



# Identification and Prioritization of Evaluation Indicators for Rescue and Relief Operations in Crisis: A Case Study of the Iranian Red Crescent Society

Mazyar Karamali<sup>1, 2</sup>, Azadeh Soleimaninejad<sup>3</sup>, PirHossein Kolivand<sup>4</sup>, Taher Doroudi<sup>1</sup>, Mohammadkarim Bahadori<sup>5\*</sup>

<sup>1</sup> Research Center for Health Management in Mass Gathering, Red Crescent Society of the Islamic Republic of Iran, Tehran, Iran.

<sup>2</sup> Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran.

<sup>3</sup> Department of Business Management and Entrepreneurship, Faculty of Management, Farabi College, University of Tehran, Iran

<sup>4</sup> Department of Health Economics, Faculty of Medicine, Shahed University, Tehran, Iran.

<sup>5</sup> Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran

**\*Corresponding Author:** Mohammadkarim Bahadori, Health Management Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran, Email: bahadorihealth@gmail.com, Tel: 02188057022, ORCID: 0000-0002-7157-9908.

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## Abstract

**Introduction:** Rescue and relief operations are a critical component of crisis response, where efficiency and effectiveness can directly reduce human casualties and enhance community resilience. However, systematic frameworks and standardized indicators for evaluating the performance of crisis management organizations face several challenges. This study aimed to identify and prioritize key standardized criteria and indicators for assessing rescue and relief operations within the Iranian Red Crescent Society (IRCS).

**Method:** A descriptive mixed-methods study was conducted in two sequential phases, qualitative and quantitative, in 2025. The study population consisted of experts employed by the IRCS, among whom 34 participants were selected through purposive sampling. For the qualitative phase, content analysis was employed, while the quantitative phase utilized multi-criteria decision-making methods, including the Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).

**Result:** In the qualitative phase, based on expert evaluation, 58 key indicators were prioritized (17 input indicators, 11 efficiency indicators, 15 effectiveness indicators, and 15 impact indicators). The highest scores were assigned to the following indicators: deployment level of information and communication systems (score: 0.886) under the input dimension; time required to activate early warning systems (score: 1.000) under the efficiency dimension; number of specialized teams organized (e.g., high-altitude rescue, medical, firefighting) (score: 0.872) under the effectiveness dimension; and number of post-incident performance analysis reports (score: 1.000) under the impact dimension.

**Conclusion :** The standardized criteria and key indicators across the four dimensions of inputs, efficiency, effectiveness, and impact can provide a comprehensive structural framework for analyzing rescue and relief operations. This framework can enhance organizational performance, improve operational readiness, increase transparency and accountability, and build public trust in responsible institutions. It is recommended that operational activities be monitored based on this framework to support learning, improvement, and capacity building for community resilience, with further development of composite indicators and integration of innovative technologies.

**Keywords:** Performance Evaluation, Rescue and Relief, Efficiency and Effectiveness Indicators, Crisis Management.

## Introduction

In recent decades, the increasing frequency of natural disasters and human-made incidents such as earthquakes, floods, large-scale fires, accidents, as well as pandemics and epidemics caused by infectious diseases has placed growing pressure on health systems and relief organizations worldwide<sup>1</sup>. In this context, humanitarian organizations such as the Red Crescent

Society play a key role in responding to crises, saving lives, and reducing damages. Given limited resources, the complexity of operational environments, and rising societal expectations, the need for accurate, comprehensive, and multi-dimensional performance evaluation of these organizations has become more pronounced than ever<sup>2</sup>. The Sendai Framework for

Disaster Risk Reduction (2015–2030) emphasizes the importance of strengthening preparedness, resilience, and effective response in managing challenges and complexities arising from crises <sup>3</sup>.

Timely and efficient rescue and relief operations play a critical role in reducing human casualties and mitigating the impacts of disasters. However, evaluating the performance of these operations, particularly in the prehospital phase, is often challenging. Recent studies indicate that existing key performance indicators (KPIs) used to assess prehospital emergency responses to disasters lack sufficient standardization and validation, which hinders continuous performance analysis, comparison, and improvement <sup>1,4</sup>. Therefore, there is a growing need to develop comprehensive frameworks for evaluating public health emergency management (PHEM) programs. Such frameworks should be based on global evidence and capable of measuring structural, process, and outcome-related components <sup>4</sup>.

Training and capacity-building of rescue personnel play a crucial role in enhancing preparedness and crisis response. However, assessments show that many training programs lack appropriate strategies for monitoring and evaluating their effectiveness, potentially resulting in inadequate readiness of rescue teams in real-world situations <sup>5</sup>. Additionally, psychological factors also influence household preparedness for disasters. Understanding these factors can contribute to the development of more effective interventions aimed at improving community resilience <sup>6</sup>.

Performance evaluation in rescue and relief organizations extends beyond immediate operational outcomes. It must encompass various dimensions, including organizational preparedness, resource utilization quality, intervention effectiveness, and long-term socio-economic impacts. Globally, models such as the Balanced Scorecard (BSC), EFQM model, and Logical Framework Approach have been developed for performance assessment <sup>7,8</sup>. However, due to environmental, cultural, and structural differences, many of these models require contextual adaptation to specific settings. While each model has its strengths and limitations, the dynamic nature of crisis environments and the need for rapid decision-making justify the use of integrated or hybrid approaches <sup>8</sup>.

Performance evaluation serves as a key tool for assessing the effectiveness, efficiency, and impact of

organizational activities, especially within emergency response agencies where operational performance directly affects lives <sup>9</sup>. In organizations such as the Red Crescent Society, performance evaluation not only enhances crisis response but also promotes transparency, accountability, and organizational learning. Many evaluations have focused primarily on implementation or financial aspects, while qualitative dimensions such as impact or stakeholder satisfaction have received less attention <sup>10</sup>.

Based on the literature, the performance of rescue and relief operations can be examined through four core dimensions:

a) Input: Key components such as trained personnel, technical equipment, budget allocation, and communication infrastructure are essential in this dimension. Studies have shown that the quality and adequacy of these resources directly affect operational capacity during crises <sup>11</sup>.

b) Efficiency: Efficiency refers to the optimal use of available resources. Indicators such as response time, timely dispatch rate, and adherence to standard protocols are considered critical criteria in this category <sup>12</sup>.

c) Effectiveness: This dimension reflects the extent to which operational objectives—such as saving lives, stakeholder satisfaction, and successful coverage of affected areas—are achieved. These indicators serve as measures of operational success <sup>13</sup>.

d) Impact: Long-term effects of relief operations on society—including increased resilience, public trust, and reduced secondary damages—are categorized under this dimension. Although often overlooked in short-term evaluations, this aspect holds strategic importance <sup>14</sup>.

While the proposed framework applies broadly to rescue and relief operations, its relevance to trauma care is particularly critical in mass casualty incidents (MCIs) involving severe traumatic injuries. Indicators such as survival rate after rescue and reaction speed directly correlate with time to hemorrhage control, prehospital triage accuracy, and rapid trauma team activation. By measuring these dimensions, the framework can be adapted to evaluate prehospital trauma care performance, ensuring timely interventions that reduce preventable trauma deaths.

In Iran, despite efforts in evaluating the performance of executive agencies, few studies have focused on designing comprehensive and context-specific models

for assessing rescue and relief performance within humanitarian organizations such as the Iranian Red Crescent Society. This research gap may lead to suboptimal decision-making, inefficient resource allocation, and declining public trust during crises. Therefore, this study aimed to identify and prioritize standardized key criteria and indicators for evaluating rescue and relief operations within the Iranian Red Crescent Society.

## Methods

This study is applied in terms of purpose and adopts a mixed-methods approach implemented in two consecutive qualitative–quantitative phases. It was carried out in 2025 with the involvement of managers and specialists from the Iranian Red Crescent Society's Rescue and Relief Organization.

### Qualitative Phase: Identification of Criteria and Performance Indicators

In the qualitative phase, to identify criteria and enumerate performance indicators for evaluating operational performance, a comprehensive review was carried out on library documents including 34 international standard-related documents such as Sphere standards and IFRC guidelines, national crisis management frameworks, strategic policy documents related to the Iranian Red Crescent, and Standard Operating Procedures (SOPs) for rescue and relief operations<sup>15, 16, 17, 18</sup>.

Additionally, scientific articles published in both domestic and international databases—PubMed, Scopus, Web of Science, SID, and Magiran—were searched and analyzed within the time frame of 2000 to 2025. The search used keywords relevant to the field of rescue and relief, including disaster response, incidents, accountability, performance evaluation, indicators, effectiveness, and efficiency. Findings were compiled using structured data extraction forms.

The initial extraction yielded 18 criteria (components) and 71 indicators. These 18 criteria were conceptually mapped to four pre-defined dimensions (Input, Efficiency, Effectiveness, and Impact) based on established performance evaluation literature in rescue operations. No criteria were removed during this phase; rather, they were systematically grouped under their respective dimensions. The reduction from 71 to 58 indicators occurred later during the quantitative

validation phase, where 13 indicators scoring  $<0.30$  were excluded.

To validate and develop the framework of indicators, focus group discussions (FGDs) were held with the standardization task force of the Rescue and Relief Organization. This task force included 12 permanent members (senior and mid-level managers) and 22 invited provincial managers and subject-matter experts selected through purposive sampling. A total of six FGD sessions were conducted, during which participants reviewed and reached consensus on draft criteria and indicators.

The data collection tool in this stage consisted of worksheets containing preliminary drafts of criteria and indicators, along with open-ended questions to gather expert opinions. Prior to conducting the sessions, content validity of the worksheets was assessed and revised based on feedback from two academic experts and senior consultants. All sessions were facilitated by the researcher and lasted approximately 85 minutes on average.

### Quantitative Phase: Validation and Prioritization of Indicators

In the quantitative phase, a multi-criteria decision-making model was employed to validate the comprehensive evaluation framework and prioritize performance indicators across the main dimensions: alignment, input, efficiency, effectiveness, and impact.

Each criterion and indicator was evaluated separately using specially designed questionnaires distributed to organizational experts and specialists. Each key performance indicator was scored based on three evaluation criteria—importance, measurability, and relevance to the assessment axis—using a 5-point Likert scale (ranging from 1: no importance to 5: very high importance), as rated by a panel of six domain experts.

First, the Analytic Hierarchy Process (AHP) method was used to determine weights for the main criteria. According to the results, importance received the highest weight at 0.385, followed by measurability at 0.348, and relevance at 0.267. These weights were then used to prioritize key indicators. The Expert Choice software was used for this part of the analysis.

The AHP pairwise comparison matrix yielded a consistency ratio (CR) of 0.047, which is well below the acceptable threshold of 0.10, confirming logical consistency in expert judgments. The same panel of six

senior IRCS experts participated in both the AHP weighting and TOPSIS ranking phases. While a sample size of  $n=6$  is modest, it aligns with expert-driven multi-criteria decision-making practices in organizational settings where specialized experience outweighs large sample requirements. We acknowledge this as a methodological limitation; however, high inter-rater agreement among panel members ensured ranking stability.

Subsequently, the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) was employed for final ranking of the indicators. Key indicators were separately evaluated via researcher-developed questionnaires administered to six organizational experts. The scores obtained were normalized, and a weighted decision matrix was formed by multiplying each normalized value by its corresponding criterion weight.

Next, the distance of each indicator from the positive-ideal solution (PIS,  $D^+$ ) and the negative-ideal solution (NIS,  $D^-$ ) was calculated. The closeness coefficient (CCi) was used to rank the indicators; an indicator achieving a shorter distance from the PIS and a longer distance from the NIS received a higher priority. The TOPSIS software was used for this stage of the analysis.

### Overall Methodological Strength

By integrating qualitative and quantitative methods, this research methodology ensured comprehensiveness, practical applicability, and scientific rigor in identifying and validating performance criteria and indicators in the field of rescue and relief operations. The primary evaluation dimensions identified in this study include four core axes: "Input", "Efficiency", "Effectiveness", and "Impact". Each of these dimensions encompasses specific indicators that contribute to assessing the effective functioning of the rescue and relief organization.

### Ethical Considerations

At the outset, informed consent was obtained from all participants involved in various stages of the research. Before participating in focus group discussions (FGDs) or completing questionnaires related to weighting criteria and indicator prioritization, participants were verbally informed about the objectives of the study, the use of collected information, data storage procedures, and measures taken to ensure confidentiality. Participants had the right to withdraw from the study at any stage without any adverse consequences on their

employment status or organizational relationships. All collected data were kept strictly confidential and accessible only to the research team on a need-to-know basis. Participant identities were anonymized throughout the reporting process, and findings were presented in summary form without revealing personal identifiers. In the qualitative phase, FGD sessions were conducted under a standardized ethical protocol. The lead researcher facilitated the FGD sessions to prevent misuse of professional authority or unintended pressure on participants. In the quantitative phase, the questionnaires were carefully designed to avoid irrelevant, discriminatory, or emotionally charged questions, allowing participants to express their views comfortably. Finally, all research procedures were approved by the institutional and organizational ethics committees, and the necessary permits were obtained for conducting the study.

## Results

The extracted criteria and indicators were categorized into four main dimensions: Input, Efficiency, Effectiveness, and Impact, as illustrated in Figure 1.

A total of 71 key performance indicators aligned with the defined criteria were entered into the measurement and validation phase, where participants assessed them. Demographic findings indicated that the study involved 30 male and 4 female participants, with a mean age of  $47 \pm 5$  years. In terms of educational background: 8 participants held specialized doctoral degrees (24%), 4 had professional doctorates (12%), 18 held master's degrees (52%), and 4 had bachelor's degrees (12%). The majority of participants (84%) had more than 20 years of work experience and possessed substantial professional expertise.

Table 1 presents the titles and prioritization of the top five indicators for each dimension.

The results of prioritizing the key indicators of the evaluation of rescue and relief performance in Table 1 based on the scoring of experts, including: the extent of deployment of information systems and communication equipment (with a score: 0.886) in the axis of input indicators, the duration of activation of the Early Warning Systems (with a score: 1.000) in the efficiency axis, the number of specialized teams organized (rescue at height, medical, firefighting) (with a score: 0.872) in the axis of effectiveness indicators, and the number of after-action review reports (with a score: 1.000) in the axis of the indicators of the final

effect, the final effect was obtained. Finally, indicators with a score below 0.3 were eliminated, leaving 58 key indicators (17 input indicators, 11 efficiency indicators,

15 effectiveness indicators, and 15 final effect indicators) for ranking.

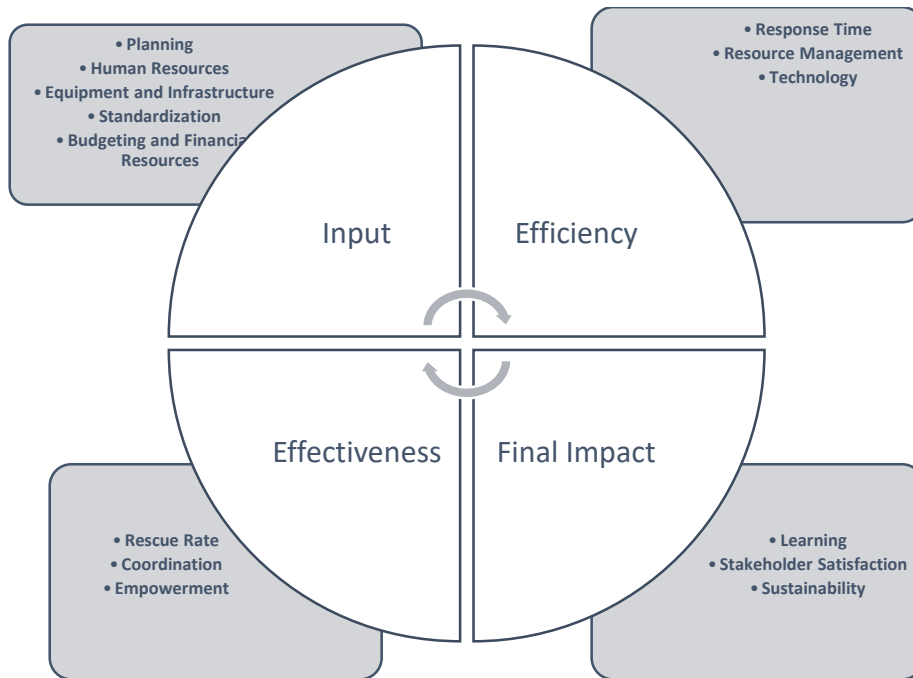


Figure 1. Framework of Dimensions and Criteria for Performance Evaluation

Table 1: Prioritization of Key Performance Evaluation Indicators Using the TOPSIS Technique

| Evaluation Axis | Criterion                | Key Performance Indicator (KPI)                                                        | Closeness Coefficient (CCi) | TOPSIS Rank |
|-----------------|--------------------------|----------------------------------------------------------------------------------------|-----------------------------|-------------|
| Input           | Infrastructure           | Deployment level of information systems and communication equipment (IT)               | 0.886                       | 1           |
|                 | Planning                 | Number of updated Emergency Operational Plans (EOP) per year                           | 0.825                       | 2           |
|                 | Equipment                | Number of standard rescue equipment (rescue kits, ambulances, etc.)                    | 0.815                       | 3           |
|                 | Human Resources          | Number of refresher and skills development courses for rescuers per year               | 0.770                       | 4           |
|                 | Infrastructure           | Percentage of fixed and mobile operational bases relative to main routes               | 0.758                       | 5           |
| Efficiency      | Response Time            | Activation time of Early Warning Systems (EWS)                                         | 1.000                       | 1           |
|                 | Resource Management      | Coverage of radio and telecommunication in crisis-affected areas                       | 0.935                       | 2           |
|                 | Resource Management      | Storage of standard relief items in proportion to population                           | 0.809                       | 3           |
|                 | Response Time            | Reaction speed (response time from incident to operational start)                      | 0.768                       | 4           |
|                 | Technology               | Access to appropriate operational tools and equipment                                  | 0.767                       | 5           |
| Effectiveness   | Rescue Rate              | Number of organized operational teams (high-altitude rescue, medical, fire, etc.)      | 0.872                       | 1           |
|                 | Coordination             | Number of people rescued per hour of operation                                         | 0.833                       | 2           |
|                 | Rescue Rate              | Number of annual training exercises and drills                                         | 0.820                       | 3           |
|                 | Empowerment              | Survival rate after rescue                                                             | 0.804                       | 4           |
|                 | Coordination             | Percentage of successful implementation of coordinated response plans (EOP)            | 0.789                       | 5           |
| Impact          | Learning                 | Number of After-Action Review (AAR) reports                                            | 1.000                       | 1           |
|                 | Stakeholder Satisfaction | Satisfaction level of relief workers with working conditions                           | 0.930                       | 2           |
|                 | Stakeholder Satisfaction | Victim satisfaction rate with services received                                        | 0.915                       | 3           |
|                 | Sustainability           | Organizational readiness: (equipment level) × (personnel skill) × (mobilization speed) | 0.873                       | 4           |
|                 | Sustainability           | Optimal responsiveness: (response time) × (quality of services provided)               | 0.819                       | 5           |

## Discussion

Given the importance of evaluating efficiency and effectiveness in rescue and relief operations during crises for crisis management organizations, this study aimed to analyze existing performance indicators and propose standardized criteria and indicators to improve evaluation frameworks for humanitarian organizations in disaster management. Effective and transparent rescue and relief operations significantly enhance public trust and support for crisis management institutions<sup>3</sup>. Furthermore, the general public's understanding of how these organizations respond during a crisis directly influences their confidence and trust<sup>1</sup>. The effectiveness of rescue and relief operations has a direct impact on the human, economic, and social consequences of disasters. However, in many countries, systematic performance evaluations of such operations still face serious challenges, and most existing frameworks (e.g., EFQM or Sphere) were developed within the context of developed nations<sup>19, 20</sup>.

The findings of Khan et al.'s comprehensive review of crisis management systems, particularly flood control, highlighted challenges such as a lack of accurate data, weak inter-organizational coordination, and the need to improve performance evaluation frameworks<sup>4</sup>. Therefore, this study aims to develop localized and operational frameworks for evaluating R&R performance by taking into account local conditions, cultural contexts, and Iran's crisis response structures under the Iranian Red Crescent Society—the primary agency responsible for rescue and relief.

Transparency in rescue and relief operations plays a key role in strengthening public trust and legitimizing humanitarian organizations. In large-scale crises, transparency in organizational performance, including timely information dissemination, acknowledgment of errors, and post-event reporting, can help rebuild trust among affected communities and facilitate public participation in later stages<sup>21, 22</sup>. A study by Rodriguez et al. showed that information accountability in relief operations related to severe storms in the United States increased public satisfaction and volunteer engagement<sup>23</sup>. The results of this study indicate that planning transparency, financial transparency, survival rates, operation success rate, satisfaction levels, and cost-effectiveness received the highest scores across

evaluation dimensions.

Challenges such as insufficient training of rescue personnel, communication system failures, shortages of human and physical resources, and inter-organizational inefficiencies are among the main causes of delays or inefficiencies in rescue and relief operations. Abdulkadir's review study identified six key challenge areas: organizational, individual, environmental, health-related, communication, and information issues, highlighting the importance of investing in targeted training programs, improving communication protocols, and enhancing coordination across sectors.<sup>24</sup> In this study, indicators such as the deployment level of information systems and communication equipment (IT), number of updated operational plans (EOP), quantity of standardized relief equipment (rescue kits, ambulances, etc.), number of annual retraining sessions for rescuers, percentage of fixed and mobile operational bases, and indicators related to emerging technology development ranked among the top priorities.

A study (2023) examining simulation exercises (SimEx) in crisis preparedness demonstrated that such drills can improve skills and readiness of rescue teams<sup>25</sup>, which aligns with the findings of this research. Indicators such as the number of organized operational teams, frequency of annual drills and preparedness exercises, and implementation success rate of coordinated response plans (EOP) were found to be among the highest-priority indicators within the dimension of effectiveness.

Indicators including time required to activate early warning systems, extent of radio and telecommunications coverage in disaster zones, level of standardized emergency supplies stored relative to population size, speed of response from incident onset to operation initiation, and access to appropriate operational tools and equipment ranked highly under the efficiency dimension. In trauma-specific contexts, the effectiveness dimension captures critical milestones such as prehospital hemorrhage control, triage fidelity, and timely activation of specialized trauma teams. High prioritization of organized specialized units (medical, high-altitude, and firefighting) and survival rates underscores the framework's utility in MCI scenarios, where structured coordination directly mitigates secondary injuries and improves post-rescue survival outcomes. According to Marco-Papas et al. (2024),

widely used performance indicators in R&R operations include response time, survival rate, geographic coverage, stakeholder satisfaction, and resource utilization rate <sup>26</sup>.

Understanding past failures is essential for improving future rescue and relief efforts. These challenges often stem from systemic issues. Analyzing past events where rescue and relief operations encountered difficulties helps identify recurring problems and areas needing improvement in training, communication protocols, resource allocation, and inter-agency coordination. An Australian study on post-event reviews in emergency management emphasized the necessity of coherent, comprehensive, and timely assessments to strengthen organizational learning and community resilience <sup>27</sup>. In our study, indicators such as the number of after-action reports, responder job satisfaction, victim satisfaction rate, organizational preparedness, and optimal responsiveness ranked among the top priorities under the impact dimension.

Proactive planning and ensuring all stakeholders understand their roles and responsibilities are essential for smooth and effective relief delivery. Strong inter-agency coordination is critical to achieving successful outcomes. Joint efforts between various humanitarian organizations prevent duplication and ensure more comprehensive and efficient responses. Effective communication mechanisms and coordination between teams and agencies guarantee optimal resource deployment and full coverage of affected areas <sup>28</sup>.

An effective procurement and supply chain system, suitable transportation infrastructure, information and communication systems, supplier relationship management, supportive government policies, timely delivery, organizational readiness (service continuity), mobilization of human resources, innovative storage methods, need assessment, demand coverage, regional culture and structure, security management, and media handling are among the most important components of logistics performance in humanitarian crisis operations, as emphasized in multiple studies <sup>29, 30, 31, 32, 33, 34, 35, 36, 37</sup>. In this study, key performance indicators under the input and efficiency dimensions, based on logistics, infrastructure, and operational resources, were identified as high priority.

The World Health Organization (WHO), in version 2.1 of its Emergency Response Framework (ERF), emphasizes the importance of an "all-hazards"

approach. Designed to improve responsiveness, predictability, and effectiveness in public health emergencies, this framework supports countries in strengthening their emergency response systems <sup>38</sup>. In this study, the deployment of information systems and need-based forecasting indicators received high priority. Victim satisfaction, comprehensiveness of services within the relief cycle, increased resilience, and psychosocial support provided via family reunification teams emerged as key indicators under the effectiveness and impact dimensions. A 2025 study showed that psychological factors such as risk perception, self-efficacy, and social support play a significant role in household preparedness for disasters. Understanding these factors is crucial for designing effective interventions <sup>24</sup>.

Ultimately, the efficiency and effectiveness of rescue and relief operations can only be ensured through continuous, data-driven, and objective-oriented evaluation. Future research opportunities include:

- Developing localized implementation models and performance evaluation frameworks tailored to local, cultural, and structural conditions;

- Designing and validating measurement tools for simultaneously assessing quantitative indicators (e.g., response time, survival rate) and qualitative indicators (e.g., stakeholder satisfaction, quality of inter-agency coordination);

- Evaluating rescue operations using AI technologies and conducting analytical studies of real-world rescue missions;

- Extracting lessons learned for revising performance indicators and organizational learning from past crises;
- Interdisciplinary studies exploring the psychological and social dimensions of rescue team performance;

- Designing training, support, and mental resilience programs;

- Developing multi-phase performance evaluation models.

Among the general challenges and limitations of this research topic are the complexity of crisis environments, limited access to real-time and up-to-date information, and diverse stakeholder perspectives that may affect the validation of performance indicators. Limitations specific to this study include the scarcity of relevant data needed for a complete evaluation of performance frameworks and differences in the conceptual definitions of key terms, which should be considered

when interpreting the results.

### Conclusion

The standardized criteria and key indicators identified in this study offer a comprehensive evaluation framework for analyzing rescue and relief operations and improving the performance of humanitarian organizations. Beyond performance evaluation, these indicators can serve as strategic tools for optimizing resource allocation in future crisis responses, increasing the preparedness of operational teams, enhancing transparency and organizational accountability, and building public trust in institutional performance. This model is built upon four core dimensions—input, efficiency, effectiveness, and impact—and aims to provide a precise and reliable picture of organizational performance through combined qualitative and quantitative indicators.

It is recommended that humanitarian organizations apply this framework not only for reporting purposes but also for organizational learning, capacity building at national and regional levels, and the development of composite indicators and integration of new technologies. The use of quantitative metrics, community involvement, multi-stage effectiveness assessments (pre-, during, and post-crisis), and independent oversight bodies in the evaluation process is advised.

### Conflict of Interest Disclosures

The authors declare that they have no competing interests.

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### Authors' Contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

### Ethical Statement

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### Declaration of Generative AI and AI-assisted technologies

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were used in the preparation, writing, or review of this manuscript.

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