Review Article

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Medical Education during Disaster: Navigating the 2025 Hat Yai Flood and a Synthesized Narrative Review of Global Disaster Pedagogy

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Abstract:

Disasters profoundly disrupt the continuity of medical education, challenging institutions to maintain academic progression while ensuring student safety and psychological well-being. This article presents a two part analysis of disaster medical education. Part 1 provides a qualitative institutional reflection on the operational and pedagogical adaptations implemented for undergraduate medical students by the Faculty of Medicine, Prince of Songkla University, during the catastrophic 2025 Hat Yai flood. It highlights the dual core challenge of balancing academic continuity with structured, tiered student deployment intended to support clinical service capacity during extreme staffing constraints while adhering to rigorous ethical and safety frameworks, demonstrating how authentic crises offer rich learning opportunities that complement high-fidelity simulations. Crucially, it illustrates how adversity may facilitate an adaptive mindset, professional reflection, and prosocial engagement when supported by robust institutional safeguards exemplified by the institutional ethos of prioritizing the benefit of mankind as the first priority. Part 2 provides a comprehensive narrative literature review of the global literature regarding medical education in disaster settings, identifying five core thematic domains: (1) structural curricular agility and rapid operational pivots, (2) low-tech, high-touch resilience during infrastructural failure, (3) competency-matched student deployment bounded by strict ethical safeguards, (4) proactive micro level psychological infrastructure and duty-hour regulation, and (5) adaptive work-based assessments tailored for crisis environments. Together, this synthesis offers a strategic blueprint and a multi-pillar conceptual framework for medical educators to lead with both strategic wisdom and humanistic empathy during institutional crises.

Keywords: disaster pedagogy, Hat Yai flood, medical education, narrative literature review, undergraduate medical education

This paper is part of the "Hat Yai Flooding 2025" collection

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Introduction

In late 2025, an unprecedented flash flood inundated Hat Yai, transforming the municipality into an isolated aquatic zone and effectively turning Songklanagarind Hospital into an island. Beyond the severe logistical paralysis, the deluge directly threatened the core functions of undergraduate medical education. In this state of acute crisis, the Faculty of Medicine at Prince of Songkla University adopted a foundational philosophy: "Education cannot pause when patients cannot wait, yet academic continuity is an ethical responsibility that must never compromise learner safety."

Rather than viewing the disaster solely as a disruptive barrier, the institution re-conceptualized the crisis as an unconventional, highly transformative classroom. The pedagogical mandate shifted from rigid, classroom-bound lecturing toward an agile, experiential paradigm: "Teach Less, Learn More." Faculty members pivoted from being mere transmitters of theoretical knowledge to architects of safe, reflective learning spaces under real-world pressure.

Central to this approach was the clinical consensus that authentic crisis environments offer profound pedagogical opportunities that complement high-fidelity simulation-based education. Simulation and authentic disaster experience serve different educational purposes. While simulation provides a controlled space for skill acquisition, authentic crisis environments introduce a dynamic cognitive load, acute emotional gravity, real-time resource scarcity, and genuine clinical accountability that are distinct from simulated settings. Within this crisis, a multitude of unforeseen learning opportunities emerged. To capture these safely, the faculty committed to the principle of learning by doing under strict supervision. Every clinical action taken by undergraduate medical trainees was paired with side-by-side faculty oversight, safeguarding patient well-being while supporting learner competence and critical decision-making under duress.

It should be noted that the operational frameworks and pedagogical observations presented throughout Part 1 represent a qualitative institutional reflection and narrative account of institutional experience derived from direct executive leadership, faculty debriefings, and operational monitoring during the crisis, rather than formally quantified empirical trial data. Furthermore, this reflection focuses specifically on undergraduate medical students (Years 1–6); postgraduate residents functioned primarily as near-peer clinical supervisors working under attending staff oversight rather than as part of the deployed undergraduate learner cohort.

Institutional reflection and operational experience – the 2025 Hat Yai flood

Educational alignment with service load mitigation and student mental health infrastructure

A key operational strategy implemented during the 2025 flood was the strategic alignment of undergraduate medical education with institutional service needs. As the disaster progressed, acute staffing shortages and an overwhelming patient surge created an unsustainable service load for clinical faculty, residents, and frontline healthcare personnel. To address this crisis, the educational leadership implemented a tiered, competence-matched deployment framework. Instead of suspending education, undergraduate students were integrated into the workforce based on their educational levels, aiming to support clinical service capacity while maximizing authentic learning:

Clinical-year students (Years 4–6): Students in their clinical years were actively deployed as supervised clinical assistants across critical zones, including emergency rooms (ER), operating rooms (OR), outpatient departments, and inpatient wards. Under close supervision, they performed clinical triaging, assisted with emergency procedures, and participated in basic inpatient care management, supporting clinical service capacity and alleviating operational pressure on senior residents and staff physicians.

Pre-clinical students (Years 1–3): Trainees in their pre-clinical years, who lacked advanced clinical

competencies, were dynamically channeled into vital supportive roles. They optimized laboratory operations, assisted in forensic medicine workflows, and provided essential non-medical humanitarian support, such as assisting in patient ambulation, managing logistics, and stepping in to perform basic care duties in lieu of displaced relatives.

Simultaneously, protecting the mental health and psychological safety of students during this intense immersion was treated as a non-negotiable administrative priority. Trainees faced immense environmental and emotional distress, compounded by academic anxiety and worry for their own families. In response, the faculty deployed a dedicated, proactive mental health support infrastructure. The "Buddy System" was operationalized to ensure continuous peer monitoring and combat isolation. Furthermore, a rapid-response student counseling unit consisting of staff psychiatrists and clinical psychologists was established on site and via emergency communication lines to provide immediate psychological first aid (PFA), de-escalate acute anxiety, and actively audit clinical duty hours to prevent emotional exhaustion, ensuring that learners felt securely supported by their institution.

Ethical governance, learner safeguards, and clinical responsibility

To ensure that undergraduate student deployment remained ethically sound, educationally justified, and student-centered rather than serving as a mechanism for workforce substitution or being framed strictly as quantified service-load mitigation, the institution operationalized a comprehensive ethical governance framework based on nine core parameters:

1. Determination of student competency: Student readiness was not assumed based on crisis urgency. Competencies were strictly determined by verifying trainees' pre-disaster academic standing and validated Entrustable Professional Activities (EPAs). Only skills previously certified within the formal curriculum were permitted in clinical deployment.

2. Scope of practice by educational level: Clear boundaries were instituted to prevent task creep. Pre-clinical students were strictly limited to non-invasive logistical, administrative, and basic humanitarian support. Clinical-year students engaged in basic triage, non-complex procedural assistance, and clinical monitoring, while invasive or high risk emergency interventions remained strictly reserved for licensed staff physicians and senior residents.

3. Level and ratio of faculty supervision: Supervision was structured around direct (side-by-side) and close oversight models. In high-acuity areas such as the ER and OR, faculty-to-student supervision ratios were capped at 1:2 to 1:4. Low-acuity inpatient wards operated at a maximum ratio of 1:8, ensuring continuous supervisory presence and immediate real-time oversight.

4. Voluntary participation and opt-out mechanisms: Trainee involvement was entirely voluntary. The faculty established a formal, non-punitive opt-out policy. Students retained the absolute right to decline deployment or opt out of specific shifts without justification, academic penalty, administrative prejudice, or social stigma.

5. Mechanism for declining inappropriate activities: Trainees were explicitly briefed on their right of refusal regarding any clinical duty exceeding their personal confidence or perceived competency. Escalation pathways were managed by designated student-advocate faculty leads who resolved scope-of-practice mismatches on the floor immediately.

6. Ultimate clinical responsibility: Legally, ethically, and clinically, primary medical responsibility for all patient outcomes, diagnostic decisions, and treatment plans remained exclusively with attending faculty physicians and licensed staff. Student contributions were classified strictly as supervised clinical assistance.

7. Patient safety and informed consent: Patient safety protocols were uncompromised. Verbal informed consent was routinely obtained where clinically feasible, explicitly informing patients and their families of trainee involvement under direct faculty supervision. All student clinical notes and order entries required mandatory attending co-signature before execution.

8. Management of adverse events and errors: Standard institutional incident reporting and clinical governance systems remained active throughout the flood. Any clinical error or near-miss involving a student was addressed through a non-punitive, supportive educational debrief focused on root-cause analysis and psychological support rather than disciplinary action.

9. Monitoring student fatigue and psychological burden: Shift lengths were capped at 8–12 hours, with mandatory rest periods to enforce recovery. Clinical supervisors conducted mandatory daily check-ins to monitor physical fatigue, moral distress, and burnout, with immediate relief and counseling referral for any trainee demonstrating signs of overload.

Competency mapping: upskilling and remediation of skill decline

The operational reality of the flood forced a dramatic restructuring of clinical exposure, precipitating a clear polarization of clinical competencies among learners. To provide a structured framework for deployment, educational levels were mapped directly to certified pre-disaster EPAs, defining clear scope-of-practice boundaries and required supervision ratios across three distinct undergraduate tiers:

Pre-clinical tier (Years 1–3): Deployment was restricted to non-clinical logistics, inventory management, sample transport, and non-medical humanitarian patient support. Students also assisted in organizing and supporting operations at shelters for people affected by the flood, assisting in patient ambulation, emergency supply distribution, and basic care tasks in lieu of displaced relatives, conducting home visits, and providing practical assistance and psychosocial support to affected individuals and families in collaboration with medical faculty members and psychologists.

Early clinical tier (Years 4–5): Trainees operated as clinical assistants performing basic triaging, vital sign monitoring, physical examination, routine venipuncture, wound care, splinting, basic procedures, and non-complex ward care assistance. They also assisted in organizing and supporting operations at shelters for people affected by the flood, conducting home visits, and providing practical assistance and psychosocial support to affected individuals and families in collaboration with medical faculty members and psychologists. Supervision was provided through close oversight by senior residents or staff at a 1:4 to 1:8 ratio, emphasizing basic clinical reasoning under resource constraints.

Late clinical/externs (Year 6): Students participated in emergency room triage assistance, non-complex procedural assistance, and inpatient care under direct supervision. Prerequisites included Advanced Cardiovascular Life Support and sterile procedural certification. Direct, side-by-side supervision by attending faculty and resident near-peer instructors fostered crisis decision making and adaptive leadership.

It must be explicitly clarified that the pedagogical observations regarding upskilling and temporary skill decline were derived from qualitative faculty debriefings, supervisory reflections, and observational qualitative feedback rather than formalized quantitative competency examinations.

Observed proficiency enhancement (the unplanned curriculum): In the absence of traditional lecture structures, faculty supervisors observed qualitative evidence of enhanced proficiencies in non-technical and crisis-management domains. Real-world clinical responsibilities were perceived to support student adaptability in resource-constrained environments, prioritization through emergency triage, and crisis communication across interdisciplinary

networks. This active learning was effectively achieved through supervised immersion, where trainees safely handled complex crisis scenarios with immediate backup from senior staff.

Temporary decline in fine motor and theoretical skills: Conversely, the institution observed a temporary decline in highly structured academic performance and fine motor procedural competencies. The urgent pace of emergency care, combined with limited equipment availability and cognitive survival modes, diminished opportunities for meticulous, low-stakes procedural practices. To counter this, the faculty openly acknowledged these deficiencies, designing systematic, post-crisis remediation and reinforcement programs once regular operations resumed.

Cultivating a growth mindset, attitudinal evolution, and altruism

Beyond technical milestones, the institutional response during the 2025 flood provided observational insights into student attitudinal responses during acute crises. It is important to note that specific psychological constructs, such as psychometrically validated measures of resilience, post-traumatic growth, formal moral development stages, or professional identity formation, were not formally evaluated using standardized quantitative instruments. Rather, the following observations represent qualitative thematic feedback synthesized from faculty debriefings and student narrative reflections during post-crisis sessions.

Immersed in adversity, learners were reported to demonstrate an adaptive mindset, learning to view overwhelming systemic constraints not as immovable roadblocks, but as operational challenges requiring collaborative problem solving and flexibility.

This environment was perceived to facilitate reflective discussions on professional ethics, civic responsibility, and prosocial attitudes. By experiencing shared hardships alongside the community, students expressed heightened empathy and a reinforced commitment to patient care. Crucially, contemporary medical education principles dictate that altruistic dedication must never be interpreted as requiring learner self-sacrifice or the neglect of personal safety; institutional policy explicitly prioritized trainee health and psychological well-being as foundational prerequisites for safe patient care. This experience directly aligned with the institutional core value and the sacred pledge of the Father of Modern Medicine in Thailand, Prince Mahidol of Songkla: "Let the benefit of mankind be your first priority, and your own self-interest be second." In this operational context, this ethos was modeled alongside robust administrative safeguards, ensuring that service to humanity was paired with active institutional care for the caregiver. Based on qualitative institutional debriefings, learners expressed a deeper appreciation for resilient, humanistic medical practice anchored in professional duty, safety, and mutual support.

Narrative literature review – global medical education during disaster

Literature search, synthesis approach, and evidence summary

To contextualize the local operational lessons from the 2025 Hat Yai flood within broader international scholarship, a targeted narrative literature synthesis was conducted. Electronic databases and information sources searched included PubMed, Google Scholar, and international disaster pedagogy repositories. The literature search spanned a 10-year period to capture contemporary frameworks in medical education during mass-casualty events, natural disasters, and global healthcare crises.

The search strategy utilized combinations of core search concepts and terms, including: medical education, disaster pedagogy, student deployment, undergraduate medical education, and psychological first aid. Literature was selected based on its direct relevance to undergraduate medical education governance, curriculum adaptation, and trainee psychological safety. Identified publications

Table 1 Operational and pedagogical framework for disaster-responsive undergraduate medical education

Domain	Institutional action (2025 Hat Yai flood)	Global literature benchmark	Key operational & safety safeguards	WBA integration
1. Curricular agility & operational pivots	Rapid shift from didactic lectures to modular asynchronous learning; clinical rotations restructured into intensive, micro-credentialed disaster response blocks.	Flexible learning delivery and adaptation of medical education during disruptions[2,3,4].	• Formal faculty audit of core learning outcomes. • Non-penalty leave policy for displaced students. • Preservation of academic credits.	Formative logging of clinical encounters; student reflective logs mapped to core EPA competencies[9,16,17].
2. Tiered experiential learning & deployment	Clear demarcation of roles: • Years 1–3 (Pre-clinical): Laboratory and forensic workflow support, logistics, and non-medical humanitarian assistance. • Years 4–6 (Clinical-Year Students): Clinical assistance appropriate to verified competence, under supervision.	Disaster-response roles for medical students should be clearly defined and matched to appropriate safeguards[8,10].	• Supervision matched to acuity and learner level (high-acuity areas: 1:2–1:4; lower-acuity wards: up to 1:6). • Voluntary opt-out without academic or professional penalty.	Mini-CEX and DOPS may be used for focused observation and feedback on appropriate clinical tasks[16,17].
3. Near-peer supervision model	Deployment of postgraduate residents (R2–R3) as frontline "near-peer supervisors" bridging clinical faculty and clinical-year students.	Peer-assisted learning can provide a structured educational model for peer support[7].	• Clear escalation pathways to attending physicians. • Residents strictly restricted from high-stakes summative evaluations.	Near-peers may support structured peer learning and immediate formative feedback[7].
4. Psychological infrastructure & safety	Implementation of a Buddy System, duty-hour limits and rest periods (8–12-hour shift limits as operationally determined), and access to on-site PFA.	Evidence on medical student mental health and burnout, together with reviews of psychosocial interventions for disaster-exposed healthcare workers, supports proactive psychological support[11–14].	• Mandatory post-shift debriefings. • 24/7 confidential mental health hotline access. • Real-time workload auditing by faculty.	Self-reflection logs may complement institutional psychological support; PFA guidance is available for field settings[9,14].
5. Post-disaster remediation & quality improvement	Comprehensive post-disaster clinical skills audit and targeted remediation bootcamps for fine-motor/procedural gaps.	Workplace-based assessment can support observation, feedback, and identification of learning needs in clinical settings[16,17].	• No academic advancement block prior to remediation. • Institutional QI feedback loop for curriculum refinement.	CBD and objective skills check-offs are proposed local remediation tools; WBA literature supports structured observation and feedback[16,17].

CBD=case-based discussion, DOPS=direct observation of procedural skills, EPA=entrustable professional activity, Mini-CEX=mini-clinical evaluation exercise, PFA=psychological first aid, QI=quality improvement, R2–R3=postgraduate residents in training years 2–3, WBA=work-based assessment

Table 2 Comparative synthesis of disaster education challenges, governance safeguards, and adaptive solutions

Disaster phase	Primary operational & pedagogical challenges	Global literature evidence & risk vulnerabilities	Institutional governance & mitigating safeguards	Recommended educational & assessment adaptation
Acute Phase *(Hours 0–72)*	• Infrastructure failure (power/water grid loss) • Immediate surge in casualty volume • Student displacement and physical safety threats	Unclear or unsupported student deployment roles raise ethical and safety concerns[8,10]. Psychological risks among medical students and disaster-exposed healthcare workers warrant attention[11,12,13].	• Mandatory suspension of routine high-stakes academic activities • Real-time accountability, safety auditing, and contact tracing for all trainees • Enactment of strict non-deployment zones (e.g., non-supervised trauma bays)	• Immediate activation of low-tech, high-touch communication protocols • Rapid deployment of PFA • Formative, informal near-peer feedback focused on safety and basic triage roles
Sub-Acute Phase *(Days 4–14)*	• Extreme clinical workforce fatigue and severe staffing shortages • Disruption of structured bedside teaching and lectures • Trainee role ambiguity (service-load vs. learning)	Student involvement in emergency response requires defined roles and ethical safeguards[8,10]. Medical student burnout and mental-health problems, alongside psychological risks among disaster-exposed healthcare workers, support duty-hour and well-being protections[11,12,13].	• Implementation of tiered, competence-matched deployment (Years 4–5 vs. Year 6) • Supervision matched to acuity (high-acuity areas: 1:2–1:4; lower-acuity wards: up to 1:8) • Duty-hour limits, rest periods, and voluntary opt-out mechanisms	• Rapid shift to ultra-brief, mobile Work-Based Assessments (e.g., 5-minute Mini-CEX, DOPS) • Near-peer supervisory models (R2–R3 residents evaluating core procedural steps) • Modular, asynchronous disaster-learning micro-credentials

DOPS=direct observation of procedural skills, Mini-CEX=mini-clinical evaluation exercise, PFA=psychological first aid, R2–R3=postgraduate residents in training years 2–3

were thematically synthesized into core dimensions and structured systematically in Table 1 and Table 2 to provide a transparent overview of the established global evidence supporting disaster pedagogy principles.

Macro-level curricular agility and technological robustness

A synthesized review of the international literature identifies disruptions to educational continuity as an important challenge for medical education during periods of institutional and health system disruption[1]. A critical response is curricular flexibility: adapting learning delivery and clinical education to changing circumstances rather than relying solely on fixed schedules[2,3].

When acute regional crises disrupt infrastructure or access to digital systems, guidance for resilient health professions education recommends flexible delivery approaches, including low-tech and hybrid methods[4]. Digital learning platforms may support educational continuity when available[5,6]; however, peer-assisted learning and adaptable faculty–student support networks can provide additional continuity when conventional systems are disrupted[2,4,7].

International literature describes disaster-medicine education and the potential involvement of medical students in disaster response, while emphasizing the need to define appropriate roles and safeguards[3,8]. Reflective writing has also been used to explore medical students' professional identity development in longitudinal clinical education[9]; however, this evidence does not establish that disaster deployment itself causes professional identity formation or improved clinical self efficacy. Ethical guidance for student participation in emergency responses underscores the importance of clear safeguards and institutional responsibility[10].

Micro-level psychological infrastructure and psychological adaptation

Literature on medical student well-being identifies substantial mental-health concerns and professional burnout in this population[11,12]. During disasters, healthcare workers may also experience adverse psychological outcomes, highlighting the importance of not assuming that trainees are protected from similar occupational stressors[13].

Institutional mental-health planning should include access to PFA and psychosocial support as part of broader emergency preparedness[13,14]. For medical students, evidence on mental-health problems and burnout supports proactive monitoring and access to the appropriate support[11,12]. Post-traumatic growth has been examined in healthcare professionals[15], but this evidence should not be interpreted as proof that student disaster deployment produces post-traumatic growth.

Adaptive competency frameworks via work-based assessment

Under the operational constraints of a disaster environment, traditional high-stakes examinations may be difficult to organize. Workplace-based assessment (WBA), which emphasizes observation, feedback, and assessment in clinical practice, offers a complementary approach for monitoring learning in clinical settings[16,17]. Structured reflection may complement these assessment methods[9].

To operationalize WBA effectively in chaotic emergency settings, specific validated assessment instruments must be adapted for ultra-brief delivery without sacrificing psychometric integrity:

Mini-Clinical Evaluation Exercise (Mini-CEX): Mini-CEX can be used for focused observation of clinical encounters, followed by feedback on selected clinical skills such as history taking and physical examination. In a constrained setting, the institution may adapt the duration and documentation format while retaining the core principles of direct observation and feedback[16,17].

Direct Observation of Procedural Skills (DOPS): DOPS can be used to observe procedural performance and provide immediate feedback. In disaster settings, institutions

may select procedures appropriate to the learner's verified competence and ensure direct supervision by qualified clinicians[16,17].

Case-Based Discussion (CBD): Brief case-based discussions can be used to explore a student's clinical reasoning and decision making in relation to actual patient encounters. The format and duration described here are proposed local adaptations for crisis conditions, rather than a validated disaster-specific CBD protocol[16,18].

Reflective Portfolios and Incident Logs: Brief narrative reflections can document ethical dilemmas, interprofessional communication, and learners' responses to challenging experiences. Reflective writing has been described as a means of examining medical students' professional identity development[9]; local review and debriefing processes should be treated as institutional adaptations[17].

Feasibility in Disaster Settings: The feasibility of clinical assessment in crisis environments depends on minimizing the administrative burden for supervisors. This manuscript proposes brief, single-page or mobile documentation and prioritization of formative observations as practical local adaptations; these specific time limits and interfaces should not be interpreted as established thresholds from the cited literature. WBA provides a basis for observation and feedback in clinical learning environments[16,17], while peer-assisted learning literature supports the educational rationale for structured peer learning[7].

Educational Validity and Reliability: Maintaining educational quality under crisis conditions requires deliberate assessment design. The Ottawa Consensus Framework emphasizes the importance of using an appropriate range of assessment methods[18]. WBA literature supports workplace observation and feedback as sources of information about clinical performance[16,17]. Accordingly, this manuscript recommends aggregating repeated observations across encounters and aligning assessment criteria with competencies defined before deployment; these are proposed operational recommendations, not a validated disaster-specific psychometric model. Reflective feedback may further support learning and professional development[9].

As synthesized across our institutional experience and global literature, these core operational domains are structurally interconnected within a comprehensive framework (Figure 1).

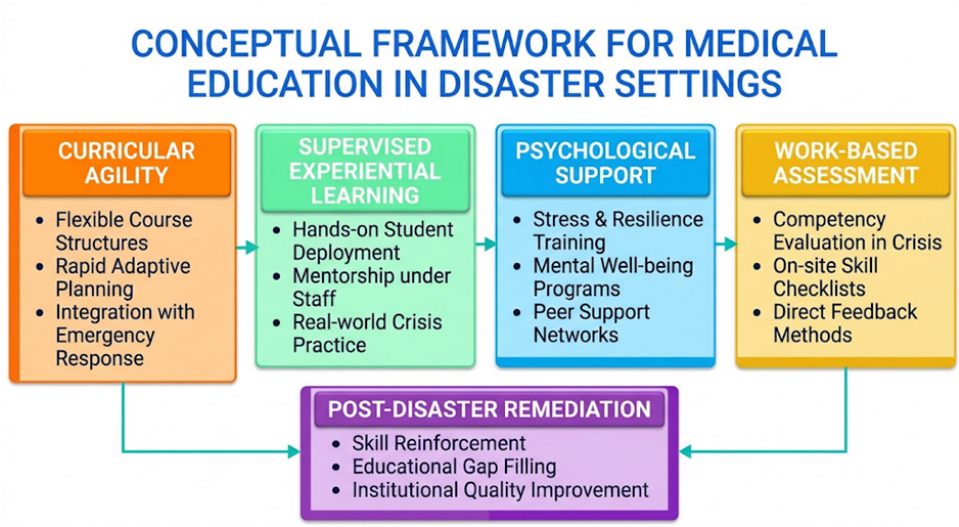


Figure 1 Conceptual framework for undergraduate medical education during institutional crises and disaster settings

Conclusion

Synthesis of the 2025 Hat Yai flood experience and the global literature demonstrates that while acute disaster environments offer distinct learning opportunities, crisis exposure does not inherently or automatically produce resilient or compassionate physicians. Rather, positive professional adaptation and educational continuity are strictly contingent upon proactive institutional governance. Executive leadership during a crisis demands an intentional balance of evidence-based structure and humanistic learner support. Academic medical centers must champion policies that treat learner safety, close faculty supervision, voluntary opt-out mechanisms, and mental health protection as foundational prerequisites. Disaster deployment of undergraduate medical trainees must remain strictly competency-based, supervised, ethically governed, and educationally justified, rather than serving as workforce substitution. By implementing agile curricula, robust psychological infrastructure, and feasible work-based assessments, medical schools can preserve rigorous educational standards while safely supporting student professional development during institutional crises.

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