Although this tool has contributed significantly to enhancing preparedness planning and capacity building, it is not without limitations.

Primarily, THIRA operates on a **single-hazard** approach and lacks a robust framework for addressing **multi-hazard** interactions, such as cascading, compound, or triggering effects which is very complicated to manage(6,12). It also does not explicitly incorporate **probability analysis**, a core component of risk quantification, nor does it sufficiently address **vulnerability**, especially across its social, cultural, environmental, and organizational dimensions (1,13–15).

Another limitation is its dependence on standardized capabilities in the USA that may not align with the preparedness levels of other countries, limiting its global applicability. Furthermore, while THIRA emphasizes mostly preparedness and response, its utility in the **prevention** phase remains limited.

To enhance the effectiveness and applicability of THIRA, we propose the following:

1. Integrate **multi-hazard approach** by accounting for interactions between hazards.
2. Include **risk-based indicators**, such as probability and vulnerability, in the risk assessment process.
3. Broaden the scope to **all hazards**, including both natural and man-made events.
4. Reduce dependency on extensive data from multiple entities, making the tool more adaptable in data-scarce environments in low and middle-income countries.
5. Develop mechanisms for **quantifying cascading impacts** of disasters resulted by hazardous events.

These recommendations align with priorities outlined in the **Sendai Framework**, the **Hyogo Framework**, and the **Global Risk Report 2024** (2,16,17), which stress the importance of holistic, multi-hazard risk assessment to gain better understanding disaster risk.

We advocate for further empirical studies and pilot implementation to evaluate THIRA's comprehensiveness and inform future improvements in the field of disaster risk management.

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