Civil and Sustainable Urban Engineering

Research Article
Volume 5(2), 2025, 88–101
https://doi.org/10.53623/csue.v5i2.845

Strengthening Urban Health Resilience through the Implementation of the Indonesian Emergency Medical Team (TCK-EMT Indonesia)

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SUBMITTED: 28 September 2025; REVISED: 18 October 2025; ACCEPTED: 20 October 2025

ABSTRACT: Urban health resilience was increasingly recognized as a critical pillar of sustainable development, particularly in densely populated and disaster-prone cities. As part of the broader framework of urban resilience engineering, strengthening health systems was essential to prevent service disruptions and ensure continuity during crises. Emergency Medical Teams (EMTs) played a central role in this process by providing rapid, standardized, and sustainable responses. However, the Indonesian Emergency Medical Team (TCK-EMT Indonesia) had not yet achieved WHO verification, indicating persistent challenges in governance, operational readiness, and integration with urban health systems. This study applied the Edwards III policy implementation framework, which covered communication, resources, disposition, and bureaucratic structure, through a narrative literature review of national regulations, WHO standards, and After Action Reports from missions in Türkiye (2023) and Myanmar (2025). Findings revealed that although TCK-EMT Indonesia personnel demonstrated strong motivation and adaptive capacity, weaknesses persisted in communication delays, limited logistical self-sufficiency, and fragmented bureaucratic structures. These gaps undermined the ability of urban health systems to sustain essential services during disasters. Comparative insights from Türkiye and Myanmar highlighted how external facilitation, linguistic and cultural barriers, and governance fragilities critically influenced resilience outcomes in urban crisis contexts. The study concluded that strengthening TCK-EMT Indonesia was not only a step toward WHO verification but also a strategic measure for developing adaptive, integrated, and sustainable urban health systems. From the perspective of urban resilience engineering, enhancing EMT capacity constituted a pivotal effort to safeguard disaster-prone cities against increasingly complex health crises.

KEYWORDS: Urban health resilience; emergency medical teams (EMTs); TCK-EMT Indonesia; governance and operational readiness; urban resilience engineering

1. Introduction

Urban health resilience was increasingly recognized as a critical global priority in disaster risk reduction efforts, particularly in rapidly urbanizing countries. The WHO emphasized that resilient urban health systems were essential to minimize mortality and morbidity during emergencies. Within this framework, EMTs played a pivotal role in delivering rapid, standardized, and high-quality medical responses to disasters, ensuring that affected populations received timely and effective care. As cities became increasingly dense and vulnerable to complex emergencies, strengthening EMT systems was regarded as a cornerstone of urban health resilience worldwide. Indonesia, as one of the most disaster-prone countries in the world, frequently experienced various natural hazards, including earthquakes, floods, volcanic eruptions, and tsunamis. In 2024 alone, the country recorded 3,472 disasters, many of which directly disrupted health services in urban areas [1]. The impacts extended beyond physical damage to health facilities and often resulted in prolonged health crises due to limited personnel and logistical constraints. In megacities such as Jakarta and Surabaya, which were highly dense and disaster-prone, even moderate-scale disasters could trigger cascading failures in health infrastructure and service delivery. Similar urban vulnerabilities were also observed during recent EMT deployments abroad, including the Türkiye (2023) earthquake and the Myanmar (2025) crisis, where the continuity of health services in densely populated cities was severely tested. These vulnerabilities underscored the systemic risk of urban health service collapse during crises, reinforcing the urgency of resilient health crisis management systems. Strengthening urban health systems after disasters was therefore a key element of broader urban health resilience strategies. This situation emphasized the urgent need for a rapid, well-coordinated, and internationally recognized health response mechanism to ensure effective crisis management at both national and global levels. Health crisis management formed an integral component of national resilience systems, particularly within the health sector. One essential activity to enhance preparedness was capacity building within health facilities [2]. Consequently, establishing such mechanisms was critical to sustaining urban health resilience as part of national resilience.

However, Indonesia's health crisis management system continued to face multiple challenges, particularly concerning the availability and readiness of personnel and health logistics that could be mobilized swiftly. These challenges were compounded during large-scale disasters that required coordinated and systematic responses. To address these gaps, the Ministry of Health established the Indonesian Emergency Medical Team (Tenaga Cadangan Kesehatan – Emergency Medical Team Indonesia, TCK-EMT Indonesia) [3]. This mechanism was first institutionalized through the Technical Instructions for Health Reserve Personnel and was subsequently reinforced by Law No. 17/2023 (Undang-Undang No. 17 Tahun 2023) and Government Regulation No. 28/2024 (Peraturan Pemerintah No. 28 Tahun 2024) [4, 5], which officially positioned TCK-EMT as part of the national health crisis response system. TCK-EMT Indonesia was designed to accelerate health crisis responses through a cross-professional network comprising medical, non-medical, and support personnel who were deployed in accordance with WHO EMT competency standards [6]. In this regard, TCK-EMT held strategic potential not only for accelerating WHO verification but also for improving cities'

capacity to maintain essential health services during and after disasters, which was a core component of urban health resilience.

The WHO launched the EMT initiative as a global framework to ensure rapid and standardized medical response capacity [7]. However, as of 2025, TCK-EMT Indonesia had not yet obtained official WHO verification as a classified EMT [8]. This indicated that Indonesia's position in global EMT coordination remained limited, despite its participation in international missions in Türkiye (2023) and Myanmar (2025). Strengthening TCK-EMT Indonesia was not only essential for achieving WHO verification but also crucial for improving cities' capacity to sustain essential health services during disasters, which was a fundamental element of urban health resilience.

Academic studies on TCK-EMT Indonesia were also limited. Most publications focused on documenting mission experiences, such as the EMT response in Türkiye (2023), without critically examining governance, regulatory, and operational aspects in comparison with WHO EMT standards. Yet, compliance with these standards was a crucial prerequisite for international verification. This lack of academic inquiry also limited the integration of TCK-EMT Indonesia within broader urban health resilience strategies, both domestically and internationally, particularly in ensuring the continuity of health services during and after disasters.

Despite its strategic importance, scholarly research on TCK-EMT Indonesia remained scarce and largely descriptive. Few studies critically examined governance and operational practices, compared TCK-EMT Indonesia with WHO EMT standards, or explored its implications for urban health resilience. This gap highlighted the need for a comprehensive analysis to understand how TCK-EMT implementation affected the resilience of urban health systems in disaster-prone urban settings. This study was among the first to systematically apply the Edwards III framework to EMT implementation in Indonesia, providing a structured analysis that bridged health crisis policy and sustainable urban resilience engineering. By drawing on both domestic urban contexts and lessons from international EMT missions in Türkiye and Myanmar, this study offered a more holistic perspective on the governance and systemic challenges facing EMT implementation.

Policy implementation involved several dimensions, including regulatory frameworks, organizational structures, and the practical application of these policies, which ultimately shaped their impact on targeted communities. In the case of TCK-EMT Indonesia, it was crucial to examine how this scheme was systematically implemented. This included activation processes, deployment, inter-agency coordination, resource management, and post-mission evaluation. A key analytical focus lay in examining the alignment between field implementation and the established regulatory framework. The Edwards III framework was selected because its four dimensions, communication, resources, disposition, and bureaucratic structure, were particularly relevant to the governance and systemic challenges of EMT implementation in urban health resilience contexts. Based on these gaps, this study addressed the following research questions: (1) How did the current implementation of TCK-EMT align with WHO EMT standards? (2) What were the key governance and structural barriers to strengthening urban health resilience in Indonesia? (3) What reforms were required to integrate TCK-EMT into sustainable urban crisis management systems?

Building on this background, the purpose of this study was to analyze the implementation of TCK-EMT Indonesia in health crisis management, focusing on structural, regulatory, and

operational aspects, and to assess its alignment with WHO EMT standards through a narrative literature review approach. This study applied the Edwards III framework, which encompassed four key dimensions: communication, resources, disposition, and bureaucratic structure. The analysis focused on two recent international deployments in Türkiye (2023) and Myanmar (2025), to evaluate the strengths and weaknesses of TCK-EMT operations and their conformity with WHO EMT standards. Specifically, the study aimed to understand how the implementation of TCK-EMT contributed to strengthening the resilience of urban health systems, including aspects of preparedness, response effectiveness, and post-disaster recovery of health services in urban settings.

Theoretically, this research enriched the academic discourse on the implementation of global health policy standards by linking EMT implementation with the concept of urban health resilience. Practically, the findings provided evidence-based recommendations for the Ministry of Health to accelerate WHO EMT accreditation and strengthen cross-sectoral integration to enhance national health crisis resilience. Optimizing TCK-EMT Indonesia was expected to become an integral part of long-term strategies to build urban health systems that were robust, responsive, and adaptive to disasters. This would enhance the capacity of urban health systems to effectively respond to and recover from health crises.

2. Materials and Methods

2.1. Inclusion and exclusion criteria.

This study employed a narrative literature review design to systematically assess the implementation of the TCK-EMT in strengthening urban health resilience [9–12]. The narrative review approach was selected to synthesize diverse sources, including regulatory documents, After Action Review (AAR) reports, WHO standards, and academic publications. The analysis focused on governance, policy, and operational dimensions of EMT implementation in Indonesia, as well as its alignment with WHO EMT standards. To ensure methodological transparency, this study applied explicit inclusion and exclusion criteria. Documents were included if they: (1) were published primarily between 2019 and 2025; however, foundational documents or regulations published earlier were also included if they remained valid, had no newer revisions, or represented seminal works such as WHO EMT initiative guidelines or the Edwards III framework; (2) directly discussed EMT policies, health crisis management regulations, or international EMT deployments; and (3) were produced by credible institutions such as the Ministry of Health, WHO, or peer-reviewed journals. Documents were excluded if they lacked clear relevance to EMT implementation or if the full text was not accessible. A total of 32 documents were reviewed, consisting of eight national regulations and policy documents, two WHO EMT guidelines, two international AAR reports (Türkiye 2023 and Myanmar 2025), and twenty peer-reviewed articles. To enhance clarity and replicability, the main documents and sources used in this study were consolidated in Table 1. The review process was conducted systematically through three main stages. First, relevant literature and policy documents were identified. Second, the extracted information was categorized according to the four dimensions of the Edwards III framework: communication, resources, disposition, and bureaucratic structure. Third, a thematic analysis was performed to identify implementation gaps. The overall process flow is illustrated in Figure 1, which was

adapted from Levy and Ellis [11] to highlight the stages of literature selection and synthesis undertaken by the researchers.

Table 1. Key literature and policy sources used in the review.

Type of Document	Key Examples (Reference No.)	Year Range	Relevance
Disaster Data Reports	BNPB Disaster Summary [1]	2024	Provides national disaster trends & urban impact
National Regulations	UU No. 17/2023 [5]; PP No. 28/2024 [4]	2023–2024	Establishes EMT within health crisis system
Technical Guidelines	MoH Technical Instruction [6]; EMT Strategy [3]	2022–2023	Operational framework for TCK-EMT
WHO Standards	EMT Classification [7]; EMT Global Database [8]	2021–2025	International benchmark for EMT verification
AAR Reports	EMT Missions in Türkiye [13]; Myanmar [14]	2023–2025	Field evaluation of EMT deployment
Academic Literature	von Harbou [15]; Casey et al. [16]	2020–2025	EMT role, integration, and regional analysis

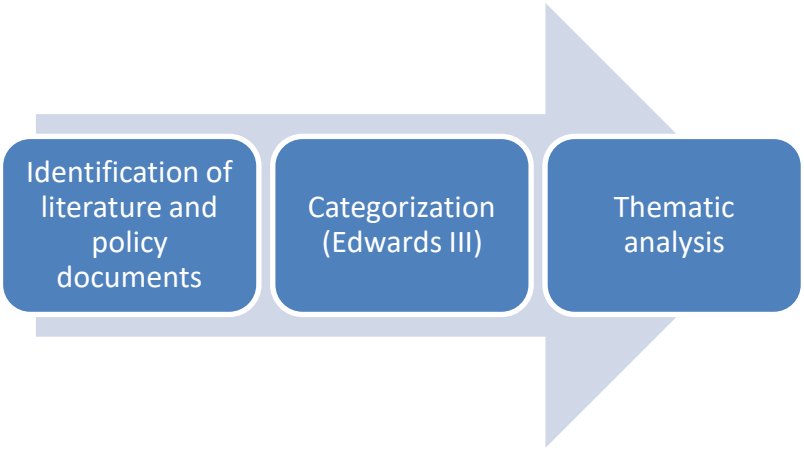

Figure 1. Literature review process [11].

2.2. Framework selection.

The Edwards III policy implementation framework was employed as the primary analytical tool. This framework was chosen because its four dimensions, communication, resources, disposition, and bureaucratic structure, directly captured the governance and systemic challenges faced by EMT systems. Although alternative models, such as Mazmanian and Sabatier's top-down model and Lipsky's Street-Level Bureaucracy, emphasized the policy environment and frontline discretion, the Edwards III framework provided a more comprehensive perspective on administrative processes and structural barriers, which were particularly relevant to EMT implementation in urban crisis contexts [12].

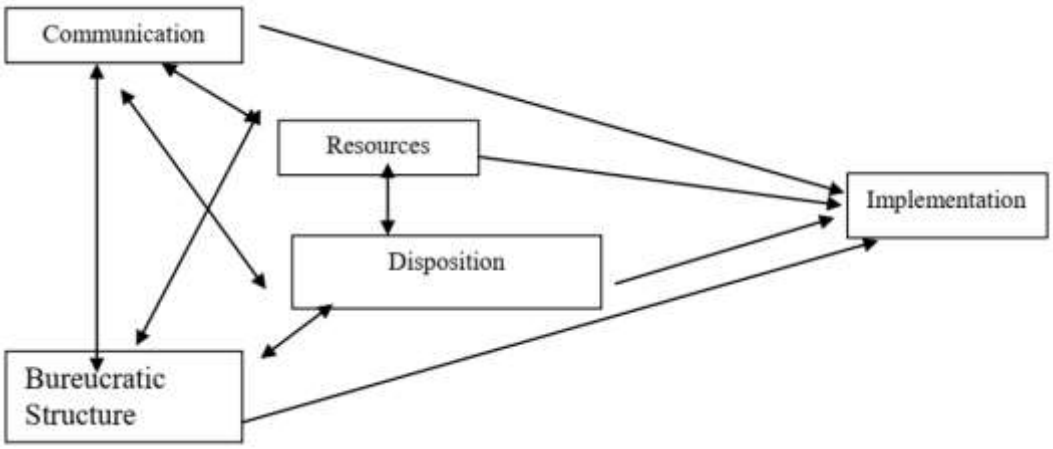

Figure 2. The relationship between policy implementation concepts [12].

2.3.Analytical approach.

Data were extracted and synthesized thematically according to the four dimensions of the Edwards III framework. Given the qualitative nature of the available data, primarily regulatory texts, policy documents, and narrative AAR reports, statistical analysis was not applied. Instead, the study emphasized qualitative synthesis to identify gaps, challenges, and opportunities. Future research could incorporate simulation models, such as analyses of deployment response times or system dynamics related to urban health resilience, to complement qualitative findings. By integrating regulatory analysis, mission reports, and academic literature within the Edwards III framework, this methodology enabled a structured examination of the alignment between TCK-EMT implementation and WHO EMT standards, while positioning the findings within the broader discourse on sustainable urban health resilience.

3. Results and Discussion

The results of this study were compiled based on an analysis of regulatory documents, after-action reports, and WHO EMT standards. To facilitate analysis, the findings were mapped using the Edwards III framework, which emphasized four key dimensions of policy implementation: communication, resources, disposition, and bureaucratic structure. Each dimension was presented through a description of field findings, followed by a discussion linking them to theory and international standards (Table 2).

Table 2. Key Findings Based on the Edwards III Framework for TCK-EMT Implementation.

Dimension	Key Findings	Main Challenges / Policy Gaps	Reference
Communication	Coordination between the Ministry of Health, BNPB, and the Ministry of Foreign Affairs caused mobilization delays (6–7 days vs. WHO standard of 72 hours). International communication improved with WHO EMT-CC facilitation in Myanmar.	Domestic communication delays, lack of delegated emergency authority, fragmented information channels, and absence of standardized SOPs; language and cultural barriers hindered effectiveness.	[13–23]
Resources	TCK-EMT demonstrated flexible deployment capacity (Type 1–2 EMTs). Personnel adaptability was high, and operations aligned with WHO EMT standards.	Lack of logistical self-sufficiency, dependency on local utilities and funding from central budgets (APBN), inadequate stockpiles, and limited diversification of financing.	[4, 5, 7, 13, 14, 18, 19, 25–28]

Dimension	Key Findings	Main Challenges / Policy Gaps	Reference
Disposition	Personnel showed strong motivation, discipline, and ethical conduct across missions, ensuring service continuity despite limited resources.	Sustaining morale required institutional support—psychosocial care, fair workload distribution, recognition, and structured capacity-building.	[12, 13, 14, 29–33]
Bureaucratic Structure	Formal coordination under Puskriskes provided legitimacy, but fragmented governance persisted. WHO EMT-CC involvement improved international but not domestic coordination.	Absence of binding cross-ministerial SOPs, unclear delegation of authority, and centralized decision-making hindered rapid mobilization; structural fragmentation weakened governance.	[7, 13, 14, 18, 19, 34–39]

3.1. Communication.

Communication was one of the most crucial aspects of Indonesian TCK-EMT implementation, and findings indicated that this dimension still faced major challenges. In the 2023 Türkiye mission, the after-action report highlighted weak coordination between the Ministry of Health, BNPB, and the Ministry of Foreign Affairs, which caused delayed mobilization, with the team departing after seven days—far beyond the WHO EMT standard of 72 hours [13–16]. A similar situation occurred in the 2025 Myanmar mission, where mobilization took six days. In addition to time delays, the Myanmar report revealed communication barriers in the field due to language differences between the Indonesian team, local authorities, and international partners [14]. Nevertheless, international communication during the Myanmar mission was relatively smoother compared with Türkiye, largely because of the active role of the WHO EMT-CC in facilitating permits, logistics, and security [13, 14, 16]. Despite these improvements, both missions lacked standardized documentation and SOPs, which complicated evaluation and preparation for WHO verification.

These findings suggested that communication barriers primarily occurred at the domestic level, where lengthy inter-ministerial decision-making, the absence of delegated emergency authority, and fragmented information channels became the main obstacles [18]. Myanmar's relatively better performance confirmed the importance of the EMT-CC as a facilitator of international communication [17], while also showing that cultural and linguistic factors slowed the transfer of technical instructions and reduced the effectiveness of logistics and health services [19]. Moreover, communication failures created cascading effects across other dimensions: delayed decision-making hindered timely logistics mobilization, exacerbated resource shortages, and exposed weaknesses in bureaucratic coordination. This demonstrated that communication was not an isolated factor but a systemic determinant of EMT effectiveness.

The literature further emphasized that effective crisis communication required transparent, fact-based, and empathetic messaging supported by international collaboration [20]. Highly centralized systems without feedback loops created uncertainty and slowed coordination, whereas hybrid models that combined standardization with open feedback channels reduced uncertainty and improved decision-making [20, 21]. Systematic reviews also stressed that language barriers, cultural perceptions, and the lack of cultural competency training significantly hindered international EMT operations [22, 23]. In dense urban contexts such as Jakarta, Surabaya, Naypyitaw, or Hassa, such barriers disrupted emergency mobility and hospital supply chains across interdependent infrastructures, underscoring the central role of communication in systemic urban health resilience. To address these issues, Indonesian TCK-EMTs required several strategic reforms: establishing delegated emergency authority to

reduce delays; forming a permanent liaison structure among key ministries with standardized protocols; developing uniform SOPs and mobilization documentation; and optimizing the HEOC dashboard as a real-time communication platform. Regular cross-agency exercises targeting a mobilization time of 72 hours were essential, alongside improved linguistic and cross-cultural competencies through training and interpreter support. By institutionalizing clear communication pathways and embedding them into the broader framework of urban crisis management, Indonesian TCK-EMTs could enhance operational readiness, reduce mobilization delays, and strengthen the resilience of urban health systems during disasters.

3.2. Resourches.

The resource dimension encompassed the availability of personnel, logistics, and funding to support the effectiveness of Indonesian TCK-EMTs in international missions. In the 2023 Türkiye mission, the team deployed 105 multidisciplinary personnel with Type 2 EMT capacity, including inpatient, surgical, and laboratory services, operating for three weeks. In contrast, the 2025 Myanmar mission deployed only 35 personnel with Type 1 Fixed EMT capacity, focusing on outpatient and minor surgical care, and operated for two weeks [13, 14]. These variations confirmed the flexibility of Indonesian TCK-EMTs in adjusting deployment scale, aligning with WHO EMT standards that emphasized adaptable multidisciplinary teams [7].

Despite this adaptability, logistical self-sufficiency had not yet been achieved. In Türkiye, electricity and water supplies during the first week depended on local facilities, while in Myanmar, essential medicines were sourced from local hospitals. Funding also remained centralized under the state and regional budgets (APBN) as stipulated in Law No. 17/2023 and Government Regulation No. 28/2024 [4, 5, 13, 14, 24]. These dependencies demonstrated that delays in resource activation were compounded by weak communication and bureaucratic bottlenecks, revealing how resource gaps interacted with other dimensions of EMT implementation.

Scholarly evidence reinforced these challenges. Rimadeni et al. [19] emphasized that fragile supply chain planning undermined medical team resilience, while Baş and Sur [18] showed that balancing centralized and decentralized financing was critical for rapid response. Kwon and Kim [25] argued that sustainable health financing was key to ensuring resource continuity during crises, yet Indonesian mechanisms remained limited. Marlina et al. [26] confirmed that disaster funding relied heavily on central budgets without adequate diversification, reducing flexibility for rapid mobilization. Lestari et al. [27] highlighted hospital gaps in emergency stocks and infrastructure, which constrained EMT independence during deployment. These findings suggested that resource limitations were not merely operational but systemic, reflecting broader urban health system vulnerabilities. In dense urban contexts, dependency on local utilities and hospitals exposed EMTs to cascading risks when infrastructures such as electricity, transport, and supply chains failed simultaneously.

Moreover, integration and collaboration with local stakeholders were critical. Manesh [28] emphasized that empowering communities and aligning EMT logistics with local systems could reduce dependency on external resources, ensuring that EMTs complemented rather than burdened urban health facilities. To strengthen the resource dimension, several reforms were required: developing comprehensive logistics systems to ensure two to three weeks of independence; diversifying disaster financing mechanisms beyond the APBN; improving

hospital readiness through stronger emergency stockpiles and interoperability with EMTs; expanding cross-disciplinary personnel capacity to flexibly scale between Type 1 and Type 2 EMT configurations; and integrating EMT logistics with local health systems through regular simulation exercises [18, 19, 25–28]. By embedding these reforms into urban crisis management frameworks, Indonesian TCK-EMTs could reduce systemic vulnerabilities and contribute to more resilient urban health systems.

3.3. Disposition.

The disposition dimension highlighted the attitudes, motivations, and commitments of Indonesian TCK-EMT personnel in carrying out transnational humanitarian missions. AARs from the 2023 Türkiye mission documented high morale and dedication, reflected in long working hours and disciplined rotation without compromising service quality. In the 2025 Myanmar mission, despite fewer personnel, motivation and commitment remained strong, enabling teams to adapt to limited infrastructure and logistical support while maintaining consistent service delivery [13, 14]. Discipline, adherence to security protocols, and professional ethics were also noted as key factors sustaining operations despite resource constraints.

The strong motivation of Indonesian TCK-EMT personnel illustrated that disposition served as a relative advantage in policy implementation. This finding aligned with Mediani et al. [29] and Chen et al. [30], who reported that healthcare worker motivation and job satisfaction were strongly influenced by support, coaching, recognition, and external environments. Within the Edwards III framework, disposition functioned as a variable that could offset weaknesses in structure and logistics. However, field evidence showed that sustained motivation depended on institutional mechanisms such as recognition, capacity building, and psychosocial support [12]. Moreover, disposition was closely linked to other dimensions: when communication delays or bureaucratic rigidity strained operations, strong team morale often mitigated disruptions, ensuring service continuity in crisis-affected urban settings.

Recent studies underscored the need to integrate psychosocial support into EMT systems. Research from Bangladesh revealed that workplace stressors significantly affected humanitarian workers' mental health, with coping mechanisms mediating burnout risks [31]. Similar findings emphasized that peer support, supervision, and psychosocial training could mitigate exhaustion and enhance performance in complex operations [32]. In densely populated urban disaster zones, where operational stress was heightened by infrastructure collapse and resource scarcity, maintaining high disposition was vital to ensure uninterrupted health services. At the same time, work rotation systems—though designed to distribute workload—had to be carefully regulated. Evidence showed that irregular shifts increased fatigue and burnout, reducing professional efficacy [33]. Hence, the fair rotation system adopted by TCK-EMTs should be refined to balance workload distribution, rest periods, and recovery to sustain long-term commitment.

To strengthen this dimension, several measures were recommended: continuous technical and psychosocial training, including mission simulations [32]; formal recognition through certification and career pathways to build professional pride [30]; structured psychosocial support during and after deployments [31, 32]; and regulated rotation mechanisms that ensured fairness and rest [33]. Institutionalizing disposition within

organizational systems for example, by including motivation, resilience, and commitment as performance indicators, would transform it from an individual attribute into a measurable, supported organizational outcome [12]. By embedding these measures within urban crisis management frameworks, TCK-EMTs could help maintain resilient health service delivery in disaster-prone urban areas.

3.4. Bureaucratic structure.

The bureaucratic structure dimension referred to the extent to which institutional governance and coordination flows supported the effective implementation of TCK-EMT in Indonesia. In the 2023 Türkiye mission, the after-action report highlighted that the absence of standardized cross-ministerial SOPs created fragmented coordination, with every mobilization decision requiring multiple levels of approval from the Ministry of Health, BNPB, and the Ministry of Foreign Affairs. This prolonged process caused deployment delays beyond the 72-hour WHO EMT standard [7, 13, 14]. A similar pattern was observed in the 2025 Myanmar mission, although coordination improved through the involvement of the WHO EMT-CC, which facilitated administrative and logistical processes. Nevertheless, at the domestic level, decision-making remained constrained by unclear delegation of authority, despite the formal mandate of the Ministry of Health's Health Crisis Center (Puskriskes) as the national coordinator [14].

These findings indicated persistent fragmentation and weak command clarity within Indonesia's bureaucratic system. The lack of binding SOPs reflected a misalignment between institutional mandates and the need for rapid response, echoing Rimadeni et al. [19], who reported that disjointed coordination disrupted supply chains and service delivery during crises. Baş and Sur [18] similarly emphasized that achieving an appropriate balance between centralization and decentralization was essential for effective emergency health governance. These structural weaknesses were not unique to Indonesia. In dense urban disaster contexts such as Jakarta, Surabaya, Hassa in Türkiye, and Nay Pyi Taw or Yangon in Myanmar, the absence of coherent governance structures amplified the vulnerabilities of health systems during emergencies. Evidence from Myanmar's experience with Cyclone Nargis showed that while social capital and cultural motivation provided temporary support, fragile bureaucratic systems rooted in political and historical legacies hindered long-term resilience [34]. Likewise, a household-level survey in Yangon identified inadequate first-aid knowledge, weak communication infrastructure, reliance on daily markets, and underutilized volunteer capacity as key barriers to preparedness [35]. These insights demonstrated that systemic governance weaknesses at both national and community levels exacerbated the fragility of urban health resilience.

Broader disaster governance research reinforced these lessons. Marulanda Fraumea et al. [36] found that institutional fragility amplified disaster risks beyond the hazard itself, while Comfort et al. [37] argued that fragmented structures undermined collective decision-making in emergencies. Comparative case studies highlighted potential pathways forward. In Japan, Disaster Medical Assistance Teams (DMATs) were institutionalized through strong legal frameworks and standardized inter-agency agreements, enabling rapid mobilization under a clear chain of command [38]. Conversely, the Philippines' response to Typhoon Haiyan demonstrated how excessive centralization and weak intergovernmental collaboration led to failures despite existing plans, underscoring Santiago et al. [39], who recommended stronger NGO participation and local government leadership.

Taken together, the experiences of Indonesia, Türkiye, and Myanmar demonstrated that bureaucratic structure was not a neutral backdrop but a decisive determinant of EMT effectiveness. External facilitation, such as the WHO EMT-CC in Myanmar, enhanced international coordination but could not overcome domestic barriers rooted in fragmented governance. In line with Edwards III, weaknesses in bureaucratic structure undermined implementation even when personnel and motivation were strong. Addressing these gaps required legally binding cross-ministerial SOPs, clearer delegation of emergency authority, stronger mandates for Puskriskes, integration of liaison structures within the HEOC, and routine learning mechanisms such as After-Action Reviews. Ultimately, harmonizing Indonesia's bureaucratic system with WHO EMT standards was essential to ensure timely mobilization, operational coherence, and sustained contributions to urban health resilience.

4. Conclusions

This study examined the implementation of the Indonesian TCK-EMT using the Edwards III framework, which encompassed four dimensions: communication, resources, disposition, and bureaucratic structure. A narrative review of national regulations, WHO EMT standards, and after-action reports from Türkiye and Myanmar revealed that although TCK-EMT personnel demonstrated strong motivation and adaptive capacity, significant challenges persisted in communication delays, logistical self-sufficiency, and fragmented governance. From the perspective of urban resilience engineering, these gaps illustrated how governance fragilities and systemic bottlenecks undermined the capacity of health services to withstand urban disasters. At the same time, applying a systems approach to urban health resilience emphasized the need for integrated solutions that connected standardized SOPs, flexible financing, resource planning, and psychosocial support. Strengthening TCK-EMT was therefore not only a pathway toward WHO verification but also a strategic measure for building resilient and sustainable urban health systems capable of responding effectively to complex crises.

Acknowledgments

The authors would like to express their sincere gratitude to the Master's Program in Disaster Management, Department of Environmental Engineering, Faculty of Mineral Technology and Energy, Universitas Pembangunan Nasional "Veteran" Yogyakarta, and to the Health Crisis Center, Ministry of Health of the Republic of Indonesia, for their institutional support during this research. We also extend our heartfelt thanks to our academic supervisors and colleagues for their valuable insights and encouragement throughout the study.

Author Contribution

All authors (Muhammad Hakiim Marzun, Johan Danu Prasetya, Eko Teguh Paripurno, Jaka Purwanta, and Arif Rianto Budi Nugroho) jointly contributed to the conceptualization, methodology, data collection, data analysis, writing – original draft, and review & editing of this manuscript. Supervision and academic guidance were collectively provided within the team..

Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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