ASEAN Journal of Disaster Health Management https://doi.org/10.22146/ajdhm.v2i1.26478
Vol. 2 (1) 2026: 1-21

EVALUATION OF THE SINGAPORE EMERGENCY MEDICAL TEAM (SGEMT) HYBRID TRAINING COURSE AND ITS FIELD IMPACT DURING THE MANDALAY EARTHQUAKE RELIEF MISSION USING THE KIRKPATRICK FRAMEWORK

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Submitted: 26-11-2025 **Revised**: 03-01-2026 **Accepted**: 09-01-2026

List of Abbreviations

AHA	: ASEAN Coordinating Centre for Humanitarian Assistance
AHP	: Allied Health Professionals
ARCH	: ASEAN Regional Capacity on Disaster Health Management
ASEAN	: Association of Southeast Asian Nations
BAU	: Business As Usual
BoO	: Base of Operations
DM	: Disaster Medicine
DMAT	: Disaster Medical Assistance Team
DOPS	: Direct Observation of Procedural Skills
EMT	: Emergency Medical Team
Eq	: Equipment
F2F	: Face-to-Face
GDX	: Ground Deployment Exercise
IOM	: International Organization for Migration
Iso	: Isolation

JATEC : Japan Advanced Trauma Evaluation and Care
KSA : Knowledge, Skills and Attitude
MCI : Mass Casualty Incident
MDS : Minimum Data Set
MGH : Mandalay General Hospital
MIMMS : Major Incident Medical Management and Support
Mini-CEX : Mini-Clinical Evaluation Exercise
MOH : Ministry of Health
OSCE : Objective Structured Clinical Examination
SGEMT : Singapore Emergency Medical Team
TEAM : Team Emergency Assessment Measure
TEAMS : Training for Emergency Medical Teams and European Medical Corps
TTX : Table Top Exercise
WHO : World Health Organization

ABSTRACT

Introduction: Effective pre-deployment training enables disaster relief medical teams to operate safely and efficiently in resource-limited environments. **Objective:** This study evaluates the effectiveness of the Singapore Emergency Medical Team (SGEMT) Hybrid Training Course in preparing personnel for WHO Type 1 (Fixed) EMT accreditation and subsequent deployment to Mandalay following a major earthquake. **Methods:** Training outcomes were assessed using the Kirkpatrick four-level evaluation model, which included post-training surveys, training completion records, thematic analysis of free-text responses, WHO EMT classification exercise, deployment operational metrics and post-deployment evaluation. **Results:** Participants reported high satisfaction and perceived role relevance (Kirkpatrick-Level-1) Thematic analysis revealed enhanced confidence and operational preparedness (Kirkpatrick-Level-2). After attaining WHO EMT accreditation, SGEMT underwent its first deployment, treating 1,803 patients over eight days, including 33 high-acuity cases with no adverse events (Kirkpatrick-Levels-3-and-4). Key program enablers were realistic scenarios conducted in a collaborative learning environment that reinforced technical and non-technical skills such as team collaboration, open communication, and psychological resilience. **Conclusion:** The SGEMT Hybrid Training Course helped foster individual and team competencies, which supported effective real-world disaster response. This study provides

evidence supporting a multi-component, team-based training model grounded in adult learning principles and offers a practical framework for evaluating EMT training programs.

Keywords: Singapore Emergency Medical Team; SGEMT Training Course; Mandalay Earthquake Deployment; Training Course Evaluation; Kirkpatrick Model of Evaluation

INTRODUCTION

Multinational disaster response has come a long way since 2010, following World Health Organization's (WHO) first meeting to address significant operational gaps in the aftermath of the Haiti earthquake (1). These include challenges in coordinating efforts between local government and Emergency Medical Teams (EMT) and the lack of standardisation between EMTs from different countries (1). A blueprint of an EMT was first published by the WHO in 2013 and later refined in 2021 categorises EMTs into three types - Type 1 (Mobile or Fixed), Type 2 and 3 - each providing certain services with an expected number of patients to see per day. Malaysia, Thailand, the Philippines and Singapore are examples of countries that have attained Type 1 (Fixed) WHO certification within Southeast Asia.

Within Singapore, two previously published papers have detailed the establishment of the Singapore Emergency Medical Team (SGEMT) and the development of its hybrid training course (2, 3). Two SGEMT teams, each consisting of 33 personnel, commenced concurrent training and completed the program in August 2024. Following this, the SGEMT underwent a WHO classification exercise and was successfully accredited as a WHO Type 1 (Fixed) EMT on 11 September 2024 (4). On 28 March 2025, Myanmar declared a state of emergency after a devastating magnitude 7.7 earthquake struck its second-largest city, Mandalay (5). In response to Myanmar's request for international assistance, the newly minted SGEMT embarked on its maiden deployment on 03 April 2025 (6). Ensuring personnel are adequately prepared for disaster relief missions is essential for a safe and effective response. There is broad international agreement that disaster medicine (DM) education is essential at both undergraduate and postgraduate levels (7). However, research has shown that the current state of DM training varies globally in terms of content, teaching methods, and scopes (8). Additionally, there appears to be a lack of literature on the evaluation process of DM training programs and their real-world impact (9).

In this follow-up study, we evaluate the effectiveness of the SGEMT training course in supporting the team's successful attainment of WHO Type 1 (Fixed) accreditation and its subsequent real-world operational deployment to Mandalay, using the Kirkpatrick evaluation framework (4, 10). Existing systematic reviews demonstrated that evaluations of training programs are limited and mostly focus on lower levels of the Kirkpatrick model. Most studies assess Level 1 (Reaction), such as participant satisfaction, and Level 2 (Learning), which are usually measured through pre- and post-course questionnaires or quizzes (9, 11). However, these measures do not necessarily reflect workforce readiness or operational performance. Evaluation of Level 3 (Behaviour), which assesses the application of knowledge and skills in simulated exercises or real missions, and Level 4 (Results), which considers the real-world impact of mission outcomes, are both scarce in the reviewed literature. This study addresses these gaps by presenting an evaluation framework that maps data sources and mixed-method analytical approaches to the Kirkpatrick model.

METHODS

Study Setting

Two SGEMT teams, each consisting of 33 personnel, commenced concurrent training in June 2024 and completed the program in August 2024. Each team had an identical composition, consisting of 18 clinical, 10 logistics, and five administrative personnel. All sixty-six participants underwent a three-component hybrid training course, comprising 1) E-Learning Modules in June 2024, 2) a Face-to-Face (F2F) Workshop & Tabletop Exercise (TTX) in July 2024 and 3) a Ground Deployment Exercise (GDX) in August 2024. Through Components 2 and 3, participants were able to apply the knowledge acquired from the e-learning module and demonstrate both the requisite clinical and nonclinical competencies. Eventually, all but one participant completed the full three-part training program. Following this, the SGEMT underwent a WHO EMT classification exercise and was successfully accredited as a WHO Type 1 (Fixed) EMT on 11 September 2024 (4).

On 28 March 2025, Myanmar declared a state of emergency after a devastating magnitude 7.7 earthquake struck its second-largest city, Mandalay. Singapore's Ministry of Health (MOH) received a request for assistance via the Association of Southeast Asian Nations (ASEAN) Coordinating Centre for Humanitarian Assistance (AHA) Centre on 1 April 2025. In response to Myanmar's request for international assistance, the newly minted Singapore Emergency Medical Team (SGEMT) embarked on its maiden deployment on 3 April 2025 (6). The clinical

arm consisted of five doctors, ten nurses, one physiotherapist, one psychologist, and one clinical operations executive. The deployed team was further supported by an operations unit based in Singapore, which provided continuous oversight and coordination throughout the mission. This included monitoring situational developments relevant to mission safety and success, as well as maintaining regular communication with the families of deployed personnel.

Over a 14-day deployment, which included eight days of clinical operations, SGEMT established and operated its base of operations (BoO) comprising twelve field tents at Bahtoo Stadium, with ambulance support from the Myanmar Red Cross. Located in downtown Mandalay, the stadium was a ten-minute drive from the Mandalay General Hospital (MGH) and was located 16 km away from the epicentre of the earthquake. One of the key considerations for the site was the opportunity for SGEMT to provide interim support to MGH, giving it time to focus on restoring its diminished operational capacity.

Study Design

This retrospective study employed a mixed-methods approach, combining both quantitative analysis and thematic analysis, structured around the Kirkpatrick four-level evaluation model (10), a widely used framework for evaluating training programs. Level 1 assesses participants' reactions to the training program (e.g. satisfaction level). Level 2 measures learning, i.e. attitude changed, knowledge and skills gained. Level 3 examines behavioural change, i.e. application of learning in practice. Level 4 evaluates tangible results, i.e. measuring the impact of the training on real-world performance.

Kirkpatrick Level 1 (Reaction) was assessed immediately after each training component through voluntary post-training surveys, which captured participants' individual reactions. Kirkpatrick Level 2 (Learning) was evaluated through the domains of knowledge, skills and attitude (KSA) through two staged assessments intentionally built into the program design: an initial tabletop exercise (TTX) and a ground deployment exercise (GDX) conducted one month later. Learning was further examined through thematic analysis of participants' post-training self-reflections to capture perceived learning, attitude change and operational readiness. Kirkpatrick Level 3 (Behaviour) was assessed through the WHO EMT classification exercise and, more importantly, during the real-world deployment to Mandalay seven months later. Kirkpatrick Level 4 (Results) was evaluated using clinical and operational records, as well as post-deployment after-action review to capture the measurable impact of the deployment.

Data Collection

Multiple data sources were reviewed, including post-training surveys, training completion records, official WHO documentation verifying the SGEMT's Type 1 (Fixed) accreditation, clinical and operational reports from the deployment, a post-deployment evaluation and a post-deployment after-action-review report. The post-training survey and post-deployment evaluation were designed in a hybrid format, comprising both a 5-point Likert scale and open-ended questions. Data from both were collected anonymously immediately after each activity using online questionnaires using Form.sg. This open-source government platform enables the creation of secure digital forms for data collection. Clinical and operational review reports were compiled both during and after the deployment in Mandalay.

Data Analysis

Qualitative data was analysed using Thematic Analysis, first described by Braun and Clark (12). The first step of the analysis involved familiarisation with the data, followed by the selection of keywords that succinctly captured participants' perspectives. These keywords provided the basis for generating codes, which highlighted the key elements of the data. Patterns and relationships among the codes were then examined to develop overarching themes. Quantitative data were analysed using Microsoft Excel to generate descriptive statistics.

Table 1 presents a summary of the study's overall methodology, detailing data sources and analytical approaches mapped to the Kirkpatrick evaluation framework.

Table 1: Overview of Data Sources and Analysis Through the Kirkpatrick Evaluation Framework

Kirkpatrick Level	Data Sources	Data Analysis
1 - Participant Reactions	Post-training surveys	Qualitative data analysed using Thematic Analysis to generate themes
2 - Learning Occurrence	Training completion records	
3 - Behaviour Change	Official WHO documentation verifying the Type 1 (Fixed) EMT accreditation for Singapore (4)	
	Post-deployment evaluation	Quantitative data analysed using Microsoft Excel to generate descriptive statistics
4 - Real World Performance	Clinical and operational data reports from the Mandalay deployment	
	Post-deployment after-action-review report	

Source: Rejap et al., 2026

RESULTS

The findings are organised according to the four levels of the Kirkpatrick four-level evaluation framework. Kirkpatrick Levels 1 to 3 describe the evaluation results of the SGEMT Training Course in the preparation for the WHO EMT Type 1 accreditation and the subsequent real-world deployment to Mandalay. Lastly, Kirkpatrick Level 4 (Results) highlights the operational performance and measurable impact observed during the deployment.

Kirkpatrick Level 1: Participant Reactions

A total of 47 of 66 participants' responses were anonymously collected after the F2F Workshop. Responses were recorded on a 5-point Likert scale, where 1 = Strongly Disagree and 5 = Strongly Agree. Overall, participants agreed that the F2F workshop, including its individual activities, was well-organised and offered content that was both useful and relevant to the participants' roles within SGEMT. Table 2 presents the summary of the quantitative responses collated for the F2F workshop.

Table 2. Post-Training Survey for F2F Workshop
5-Point Likert Scale, Median (Q1, Q3)

Course Domains	Overall					
Organisation	4 (4,5)					
Course Duration	4 (4,5)					
Content Usefulness	4 (4,5)					
Presentation Clarity	4 (4,5)					
Activity Domains	Act 1	Act 2.1	Act 2.2	Act 2.3	Act 2.4	Act 3
Trainer well-prepared	5 (4,5)	5 (4,5)	4 (4,5)	4 (4,5)	4 (4,5)	5 (4,5)
Trainer encouraged questions	5 (4,5)	5 (4,5)	4 (4,5)	4 (4,5)	4 (4,5)	4 (4,5)
Content Usefulness	5 (4,5)	4 (4,5)	4 (4,5)	4 (4,5)	4 (4,5)	5 (4,5)
Role Relevance	5 (4,5)	4 (4,5)	4.5 (4,5)	5 (4,5)	4 (4,5)	4.5 (4,5)

Note: Legend: Activity 1 – Introduction to SGEMT; Activity 2.1 – Mass Casualty Incident Triage; Activity 2.2 – Health Information Management; Activity 2.3 – Field Survival Skills; Activity 2.4 – Radio Communications; Activity 3 – Tabletop Exercise

Source: Rejap et al., 2026

A post-deployment survey was sent to the clinical staff of SGEMT within one week of their return from the Mandalay deployment. A total of 19 clinical staff were deployed to Mandalay, comprising 6 doctors (two without pre-deployment training), 10 nurses (one with

only e-learning training), and 3 AHP/Clinical Ops (one with only e-learning training). Out of the 19 members, all but two completed the post-deployment survey. The two non-respondents had completed full training. Of note, only three of the 17 respondents had prior experience on humanitarian missions.

In the post-deployment survey, participants were asked to provide their retrospective views on the SGEMT Training Course to assess whether their perceptions of the usefulness and relevance of the training program had changed after experiencing an actual deployment. However, direct comparison with the post-training survey was not possible due to differences in the survey instruments used. For the e-learning component, the SGEMT modules were consistently rated as useful with an overall median 4 (Q1-Q3: 4-4), while the ARCH Project modules were rated with a median of 4 (3-4). In the F2F workshop, all the activities were rated with an overall median score of 4 (4-5). Activities in GDX were rated most favourably with median score of 5 (4-5). A detailed breakdown of the quantitative results from the post-deployment survey is presented in Table 3.

Table 3. Post-Deployment Survey: Usefulness of Training Components

Usefulness of Training Components	Median (Q1, Q3)
E-Learning: 15 ARCH Modules	4 (3,4)
E-Learning S1: Introduction to SGEMT	4 (4, 4.25)
E-Learning S2: Tips & Pearls for a Safe Overseas Deployment	4 (4,4)
E-Learning S3: Caring in Crisis (Psychological first aid, triage and self-care)	4 (4,4)
E-Learning S4A: Important Clinical Operations of SGEMT	4 (4,4.25)
E-Learning S4B: Important Operations of SGEMT	4 (4,4.25)
F2F Workshop: Basic Disaster Health Management Theory	4 (4,4)
F2F Workshop: Health Information Management (MDS form practice)	4 (4,5)
F2F Workshop: MCI Triage Game	4 (4,4)
F2F Workshop: Field Survival Skills - First Aid Skills	4 (4,4.5)
F2F Workshop: Field Survival Skills - Grab Bag, EQ drill	4 (4,5)
F2F Workshop: Field Survival Skills - Radio Communications	4 (4,4.5)
F2F Workshop: Table-Top Exercise - Normal BAU (Iso & Non-Iso) Cases	5 (4,5)
F2F Workshop: Table-Top Exercise - MCI Cases	4 (4,5)
GDX: Setting Up BoO	5 (4,5)
GDX: Tearing Down BoO	5 (4,5)
GDX: (Iso & Non-Iso) Cases	5 (4,5)
GDX: MCI Cases	4 (4,5)

Source: Rejap et al., 2026

Kirkpatrick Level 2 Evaluation: KSA Learning Occurrence

Thematic analysis of the post-training surveys free-text responses revealed "Confidence and Preparedness for Real Life Deployment" as the primary theme, reflecting the Kirkpatrick Level 2 outcome. Participants reported acquiring the intended knowledge, skills, attitudes, and confidence required for overseas deployment. Two secondary but essential sub-themes, "Authentic and Well-Structured Training Experience" and "Supportive and Collaborative Learning Environment" emerged as key enablers of this outcome.

1. Main Theme - Confidence and Preparedness for Real-World Deployment

Participants perceived the training course as instrumental in building confidence, adaptability, and readiness for real-life field deployments. The GDX, in particular, provided a realistic, simulated environment to apply knowledge and skills, reinforcing teamwork and resilience. One participant shared, "It provided an interactive platform to reinforce theoretical knowledge, practice practical skills and engage in meaningful discussions relevant to the field deployment."

Another participant reflected, "The GDX that we had played an important role for us to adapt to (the) actual scenario makes the team more adaptable and enhances coping." These reflections illustrate how the training not only enhanced technical skills but also cultivated the mindset and attitudes essential for effective performance in unpredictable, high-stakes disaster relief missions.

2. Sub-Theme 1- Authentic and Well-Structured Training Experience

Participants consistently emphasised the realism of the training scenarios as a key factor that enhanced engagement and role relevance. The ability to visualise and anticipate field conditions was instrumental in fostering preparedness for actual deployment. As one participant noted, "The realism and structure of the exercise are highly commendable and should remain a central feature of future training programs."

Participants also valued clear and precise instructions from experienced trainers. One participant noted, "Clear instructions were given from the start." Another also shared, "The logistics gave clear instructions for us to follow (during the set-up of the BoO)". These observations highlighted how structured facilitation and effective communication contributed to the overall quality and flow of the learning experience.

3. Sub-Theme 2 - Supportive and Collaborative Learning Environment

Participants appreciated the F2F workshop as a platform for interpersonal connection, collaborative learning, and problem-solving. One participant described it as "a time of bonding for the team to get to know each other," while another suggested incorporating ice-breakers for new members. Several participants valued the workshop for knowledge exchange and its reinforcement of the e-learning component, achieving the objective of the three-part curriculum.

The GDX was also regarded as a safe and supportive platform for active learning, bridging theory with practice. Numerous participants provided positive feedback about the hands-on practice, sharing that it helped to consolidate their learning, and enhanced their ability to translate that knowledge into real-life. One participant noted, "It effectively translated theoretical knowledge into field-ready skills and ensured that participants were well-prepared to respond to the demands of humanitarian deployment." Another shared, "Overall, the workshop played a crucial role in bridging knowledge with practice and enhancing confidence ahead of deployment."

Team cohesion, peer support and open communication were also highlighted as vital. Several participants emphasised on the importance of open communication, constructive feedback, and the opportunity for interdisciplinary exchange. One member commented, "It is important for the team to discuss what works and what doesn't so we can improve." Another shared, "Communication is key to further improve the workflow." These reflections illustrate that beyond technical learning, the training course design has enabled a collaborative and growth-oriented learning environment that reinforced operational confidence.

In the post-deployment survey, participants were asked to provide retrospective views on whether their perceptions of individual preparedness and confidence after an actual deployment. As previously noted, direct comparison with the post-training survey was not possible due to differences in survey instruments used. Most respondents agreed that the course had prepared them adequately and accurately for deployment and that they could apply their learning to perform their clinical roles confidently in the field, with all domains rated at a median of 4 (Q1–Q3: 4–5). These findings suggest perceived gains in knowledge, skills and confidence. This is consistent with Kirkpatrick Level 2 and align with themes identified in the post-training qualitative analysis. Perceived physical, psychological and overall preparedness for deployment were similarly rated highly (all

medians 4) (4-5). Most respondents also agreed that completion of all components of the SGEMT Training Course should be a mandatory prerequisite for staff to be selected for deployment with SGEMT (median 4) (4-5), reflecting a positive attitude shift towards training completeness. A detailed breakdown of the quantitative post-deployment findings is presented in Table 4.

Table 4. Post-Deployment Survey: Individual Preparedness and Confidence

Individual Preparedness and Confidence	Median (Q1, Q3)
Overall Preparedness for Deployment	4 (4,5)
Accuracy of Training Content	4 (4,5)
Physical Preparedness	4 (4,5)
Psychological Preparedness	4 (4,5)
Confidence in Field Performance	4 (4,5)
Perceived Need for Mandatory Completion of Full Training	4 (4,5)

Source: Rejap et al., 2026

Kirkpatrick Level 3 Evaluation: Behaviour Change

One month after the completion of training, the trained participants underwent a WHO EMT classification exercise. The team was successfully accredited as a WHO Type 1 (Fixed) EMT on 11 September 2024, demonstrating effective transfer of learning to independent operational performance. This represents a Kirkpatrick Level 3 outcome, i.e. measurable behaviour change (4).

The newly accredited SGEMT embarked on its maiden deployment on 3 April 2025, where their training and competencies were put to the real-world test under challenging disaster conditions (6). A thematic analysis of the free-text responses from the post-deployment evaluation showed that members' reflections centred primarily on how the training shaped their operational readiness and confidence during the real-world mission. This overarching theme was supported by three reinforcing sub-themes: 1) strengthened team cohesion and coordination, 2) adaptability and professionalism under pressure, and 3) the presence of strong leadership and psychologically resilient team members. Taken together, these sub-themes illustrate how the training translated into effective field performance and collective mission success.

1. Main Theme - Operational Readiness and Confidence

Members conveyed a strong sense of operational readiness and confidence derived from their pre-deployment training. The close alignment between the simulated training environment and the real field conditions enabled them to anticipate challenges and respond effectively. During the team's maiden deployment to Mandalay following WHO accreditation, the team treated a total of 1803 patients, averaging about 200 to 250 patients per day, surpassing the benchmark set by the WHO for a Type 1 Fixed EMT (13). Despite being a newly established team, this performance was viewed as clear evidence of the team's effectiveness. Members reflections highlighted teamwork, preparedness, and adaptability, all of which were nurtured during the training, proved to be critical to their actual field performance.

2. Sub-Theme 1 - Strengthened Team Cohesion and Coordination

Members consistently emphasised that strong bonds and teamwork developed during pre-deployment training were central to mission success. The shared training experience fostered mutual trust and understanding, allowing for smooth collaboration and efficient task execution in the field. Effective communication, mutual respect, and a strong sense of unity enabled the team to operate seamlessly in the high-pressure challenging conditions. Clear role designation, standardised naming conventions, and early coordination reduced confusion and facilitated smoother inter-professional coordination. These observations illustrate how relationship-building and coordinated team behaviours cultivated during the training course were effectively translated into practice during deployment, demonstrating a clear Kirkpatrick Level 3 behaviour change outcome.

3. Sub-Theme 2 - Adaptability and Professionalism Under Pressure

The second sub-theme highlights the team's ability to adapt effectively to unpredictable and demanding field conditions while maintaining professional standards. Members reflected positively on how the training's emphasis on standardized practices, being a cohesive unit, and flexibility enhanced their ability to provide aid safely and efficiently in resource-limited environments. The limited consumables, incompatible equipment, and harsh working environments were described as both physically and operationally challenging. Team members had to adapt quickly, re-purposing materials,

adjusting expectations and sustaining patient care through proactive problem-solving and improvisation. One member reflected, "Clear protocols, teamwork, and adaptability ensured that care was delivered safely and effectively under challenging conditions". Others emphasised the structured yet flexible approach allowed for reliable clinical performance whilst also maintaining effective operational flow during actual deployment. Another member noted, "Overall, the mission was conducted professionally and effectively with core operational and welfare requirements met". These reflections suggested that the training course had strengthened the team's operational readiness and resilience, both of which were essential in a demanding humanitarian environment.

4. Sub-Theme 3 - Strong Leadership and Psychologically Resilient Members

Strong leadership and psychological resilience were identified as essential for maintaining performance during demanding phases of the mission. Team leaders modelled calm decision-making, initiative, and process improvement, while individuals emphasised emotional self-awareness, stress regulation, and pacing to prevent burnout. Members also highlighted the importance of psychological and physical wellness, as well as cultural and political awareness, for navigating complex interpersonal and contextual dynamics. This theme underscores that disaster response effectiveness is closely linked to the knowledge, skills, emotional resilience, and decision-making capacity of SGEMT members. The SGEMT Training Course deliberately addressed this through activities designed to equip participants with self-sufficiency skills, such as psychological first aid, triage and self-care, earthquake drills, and field survival techniques, to ensure a safe and effective overseas deployment.

Kirkpatrick Level 4 Evaluation: Real World Performance

In the Mandalay deployment, SGEMT saw and attended to walk-ins as well as overflow cases referred from MGH. The typical journey of a patient who attended the SGEMT field clinic includes registration and triage, consultation, treatment and discharge. Patients who were assessed with higher acuity care needs were stabilized on-site before being transferred to MGH for further treatment.

A key component of EMT performance lies in the rapid set-up where WHO EMT minimum standards require operationalisation of the field facility within 24 hours of site

allocation (13). SGEMT commenced set up at 4pm on 5 April 2025 and completed at 5pm on 6 April 2025, but operationalised clinical services at 8am on 7 April 2025. This delay did not reflect gaps in the training course itself per se, but rather challenges inherent to logistics, coordination with local authorities, and ground contingencies. Such external constraints may limit future improvements to this metric, although refinements in deployment coordination processes could enhance responsiveness.

During the eight days of clinical operations, SGEMT provided medical care to a total 1,803 patients in Mandalay City. Of the total caseload, 21.6% of the patients had injuries directly resulting from the earthquake (e.g. unattended fractures, infected wounds, sprains and contusions) and 7.9% had indirectly related conditions (e.g. conditions resulting from a loss of access to clinics or medications and psychological trauma). The clinical psychologist saw a total of 46 patients with acute stress reactions, while the physiotherapist attended to 221 patients. SGEMT also dispensed 72 sets of walking assistive aids. A breakdown of patient count by event relevance is shown in Table 5.

Table 5: Patient Count by Event Relevance

Condition in Relation to Earthquake	No. of Patients								
	7-Apr	8-Apr	9-Apr	10-Apr	11-Apr	12-Apr	13-Apr	14-Apr	Cumulative Total
Directly related	21	56	68	74	62	64	37	7	389
Indirectly related	21	21	26	12	12	20	20	11	143
Not related	106	143	165	166	198	225	224	44	1281
Total	148	220	259	252	272	309	281	62	1803

Source: Rejap et al., 2026

On average, SGEMT saw about 200 to 250 patients daily, well above the WHO EMT minimum standards of 100 out patients throughput a day (13). SGEMT's ability to sustain this high throughput was attributed to its patient flow management, the layout of its BoO, planning assumptions to train and cater for a 50% additional load, and supplies, as well as the effective collaboration with local actors - particularly translators with a medical background. In terms of quality of care and inter-agency coordination, SGEMT managed 33 resuscitation-type Priority 1 cases with no fatalities. There were also no recorded adverse clinical events among the total caseload of 1,803. The team also demonstrated effective coordination with partner hospitals, ensuring timely transfers for patients requiring higher-level care acuity.

The SGEMT training course was noted to have significantly contributed to the overall operational effectiveness by strengthening inter-professional teamwork, cross-covering behaviours and workflow discipline. It effectively prepared personnel for deployment challenges, validating the appropriateness of its content and delivery methods, and enabled the team to adapt well to resource limitations while maintaining efficient operations despite infrastructure constraints. Additional cross-training, such as physiotherapy-led walking-aid dispensing, had since been implemented to further enhance overall system efficiency.

Safety, risk mitigation and preventative health measures were also sustained throughout the deployment, contributing to excellent team health with only one reported illness. No SGEMT personnel sustained injuries, and the single case of mild gastroenteritis resolved after a day of rest, after which the individual returned to duty the following day. There was full adherence to safety and infection-prevention protocols. Compliance with the complete documentation of the WHO EMT Minimum Data Set (MDS) allowed for end-of-day tallies and support surveillance of potential infectious disease concerns. From the psychosocial standpoint, no psychological adverse events were reported in the anonymous post-deployment surveys and individual three-month follow-up assessments conducted by the team psychologist.

From an organisational perspective, the substantial patient load managed, coupled with safe operations and effective interprofessional coordination, reflects SGEMT's operational capacity to provide reliable medical care in challenging environments. SGEMT's commitment to operational excellence, compassionate care and adherence to WHO EMT minimum standards not only saved lives but also contributed positively to Singapore's standing at the international disaster health management and diplomatic fronts, aligning with a Kirkpatrick Level 4 organisational outcome.

DISCUSSION

This study suggests that SGEMT Hybrid Training Course was associated with preparedness for real-world deployment, as evaluated using the Kirkpatrick four-level model. Participants reported high engagement, confidence, and preparedness following the training. The team subsequently achieved WHO Type 1 (Fixed) EMT accreditation and performed effectively during the Mandalay deployment, outcomes that reflect the program's operational relevance. Building on these observations, the following discussion situates the SGEMT training course within the broader EMT education landscape, compares it with other established

training and evaluation frameworks, and identifies lessons to inform the development of future EMT training programs.

Comparison with Other EMT Training Models

The SGEMT Hybrid Training Course is characterised by its three-component structure: e-learning, face-to-face workshop, and ground deployment exercise. The design integrates realistic, team-based scenarios with progressive technical skill application, including the establishment of the BoO, aligning closely with WHO EMT standards. Through the integration of adult learning principles into the curriculum design, the SGEMT training model effectively develops individual clinical competencies while building collective operational readiness (3).

Internationally, EMT training programs adopt different approaches that reflect their operational priorities and context. The Japanese Disaster Medical Assistance Team (DMAT) program is a 4-day intensive course grounded in international frameworks such as MIMMS (Major Incident Medical Management and Support) and JATEC (Japan Advanced Trauma Evaluation and Care) (14, 15). Its curriculum prioritises rapid deployment, mass-casualty triage, hospital coordination, and situational adaptability. Training is delivered through a compressed sequence of lectures, tabletop exercises, and scenario-based simulations, enabling progressive skill development within a short timeframe.

Similarly, the Training for Emergency Medical Teams and European Medical Corps (TEAMS) Training Package, aims to strengthen team-based competencies in emergency medical teams (16). The program comprises eight stand-alone simulation-based exercises, blending both tabletop and functional components, that cover the full deployment cycle, from pre-deployment, arrival, and setup, to operational activities and exit. Pilot implementation in Germany (Irsee, September 2018) and Turkey (Istanbul, October 2018) successfully implemented all eight exercises under the guidance of WHO-certified EMTs, demonstrating the feasibility of structured scenario-based training.

Team-Based Evaluation Tools

SGEMT is possibly one of the first to systematically apply the Kirkpatrick evaluation model to evaluate its training program. The Kirkpatrick model offers a multi-level evaluation framework to assess participant reactions, learning, behaviour, and real-world results. This structured approach is particularly suited for EMT training, where both individual competence and collective team performance are critical to operational success.

In contrast, traditional clinical competence assessment frameworks, such as the Miller's Pyramid (17), which relies on various workplace-based assessment tools like the Direct Observation of Procedural Skills (DOPS), Mini-Clinical Evaluation Exercise (mini-CEX) and Objective Structured Clinical Examinations (OSCEs), is designed mainly to evaluate an individual's progression in knowledge, skills and performance development. While valuable for evaluating clinical competence, such tools do not adequately address team dynamics, operational decision-making, or adaptability under complex disaster conditions, highlighting a gap in conventional evaluation methods for EMTs.

Alternative team-based evaluation approaches exist, but are generally more limited in scope. The Team Emergency Assessment Measure (TEAM) was originally developed for resuscitation and emergency teams to assess leadership, teamwork, and task management (18). The TEAM instrument comprises 11 items rated on a five-point scale, covering leadership, teamwork including situational awareness, and task management, with an additional global performance rating. While reliable and valid in both simulated and real-world settings, TEAM primarily provides an assessment aligned with Kirkpatrick Levels 2 and 3 outcomes, lacking measurement of organisational-level impact (Kirkpatrick Level 4).

The TEAMS training programs piloted in Germany and Turkey evaluated the training outcomes using three complementary constructs: self-efficacy, teamwork skills and quality of training (16). These correspond to Kirkpatrick Levels 1 to 3. Quality of training, assessed through an in-house designed questionnaire, reflects participants' perceptions of the training's relevance and effectiveness, aligning with Kirkpatrick Level 1 (Reaction). Self-efficacy, measured using a validated scale by Chen, Gully, and Eden, represents participants' confidence in their ability to apply skills under real situational demands, corresponding to Kirkpatrick Level 2 (Learning). Teamwork skills, assessed using the validated TEAM instrument, measure observable behavioural competencies such as leadership, communication, situational awareness, and task management, constituting Kirkpatrick Level 3 (Behaviour) (18). Notably, these tools do not evaluate Kirkpatrick Level 4 (Results), such as deployment performance or system-level impact, which limit their ability to assess the real-world effectiveness of EMT operations.

Recommendations for Future EMT Training Programs

Findings from this study underscore the importance of integrating both technical and non-technical skills into EMT training. In addition to clinical preparedness, non-technical skills, including communication, situational awareness, human resources management, coordination, decision-making, and problem-solving, have been consistently identified as critical for effective disaster response (19–21). Hence, for future EMT training programs, we recommend:

1. Multi-component Training: Combine e-learning, hands-on workshops, and field exercises to reinforce knowledge, skill acquisition, and behaviour change. Apply adult learning principles to guide curriculum design and ensure relevance to operational contexts (3).
2. Team-Based, Realistic Scenarios: Simulate operational environments with progressive complexity to enhance adaptability, collaboration, and decision-making under pressure.
3. Structured Evaluation Framework: Employ multi-level evaluation models, such as the Kirkpatrick four-level model, to capture outcomes at the reaction, learning, behaviour, and results levels (10). Complement with validated tools like TEAM for focused assessment of teamwork and leadership more specifically (18).
4. Focus on Non-Technical Competencies: Explicitly teach and assess open communication, situational awareness, team collaboration, problem-solving and psychological resilience in high-pressure scenarios.
5. Continuous Feedback and Iteration: Incorporate after-action reviews to reinforce learning and align training with real-world challenges.

By incorporating these principles, EMTs can work towards developing training programs that are practical, adaptable, and contextually relevant, thereby supporting teams in safe and effective deployment.

LIMITATION

This study has several limitations. Firstly, the training surveys were neither pilot tested nor formally validated. The designs of the post-training and post-deployment surveys also differed, precluding direct comparison of quantitative findings between two time points. Such comparative analysis could have provided deeper insights into how effectively the training

translated into real-world performance. This limitation should be considered when interpreting the results.

Secondly, the post-deployment survey captured responses from 17 of the 19 deployed clinical staff, four of whom had not completed full training. The small sample size and differences in prior training experience may limit the generalisability of this study's findings. Nonetheless, as thematic analysis focuses on the depth and richness of qualitative data rather than sheer numbers, meaningful themes about participants' experiences could still be identified.

Thirdly, the integration of qualitative and quantitative findings involves interpretive judgment, as researchers must determine how numerical data and narrative responses relate to each other. To enhance reliability and reduce individual bias, two independent researchers conducted the thematic analysis of the free-text data. While the thematic analysis was conducted rigorously, it remains inherently interpretive, which may introduce some subjectivity into the findings.

Lastly, the real-world achievements of SGEMT, categorized as Kirkpatrick Level 4, it is important to recognise that these achievements may not be solely attributable to the training course. Individual team members' prior experience, personal attributes, resourcefulness, and leadership qualities likely contributed, alongside organisational support, resource availability, and other contextual factors encountered during deployment. These elements may act as potential confounders, making it difficult to isolate the specific impact of training on operational performance. This limitation is inherent to Kirkpatrick Level 4 evaluations, which capture real-world effectiveness but cannot definitively attribute outcomes solely to a training program (22). Future assessments should consider both individual and systemic factors when interpreting Kirkpatrick Level 4 results in disaster response contexts.

CONCLUSION

Effective pre-deployment training enables disaster medical teams to operate safely and efficiently in complex, resource-limited environments. The SGEMT Hybrid Training Course was associated with high participant engagement and learning (Kirkpatrick Levels 1–2), apparent translation of skills into operational performance (Kirkpatrick Level 3), and contributions to patient care and mission outcomes in Mandalay deployment (Kirkpatrick Level 4). Key program enablers were realistic scenarios conducted in a collaborative learning environment that reinforced technical and non-technical skills such as team collaboration, open

communication, and psychological resilience. This study provides evidence supporting a multi-component, team-based training model grounded in adult learning principles and offers a practical framework for systematically evaluating EMT training programs, addressing gaps in assessing higher-level outcomes and real-world operational impact.

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ACKNOWLEDGMENTS

We sincerely acknowledge all SGEMT team members of the Ministry of Health Singapore, Singapore Health Services, and ST Engineering Synthesis for their vital contributions to SGEMT's establishment and first deployment.

FUNDING

There is no funding received for this research.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ETHICAL APPROVAL

Ethical approval was obtained from Singapore Health Services Centralised Institutional Review Board (Ref: 2025-0898) on 14 August 2025.

REFERENCES

1. Casey ST, Noste EE, Cook AT, Muscatello D, Heslop DJ. Emergency medical teams in WHO's Western Pacific Region. Western Pac Surveill Response J. 2023;14(6).
2. Quah LJJ, Ho SF, Tan D, Faisal FIM, Ng KC. Setting up the World Health Organization–Singapore Emergency Medical Team for a Type 1 fixed facility deployment.
3. Ho SF, Quah LJJ, Tan D, Faisal FIM, Ng KC. Developing a hybrid training curriculum for the inaugural World Health Organization Singapore Emergency Medical Team using andragogical principles for adult training. ASEAN J Disaster Health Manag. 2025 Jan 2;1(1):65–81.
4. World Health Organization. Singapore contributes to regional health emergency readiness through achieving Emergency Medical Team classification [Internet]. Geneva: World Health Organization; 2024 [cited 2025 Oct 16]. Available from: https://www.who.int/malaysia/news/detail/12-09-2024-singapore-contributes-to-regional-health-emergency-readiness-through-achieving-emergency-medical-team-classi-fication
5. International Organization for Migration. IOM flash appeal: Myanmar earthquake response (29 March 2025–30 June 2025) [Internet]. Yangon: United Nations in Myanmar; 2025 [cited 2025 Nov 19]. Available

from: https://myanmar.un.org/en/291948-iom-flash-appeal-myanmar-earthquake-response-29-march-2025-30-june-2025

6. Ministry of Health Singapore. Singapore Emergency Medical Team to provide medical assistance in Myanmar relief efforts [Internet]. Singapore: Ministry of Health; 2025 [cited 2025 Oct 16]. Available from: https://www.moh.gov.sg/newsroom/singapore-emergency-medical-team-to-provide-medical-assistance-in-myanmar-relief-efforts/
7. Rashid H, Alexakis LC, Pereira I. Disaster medicine education for medical students: a scoping review. Cureus [Internet]. 2024 Dec 3 [cited 2025 Sep 30]. Available from: https://www.cureus.com/articles/304492-disaster-medicine-education-for-medical-students-a-scoping-review
8. Olsson S, Kurland L, Taube F, Björås J, Robinson Y. Disaster medicine in Swedish undergraduate medical education: analysing current programs and future integration in the six-year curriculum. BMC Med Educ. 2025 May 20;25(1):731.
9. Voicescu GT, Lamine H, Loșonți AE, Lupan-Mureșan EM, Luka S, Ulerio JG, et al. Monitoring and evaluation in disaster management courses: a scoping review. BMC Med Educ. 2025 Feb 6;25:188.
10. Kirkpatrick D, Kirkpatrick J. Evaluating training programs: The four levels. Berrett-Koehler Publishers; 2006.
11. Johnston S, Coyer FM, Nash R. Kirkpatrick's evaluation of simulation and debriefing in health care education: a systematic review. J Nurs Educ. 2018 Jul;57(7):393–8.
12. Naeem M, Ozuem W, Howell K, Ranfagni S. A step-by-step process of thematic analysis to develop a conceptual model in qualitative research. Int J Qual Methods. 2023 Oct 1;22:16094069231205789.
13. World Health Organization. Classification and minimum standards for emergency medical teams [Internet]. Geneva: World Health Organization; 2021 [cited 2025 Oct 16]. Available from: https://iris.who.int/server/api/core/bitstreams/f1a9750a-f68b-401c-87ea-c5157a3af6d9/content
14. Yamashita K, Nagatani A, Tasaki O. The education for DMAT. Jpn J Reanimatol. 2013;32(2):88–90.
15. Anan H, Akasaka O, Kondo H, Nakayama S, Morino K, Homma M, et al. Experience from the Great East Japan Earthquake response as the basis for revising the Japanese Disaster Medical Assistance Team training program. Disaster Med Public Health Prep [Internet]. [cited 2025 Nov 21]. Available from: https://www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/article-/experi-ence-from-the-great-east-japan-earthquake-response-as-the-basis-for-revising-the-japanese-disaster-medi-cal-assistance-team-dmat-training-program/9D310CC51EA973FF16E813DA5E860803
16. Bodas M, Peleg K, Adini B, Ragazzoni L. Training package for emergency medical teams deployed to disaster-stricken areas: has "TEAMS" achieved its goals? Disaster Med Public Health Prep. 2022 Apr;16(2):663–9.
17. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. Int J Med Educ. 2019 Oct 25;10:191–2.
18. Cooper S, Cant R, Connell C, Sims L, Porter JE, Symmons M, et al. Measuring teamwork performance: validity testing of the Team Emergency Assessment Measure (TEAM) with clinical resuscitation teams. Resuscitation. 2016 Apr;101:97–101.
19. Amat Camacho N, Hughes A, Burkle FM, Ingrassia PL, Ragazzoni L, Redmond A, et al. Education and training of emergency medical teams: recommendations for a global operational learning framework. PLoS Curr. 2016 Oct 21;8:ecurrents.dis.292033689209611ad5e4a7a3e61520d0.
20. Peller J, Schwartz B, Kitto S. Nonclinical core competencies and effects of interprofessional teamwork in disaster and emergency response training and practice: a pilot study. Disaster Med Public Health Prep. 2013 Aug;7(4):395–402.
21. Westman A, Kurland L, Hugelius K. Non-technical skills needed by medical disaster responders: a scoping review. Scand J Trauma Resusc Emerg Med. 2024 Apr 2;32:25.
22. Neubauer FB, Wagner FL, Lörwald A, Huwendiek S. Sharpening the lens to evaluate interprofessional education and interprofessional collaboration by improving the conceptual framework: a critical discussion. BMC Med Educ. 2024 Jun 4;24(1):615.