

Opinion Paper

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Essential laboratory tests in emergencies; on behalf of the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Committee on Preparation of Laboratories for Emergencies (C-PLE)

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Abstract: This article aims to define a minimum panel of essential laboratory tests to be used in emergency and disaster settings through expert consensus. A structured survey was distributed to the 24 members of the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Committee on Preparation of Laboratories for Emergencies (C-PLE). Participants were asked to rate a pre-defined list of diagnostic tests using a four-level priority scale (essential, critical, supportive, not recommended), with scores ranging from 1 to 4. Responses were collected over a two-week period, and mean scores with standard deviations

were calculated to classify each test into priority categories. Additional test suggestions were also solicited and evaluated. A total of 20/24 members (83.3 %) completed the survey. Tests classified as essential (mean score 1.00–1.49) included complete blood count, electrolytes (sodium, potassium, chloride), blood glucose, lactate, blood gases (including ionized calcium), urinalysis, and ABO/RhD blood typing. Critical tests (mean score 1.50–2.49) comprised urea and/or creatinine, coagulation parameters such as prothrombin time/international normalized ratio (PT/INR) and activated partial thromboplastin time (APTT), aminotransferases (especially alanine aminotransferase; ALT), and cardiac troponins. Supportive tests (mean score 2.50–3.49) included C-reactive protein, D-dimer, rapid diagnostic tests for

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infectious diseases, and procalcitonin. Additional tests, such as urine pregnancy testing, bilirubin, and pancreatic enzymes, were proposed for potential inclusion based on clinical relevance. These findings establish a prioritized, consensus-based diagnostic framework tailored to resource-limited emergency contexts, emphasizing rapid, high-impact testing to support clinical decision-making and patient outcomes.

Keywords: laboratory medicine; testing; emergency; natural disasters; war

Introduction

The growing convergence of climate-related disasters, armed conflict, and chronic geopolitical instability has placed unprecedented strain on healthcare systems worldwide, with health facilities frequently becoming deliberate targets and suffering operational disruptions during conflicts [1, 2]. These crises predominantly arise in settings characterized by pre-existing fragility or the progressive degradation of healthcare infrastructure, which can precipitate adverse clinical and public health outcomes, including disrupted supply chains, mass population displacement, and severe shortages of personnel and essential resources [3, 4]. In these settings, the need to deliver timely, accurate diagnostic services becomes essential. Whenever laboratory support is absent or inadequate, delays in diagnosis and triage, and preventable increases in morbidity and mortality will invariably follow [5].

Laboratory medicine must be regarded as a core component of emergency healthcare delivery [6]. It serves as the foundation upon which both individual patient care and broader public health interventions depend. Its utility extends well beyond confirmatory testing, encompassing early detection of outbreaks, monitoring of therapeutic interventions, together with perioperative risk assessment, especially in trauma and emergency surgery [6]. This is especially relevant for displaced and vulnerable populations, where chronic illnesses frequently overlap with traumatic injuries and the risk of developing infectious diseases. In these circumstances, access to a limited panel of “essential” laboratory tests can help maintain continuity of care and provide useful information about the clinical course of diseases [5].

Nevertheless, delivering laboratory services in crisis environments requires a careful balance. Analytical accuracy must be maintained while operating under constraints, including damaged infrastructure, environmental instability, and unfavorable logistics, and this must be achieved

through a pragmatic approach that prioritizes robustness, portability, and clinical relevance without compromising reliability [7].

In response to these challenges, some international and professional bodies have proposed frameworks to define essential diagnostic capacity in emergency situations (Table 1). The Model List of Essential *In Vitro* Diagnostics, endorsed by the World Health Organization [8], provides a comprehensive, policy-oriented foundation for prioritizing cost-effective, high-impact tests within national health systems. It includes core laboratory disciplines and assays targeting high-burden diseases. This document is highly valuable, indeed, but its primary focus is system-wide prioritization rather than rapid deployment in austere conditions [9].

More operationally-focused guidance has emerged from regional WHO initiatives, especially in settings more vulnerable to humanitarian crises, such as the Health Laboratory Facilities in Emergency and Disaster Situations [10]. This framework emphasizes the minimum laboratory capabilities that are needed for immediate deployment, prioritizing rapid diagnostic tests and simplified platforms (e.g., point-of-care testing (POCT)) that can function reliably in resource-constrained environments [11] (Table 1). Therefore, the goal is to enable timely clinical decision-making and disease surveillance when conventional laboratory infrastructure becomes unavailable.

From an operational military perspective, diagnostic priorities are primarily determined by the exigencies of combat casualty care, with an emphasis on rapid assessment, efficient triage, and the optimization of life-saving interventions under resource-constrained conditions. For example, the standards developed by the North Atlantic Treaty Organization (NATO) for deployed medical facilities focus on tests that directly inform life-saving interventions, including POCT assessments of a discrete number of tests that are essential for guiding resuscitation and surgical management in critically injured patients [12] (Table 1).

Complementing these approaches, professional laboratory organizations have addressed the practical implementation of POCT in emergency settings. The POCT16 standard, developed by the Clinical and Laboratory Standards Institute (CLSI) [13], emphasizes the imperative to maintain rigorous quality assurance systems, robust governance frameworks, and seamless integration into clinical workflows under emergency and disaster conditions, while also advocating for an expanded diagnostic repertoire (Table 1).

Altogether, these frameworks reflect the shared consensus that laboratory testing represents an essential pillar across the full spectrum of emergency and disaster medicine. Despite their complementary value, important

Table 1: Comparative table of suggested diagnostic test panels by World Health Organization Eastern Mediterranean Regional Office (WHO EMRO), North Atlantic Treaty Organization (NATO) Allied Medical Publication version 8.5 (AMedP-8.5) that focuses on Medical Treatment Facilities (MTFs) and Clinical and Laboratory Standards Institute Point-of-Care Testing (CLSI POCT16).

Test category	WHO EMRO (emergency)	NATO AMedP-8.5 (MTFs)	CLSI POCT16 (disaster POCT)
Hematology	Hemoglobin/hematocrit (CBC when available)	CBC	Hemoglobin/hematocrit (CBC when available)
Clinical chemistry/metabolic panel	Glucose, proteins, electrolytes (sodium, potassium and chloride)	Electrolytes (sodium, potassium, and chloride), glucose, urea, creatinine, ALT, AST, GGT, bilirubin, CRP, amylase	Glucose, electrolytes (sodium, potassium), urea, creatinine
Blood gases	Core component (ABG analysis)	Core component (ABG analysis) with ionized calcium	Core component (ABG analysis) with ionized calcium
Lactate	Included	Included	Included
Coagulation	Not prioritized	PT, APTT, D-dimer, viscoelastic testing (if feasible)	D-dimer, PT (if feasible)
Cardiac biomarkers	Not prioritized	Cardiac troponin and CK-MB	Cardiac troponin, B-type natriuretic peptide (BNP)
Infectious disease testing	Strong focus on RDTs (malaria, cholera, etc.)	Limited (context-dependent)	Selected rapid infectious tests
Microbiology (culture)	Not prioritized	Not prioritized	Not prioritized
Urinalysis	Included	Included	Included
Pregnancy testing	Included	Included	Included
Blood group, Rh	Included	Included	Included

ABG, arterial blood gases; ALT, alanine aminotransferase; AST, aspartate aminotransferase; APTT, activated partial thromboplastin time; BNP, B-type natriuretic peptide; CBC, complete blood count; CK-MB, creatine kinase isoenzyme MB; CLSI POCT16, Clinical and Laboratory Standards Institute Point-of-Care Testing; CRP, C-reactive protein; GGT, gamma-glutamyl transferase; NATO AMedP-8.5 (MTFs), North Atlantic Treaty Organization Allied Medical Publication version 8.5 that focuses on Medical Treatment Facilities; PT, prothrombin time; RDTs, rapid diagnostic tests; WHO EMRO, World Health Organization Eastern Mediterranean Regional Office.

limitations remain in their translation into practical, field-ready guidance. Existing approaches are frequently either too broad and policy-oriented or, conversely, highly context-specific, thereby limiting generalizability across heterogeneous emergency scenarios. In particular, there is a lack of consensus-driven, operationally feasible recommendations to support the prioritization of a minimal yet clinically meaningful set of diagnostic tests that can be reliably implemented in austere and rapidly evolving environments. This gap highlights an unmet need for structured, evidence-informed strategies that effectively integrate clinical relevance with analytical feasibility and logistical constraints. Synthesizing these perspectives into a cohesive, adaptable diagnostic strategy is essential to ensuring that diagnostic services remain aligned with both immediate clinical priorities and the complexities of public health during crisis environments. In this context, the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Committee on Preparation of Laboratories for Emergencies (C-PLE) [14] has undertaken the present initiative to provide a pragmatic, expert-based prioritization of essential laboratory tests for emergency settings, with the aim of delivering an adaptable framework to support decision-making and strengthen the resilience of laboratory services in crisis

conditions. This effort is intended to complement prior works addressing the state of the art in emergency preparedness of laboratory medicine [15], the disruption of laboratory activities during the recent coronavirus disease 2019 (COVID-19) pandemic [16], and the preparedness and resilience of healthcare facilities and clinical laboratories against cyberattacks [17, 18].

Methods

An Excel file listing potential essential diagnostic tests for emergency settings was emailed to all 24 members of the C-PLE. Members were requested to indicate the priority of each test for inclusion in the emergency panel using the following scale: essential (1 point), including tests that are indispensable in emergency settings and must be immediately available, as they directly influence urgent clinical decision-making and patient outcomes; critical (2 points), including tests that, while not strictly indispensable, provide significant support for clinical decision-making and patient management and should be available whenever feasible, although short delays or limited access are acceptable; supportive (3 points), including tests that offer additional,

Table 2: Final recommendations of the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Committee on Preparation of Laboratories for Emergencies (C-PLE) on essential laboratory tests in emergency settings.

Test	Meaning	Clinical significance	Mean, SD	
Principal panel				
Complete blood count (CBC)	Detects anemia, infection, and platelet disorders	Identifies hemorrhage, infection risk, and guides transfusion	1.00 ± 0.00	Essential
Electrolytes (Na ⁺ , K ⁺ , Cl ⁻)	Assesses fluid and metabolic balance	Critical for dehydration, shock; K ⁺ detects crush syndrome and prevents arrhythmias	1.00 ± 0.00	Essential
Blood glucose	Detects hypo/hyperglycemia	Essential in altered mental status; prevents neurological damage	1.05 ± 0.22	Essential
Lactate	Measures tissue hypoxia	Key triage marker for shock; predicts mortality	1.05 ± 0.22	Essential
Blood gases (with ionized calcium)	Assesses respiratory/metabolic status	Critical in shock, ventilation, and inhalation injuries	1.05 ± 0.22	Essential
Urinalysis	Rapid bedside screening	Detects myoglobinuria (rhabdomyolysis), kidney damage, and dehydration	1.25 ± 0.62	Essential
ABO/RhD (and RHCE phenotype)	Determines compatibility for transfusion	Enables emergency transfusions and surgery	1.45 ± 0.50	Essential
Urea and/or creatinine	Evaluates kidney function	Detects renal failure, dehydration, and rhabdomyolysis	1.65 ± 0.48	Critical
PT/INR and APTT	Evaluates clotting function	Manages bleeding and trauma-related coagulopathies	1.75 ± 0.43	Critical
Aminotransferases (ALT, AST)	Assesses liver injury	Identifies trauma or toxin exposure	2.05 ± 0.59	Critical
Cardiac troponins	Detects cardiac injury	Differentiates trauma vs. cardiac events	2.10 ± 0.83	Critical
C-Reactive protein (CRP)	Detects inflammation	Monitors infection trends in crowded settings	2.55 ± 0.67	Supportive
D-Dimer	Detects clot formation	Screening for venous thromboembolism/pulmonary embolism	2.65 ± 0.57	Supportive
Infectious disease (RDTs)	Rapid detection of epidemic diseases	Prevents outbreaks (e.g., malaria, cholera)	2.75 ± 0.54	Supportive
Procalcitonin	Differentiates bacterial vs. viral infection and early diagnosis of sepsis	Guides antibiotic use; preserves limited resources	2.80 ± 0.40	Supportive
Additional tests to be considered for inclusion				
Urine pregnancy test	Detects pregnancy	Detects pregnancy-related complications and influences decisions on radiation exposure		– Probably critical
Bilirubin (total)	Identifies hemolysis and liver dysfunction	Identifies hemolytic anemias, hepatic dysfunctions (e.g., sepsis or toxins), and neonatal hyperbilirubinemia		– Probably critical
Pancreatic enzymes (lipase)	Identifies pancreatic diseases	For diagnosing acute pancreatitis and other pancreatic disorders (e.g., acute abdominal pain, trauma, or suspected organ injury)		– Probably supportive

ALT, alanine aminotransferase; AST, aspartate aminotransferase; APTT, activated partial thromboplastin time; Cl⁻, chloride; CRP, C-reactive protein; K⁺, potassium; Na⁺, sodium; PT, prothrombin time; INR, international normalized ratio; RDTs, rapid diagnostic tests.

complementary information, which may help refine diagnosis or management, but are not absolutely required for immediate decision-making in acute emergencies; and not recommended (4 points), including tests unlikely to provide meaningful benefit in acute emergency scenarios, due to limited impact on immediate clinical decisions, low urgency,

or practical constraints related to availability or turnaround time. Responses were collected over a two-week period. For each test, the mean and standard deviation (SD) of scores were calculated to determine its final priority classification. Tests with a mean score of 1.00–1.49 were classified as essential, 1.50–2.49 as critical, 2.50–3.49 as supportive,

and ≥ 3.50 as unnecessary. Additionally, any new tests suggested by individual members were collated and discussed for potential inclusion.

Results

Following the two-week response period, extended by an additional three days to accommodate late submissions, completed evaluations were received from 20 of the 24 C-PLE members (83.3 %).

The results of the C-PLE members' voting are summarized in Table 2 and Figure 1. Tests classified as priority 1 (essential) were the complete blood count (CBC), electrolytes (sodium, potassium, and chloride), blood glucose, lactate, blood gases (including ionized calcium), urinalysis, and ABO/RhD (and RHCE phenotype) assessment. Tests classified as priority 2 (critical) were urea and/or creatinine, prothrombin time/international normalized ratio (PT/INR) and activated partial thromboplastin time (APTT), aminotransferases (alanine aminotransferase (ALT) and aspartate aminotransferase (AST)) and cardiac troponins, while those classified as priority 3 (supportive) were C-reactive protein (CRP), D-Dimer, rapid diagnostic tests (RDTs) for infectious diseases (to be further defined) and procalcitonin. Urine pregnancy test (probably critical), total bilirubin with indirect bilirubin when available (probably critical), and pancreatic enzymes (particularly lipase) were not included in the original panel

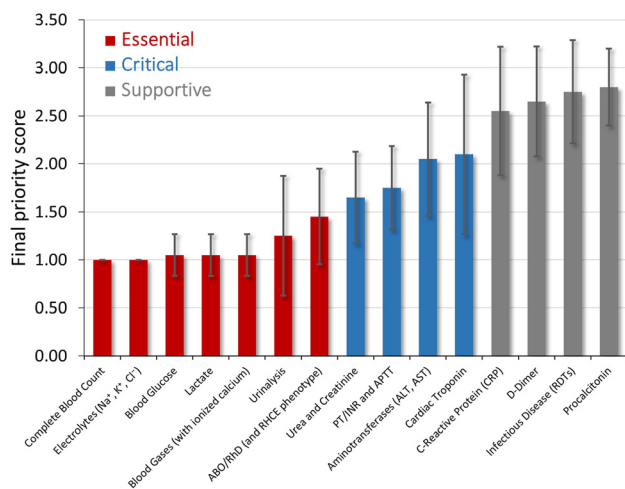


Figure 1: Mean (standard deviation) scores assigned by the Committee on Preparation of Laboratories for Emergencies (C-PLE) members to individual laboratory parameters for inclusion in the essential laboratory test panel in emergency settings. ALT, alanine aminotransferase; AST, aspartate aminotransferase; APTT, activated partial thromboplastin time; Cl⁻, chloride; CRP, C-reactive protein; K⁺, potassium; Na⁺, sodium; PT, prothrombin time; RDTs, rapid diagnostic tests.

but were subsequently identified as candidates for potential inclusion in the minimum diagnostic test panel for emergency settings

Additional laboratory investigations were selectively proposed by members of the C-PLE based on clinical expertise and contextual judgment. In descending order of frequency of recommendation, these included: urine pregnancy test, bilirubin (total), creatine kinase (CK) with or without myoglobin, lactate dehydrogenase (LDH), gamma-glutamyl transferase (GGT), comprehensive drug screening, ethanol, ammonia, and pancreatic enzymes (amylase and lipase), alkaline phosphatase (ALP).

Discussion

In emergency situations such as armed conflicts and natural disasters, the minimum laboratory testing panel must prioritize rapid, actionable diagnostics to support triage, early diagnosis, resuscitation, and rational resource allocation in austere environments with constrained infrastructure and limited analytical capacity. The panel proposed by the C-PLE encompasses a selection of assays intended to address the most frequent life-threatening conditions encountered in such settings, including traumas, wounds, shock, infectious diseases, acute organ dysfunction, and obstetric emergencies, thereby enabling high-impact clinical decision-making. Each component has been selected based on its diagnostic yield, feasibility, and applicability within field hospitals and mass-casualty scenarios.

The CBC remains indispensable for rapid assessment of anemia secondary to hemorrhage, leukocytosis suggestive of infection or systemic inflammation, and thrombocytopenia associated with increased bleeding risk, which are highly prevalent conditions in disaster settings. It is also an essential test that provides critical information to guide transfusion strategies, antimicrobial therapy, and triage prioritization in environments lacking full laboratory infrastructure [19–21].

Measuring key electrolytes (especially sodium and potassium) is essential for identifying life-threatening imbalances resulting from dehydration, gastrointestinal losses, renal dysfunction, or crush injuries. These abnormalities have direct implications for cardiac and neurological stability. POCT analyzers facilitate timely correction through targeted fluid and electrolyte therapy, mitigating the risk of arrhythmias and seizures in resource-constrained settings [22, 23].

Blood glucose testing is critical in humanitarian emergencies for detecting hypo- or hyperglycemia in patients with diabetes, during acute stress responses, or in case of

malnutrition [24, 25]. Insulin availability and monitoring may precipitate severe complications such as ketoacidosis or hypoglycemic coma. Portable glucometers enable immediate therapeutic interventions, improving survival in mass-casualty contexts.

Lactate measurement is an essential biomarker of tissue hypoperfusion in conditions such as septic shock and severe trauma, which are common in disasters with delayed access to care [26]. Elevated lactate levels correlate with increased mortality and inform resuscitation strategies, including fluid therapy and vasopressor use [27]. Thus, lactate monitoring may provide real-time risk stratification and prioritize limited critical care resources.

Arterial blood gas (ABG) analysis provides essential information on acid–base balance, oxygenation, and ventilation status in patients with respiratory failure, shock, or crush injuries [28]. These ABG parameters are crucial for guiding interventions such as mechanical ventilation and other therapies, supporting rapid decision-making in mobile and field-based clinical units. Modern ABG analyzers frequently offer extended panels that include electrolytes and metabolites; among these, ionized calcium is routinely measured, enabling simultaneous assessment of calcium homeostasis in acute care settings [29].

Urinalysis, which can be easily assessed by dipstick in emergency settings, offers a rapid, low-complexity screening tool for detecting urinary tract infections (e.g., nitrites), dehydration (e.g., specific gravity), renal injury (e.g., proteinuria or hematuria) and low glucose availability or impaired insulin action (e.g., ketones) [30, 31]. Its ease of use and minimal infrastructure requirements make it particularly suitable for non-laboratory environments, supporting antimicrobial stewardship and fluid management in overcrowded or resource-limited regions.

Blood grouping, including ABO and RhD typing (with extended Rh phenotyping where feasible), is essential for enabling transfusion safety in mass-casualty situations [32]. Rapid compatibility testing using portable platforms is critical to preventing hemolytic reactions in settings with urgent, high-volume transfusion needs.

Assessment of renal function with blood urea nitrogen (BUN) and creatinine is essential for detecting acute kidney injury resulting from hypovolemia, rhabdomyolysis, or nephrotoxic exposures [33]. These tests may reliably assist in differentiating prerenal from intrinsic causes and in guiding rehydration strategies, even in environments with limited access to renal replacement therapies.

Aminotransferases (ALT and AST) are useful for identifying liver injury due to ischemia, toxins, or sepsis, and for monitoring the progression of multi-organ dysfunction [34]. However, in emergency settings, most members of C-PLE

have suggested that ALT alone may provide sufficient clinical information, with AST considered potentially redundant in a minimal test panel.

Some selected coagulation parameters, namely PT/INR and APTT, are critical for detecting coagulopathies associated with trauma, disseminated intravascular coagulation (DIC), or massive transfusion [35]. Rapid assessment may facilitate the timely administration of plasma products or antifibrinolytic agents in patients with bleeding. In addition to PT/INR and APTT, D-dimer testing plays a critical role in assessing thromboembolic events and DIC in immobilized or critically ill patients [36], who are at increased risk due to trauma, sepsis, or dehydration, so that a timely assessment of D-dimer levels enables risk stratification and guides anticoagulation decisions [37].

CRP is a nonspecific marker of inflammation and may support the clinical assessment of infectious and non-infectious conditions when interpreted in conjunction with clinical findings and other laboratory parameters [38]. Although it may contribute to the overall evaluation of suspected infection, it does not reliably differentiate between bacterial and viral etiologies when used in isolation. Nevertheless, its measurement can assist in guiding clinical decision-making and support a more rational use of antimicrobial therapy in resource-constrained settings [39].

Procalcitonin provides high sensitivity and specificity for bacterial infections and sepsis, aiding in differentiating from non-infectious inflammatory states [40]. In high-mortality settings such as septic shock, it can support targeted antimicrobial therapy and contribute to antimicrobial stewardship [41].

The use of some RDTs for infectious diseases represents a cornerstone of outbreak detection and management, especially in settings with displaced, underserved, or otherwise vulnerable populations where conventional laboratory infrastructure is limited or absent [42]. By providing point-of-care or near-point-of-care test results with short turnaround times, RDTs facilitate early case identification, real-time surveillance, and prompt initiation of appropriate therapy and infection control measures, all of which are critical for interrupting transmission chains and mitigating the risk of large-scale epidemics in emergency contexts [43]. Although the definitive selection of specific diagnostic panels should be tailored to local epidemiology and pathogen prevalence at the emergency site, strategically placing validated RDTs enhances clinical decision-making, supports outbreak containment, and reduces reliance on centralized laboratory capacity. Among the RDTs identified by some members of C-PLE, some have specific clinical relevance in specific geographic regions. Malaria testing enables rapid detection of *Plasmodium* species in Sub-Saharan Africa,

South and Southeast Asia, the Eastern Mediterranean, and Latin America; Cholera testing allows timely identification of *Vibrio cholerae* O1 and O139 in Sub-Saharan Africa, South Asia, Haiti, and Yemen; Human Immunodeficiency Virus (HIV) testing facilitates determination of infection status in Sub-Saharan Africa, Southeast Asia, selected areas of Eastern Europe, and Latin America; screening for Hepatitis B surface antigen (HBsAg) supports detection of active Hepatitis B virus infection in Sub-Saharan Africa and East and Southeast Asia; Dengue virus NS1/nonstructural protein 1 and IgM/immunoglobulin M testing is used for early identification of dengue virus antigen and antibodies in Southeast Asia, Latin America, Sub-Saharan Africa, the Pacific region, and parts of Southern Europe; visceral leishmaniasis, or kala-azar, uses the recombinant K39 antigen (rK39) to identify *Leishmania* infection in East Africa and South Asia; plague testing detects the F1 capsular antigen of *Yersinia pestis*, and is especially important in Madagascar, the Democratic Republic of Congo, and Central Asia. Moreover, additionally, RDTs for Chagas disease supports detection of *Trypanosoma cruzi* infection in Latin America; Hepatitis C virus (HCV) testing enables identification of infection especially in Eastern Europe, Central and East Asia, and parts of Africa; syphilis testing facilitates detection of *Treponema pallidum* infection worldwide, with higher burdens in Sub-Saharan Africa, Southeast Asia, and Latin America; and, finally, tuberculosis testing supports identification of *Mycobacterium tuberculosis* infection, particularly in Sub-Saharan Africa, South and Southeast Asia, and Eastern Europe.

Cardiac troponins are critical for identifying myocardial injury, whether due to acute coronary syndromes or other forms of myocardial injury (e.g., blunt trauma), both of which may occur in disaster scenarios [44]. The use of novel POCT assays that can measure high-sensitivity cardiac troponins facilitates rapid cardiac risk stratification and guides appropriate therapeutic interventions [45].

Additional tests proposed by some members of the C-PLE include the urine pregnancy test, bilirubin, and lipase/amylase, which may be considered for inclusion in the minimal emergency panel.

Urine pregnancy test is essential for all women of reproductive age presenting with abdominal pain, trauma, or syncope, as it enables rapid identification of pregnancy-related complications such as ectopic pregnancy, miscarriage, or placental abruption, as well as for influencing the decision about radiation exposure [46]. This information is critical for appropriate triage, avoidance of contraindicated interventions, and prioritization of obstetric care in disrupted healthcare systems.

Assessment of total (and direct, when available) bilirubin may be important for detecting hemolysis (e.g.,

following transfusion or crush injury), hepatic dysfunction due to sepsis or toxins, and neonatal hyperbilirubinemia in settings with limited perinatal care [47, 48]. Its assessment enables timely clinical decisions regarding interventions such as phototherapy or exchange transfusion, particularly in vulnerable populations within disaster-affected areas.

The measurement of pancreatic enzymes (amylase, especially lipase) could be useful for diagnosing acute pancreatitis and other pancreatic disorders [49], especially in patients presenting with acute abdominal pain, trauma, or suspected organ injury, supporting timely clinical decision-making and appropriate management in resource-constrained or emergency settings.

A few additional tests were also suggested by individual C-PLE members, but these did not find broad consensus. These include, in descending order of frequency of inclusion, CK with or without myoglobin, LDH, GGT, comprehensive drug screening, ethanol, ammonia, and ALP. The inclusion of these additional tests may be decided on local judgment, considering ethnic, environmental, and causal factors underlying the emergency.

Conclusions

This study provides a pragmatic and consensus-driven framework endorsed by the EFLM C-PLE for prioritizing laboratory diagnostics in emergency and disaster settings. By identifying a core set of essential, critical, and supportive tests, the proposed panel balances clinical utility with operational feasibility in resource-constrained environments. The adoption of this structured approach may enhance triage efficiency, guide life-saving interventions, and support public health responses during crises. Importantly, the panel should remain adaptable to local epidemiology, available resources, and specific emergency scenarios, ensuring that laboratory services continue to play a central role in delivering effective and timely care under challenging conditions.

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References

- Lasater ME, Prager G, Choi YA, Groteclaus T, Rao D, Kamps SP, et al. Understanding relationships among climate change, conflict, migration/displacement and health in humanitarian settings: a scoping review. *Conflict Health* 2025;19:73.
- Usmany J, Barten DG, Goniewicz K, Granholm F, Poole DN, Tin D, et al. Attacks on healthcare in conflict-affected countries: a comparison of temporal trends in ongoing conflicts in Lebanon, Myanmar, occupied Palestinian territory, Sudan and Ukraine using WHO SSA and SHCC data, 2018–2024. *Popul Health Metr* 2025;24:5.
- Haar RJ, Rubenstein LS. Health in fragile and post-conflict states: a review of current understanding and challenges ahead. *Med Conflict Surviv* 2012;28:289–316.
- Elmi AH. Global health at a crossroads: WHO's 2025 emergency response to outbreaks, conflicts and humanitarian crises. *BMJ Glob Health* 2025;10:e020703.
- Lippi G, Favaloro EJ, Plebani M. Laboratory medicine and natural disasters: are we ready for the challenge? *Clin Chem Lab Med* 2010;48:573–5.
- Lippi G, Plebani M. A modern and pragmatic definition of laboratory medicine. *Clin Chem Lab Med* 2020;58:1171.
- Kost GJ, Hale KN, Brock TK, Louie RF, Gentile NL, Kitano TK, et al. Point-of-care testing for disasters: needs assessment, strategic planning, and future design. *Clin Lab Med* 2009;29:583–605.
- World Health Organization. The selection and use of essential in vitro diagnostics. 20 Avenue Appia, 1211 Geneva 27, Switzerland: WHO Press, World Health Organization; 2022.
- Lippi G, Plebani M, Favaloro EJ. The model list of essential in vitro diagnostics: nuisance or opportunity? *Diagnosis (Berl)* 2019;6:187–8.
- World Health Organization. Health laboratory facilities in emergency and disaster situations, 2nd ed. 20 Avenue Appia, 1211 Geneva 27, Switzerland: WHO Press, World Health Organization; 2017.
- Plebani M, Nichols JH, Luppia PB, Greene D, Sciacovelli L, Shaw J, et al. Point-of-care testing: state-of-the art and perspectives. *Clin Chem Lab Med* 2024;63:35–51.
- North Atlantic Treaty Organization. NATO standard AMEDP-8.5. minimum test requirements for laboratory units of in theatre military medical treatment facilities (MTFs). Edition B, version 1 June 2023. Brussels, Belgium: NATO standardization office (NSO), Boulevard Léopold III.
- Clinical and Laboratory Standards Institute. Point-of-Care testing for infectious diseases, 1st ed. West Valley Road, Wayne, PA, USA: Clinical and Laboratory Standards Institute; 2016:950 p. CLSI guideline POCT16.
- European Federation of Clinical Chemistry and Laboratory Medicine (EFLM). Committee on Preparation of Laboratories for Emergencies (C-PLE). Available from: <https://www.eflm.eu/site/who-we-are/divisions/science-division/fu/c-preparation-labs-for-emergencies> [Accessed 13 Apr 2026].
- Lippi G, Cadamuro J, Danese E, Favaloro EJ, Favresse J, Henry BM, et al. Results of the first survey of the EFLM task force preparation of labs for emergencies (TF-PLE). *Clin Chem Lab Med* 2023:e235–8. <https://doi.org/10.1515/cclm-2023-0622>.
- Lippi G, Cadamuro J, Danese E, Favaloro EJ, Favresse J, Henry BM, et al. Disruption of laboratory activities during the COVID-19 pandemic: results of an EFLM task force preparation of labs for emergencies (TF-PLE) survey. *EJIFCC* 2023;34:213–9.
- Lippi G, Cadamuro J, Danese E, Favaloro EJ, Favresse J, Henry BM, et al. EFLM task force preparation of labs for emergencies (TF-PLE) survey on cybersecurity. *Clin Chem Lab Med* 2024;63:e1–2.
- Lippi G, Akhvediani S, Cadamuro J, Danese E, García de Guadiana Romualdo L, Delacour H, et al. EFLM task force preparation of labs for emergencies (TF-PLE) recommendations for reinforcing cyber-security and managing cyber-attacks in medical laboratories. *Clin Chem Lab Med* 2024;63:27–34.
- Marin MJ, van Wijk XMR, Boothe PD, Harris NS, Winter WE. An introduction to the complete blood count for clinical chemists: red blood cells. *J Appl Lab Med* 2024;9:1025–39.
- Osa-Andrews B, van Wijk XMR, Herrera Rivera N, Seifert RP, Harris NS, Marin MJ. An introduction to the complete blood count for clinical chemists: white blood cells. *J Appl Lab Med* 2025;10:459–75.
- van Wijk XMR, Sanchez Oviol Z, Winter WE, Harris NS, Marin MJ. An introduction to the complete blood count for clinical chemists: platelets. *J Appl Lab Med* 2024;9:833–47.
- Safari S, Aghili SH, Shahlaee MA, Jamshidi Kerachi A, Farhang Ranjbar M. Incidence of electrolyte imbalances following traumatic rhabdomyolysis: a systematic review and meta-analysis. *Cureus* 2024;16:e59333.
- Fredrickson KA, Carver TW. Trauma-related electrolyte disturbances: from resuscitation to rhabdomyolysis. *Nutr Clin Pract* 2022;37:1004–14.
- Ledger E, Harawa PP, Daniel AI, Candler T, Prentice AM, Bandsma RHJ. Dysglycemia in children with severe acute malnutrition: a systematic review and meta-analysis. *Adv Nutr* 2021;12:959–68.
- Scheen M, Giraud R, Bendjelid K. Stress hyperglycemia, cardiac glucotoxicity, and critically ill patient outcomes current clinical and pathophysiological evidence. *Phys Rep* 2021;9:e14713.
- Deulkar P, Singam A, Mudiganti VNKS, Jain A. Lactate monitoring in intensive care: a comprehensive review of its utility and interpretation. *Cureus* 2024;16:e66356.
- Baxter J, Cranfield KR, Clark G, Harris T, Bloom B, Gray AJ. Do lactate levels in the emergency department predict outcome in adult trauma patients? A systematic review. *J Trauma Acute Care Surg* 2016;81:555–66.
- Castro D, Patil SM, Zubair M, Keenaghan M. Arterial blood gas. In: StatPearls [Internet], [Updated 2024 Jan 8]. Treasure Island (FL): StatPearls Publishing; 2026. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK536919/>.
- Batra P, Dwivedi AK, Thakur N. Bedside ABG, electrolytes, lactate and procalcitonin in emergency pediatrics. *Int J Crit Illn Inj Sci* 2014;4:247–52.
- Simerville JA, Maxted WC, Pahira JJ. Urinalysis: a comprehensive review. *Am Fam Physician* 2005;71:1153–62. Erratum in: *Am Fam Physician* 2006;74:1096.
- Kouri TT, Hofmann W, Falbo R, Oyaert M, Schubert S, Gertsen JB, et al. Task and finish group for urinalysis (TFG-U), European Federation of Clinical Chemistry and Laboratory Medicine (EFLM). The EFLM

- European urinalysis guideline 2023. *Clin Chem Lab Med* 2024;62: 1653–86.
32. Ramsey G. Blood transfusions in mass casualty events: recent trends. *Vox Sang* 2020;115:358–66.
 33. Gounden V, Bhatt H, Jialal I. Renal function tests. In: StatPearls [Internet]. [Updated 2024 Jul 27]. Treasure Island (FL): StatPearls Publishing; 2026. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK507821/>.
 34. Fiore M, Cosenza G, Coppolino F, Pota V, Sansone P, Petrou S, et al. Hypertransaminasemia in non-cirrhotic critically-ill patients. *World J Hepatol* 2025;17:109645.
 35. Lippi G, Adcock D, Favaloro EJ. Understanding the “philosophy” of laboratory hemostasis. *Diagnosis (Berl)* 2019;6:223–6.
 36. Lippi G, Mullier F, Favaloro EJ. Hemostasis assessment in patients suspected of venous thrombosis and pulmonary embolism in the emergency setting: challenges for clinicians. *Pol Arch Intern Med* 2026; 17263. <https://doi.org/10.20452/pamw.17263>.
 37. Hamada SR, Espina C, Guedj T, Buaron R, Harrois A, Figueiredo S, et al. High level of venous thromboembolism in critically ill trauma patients despite early and well-driven thromboprophylaxis protocol. *Ann Intensive Care* 2017;7:97.
 38. Ali S, Zehra A, Khalid MU, Hassan M, Shah SIA. Role of C-reactive protein in disease progression, diagnosis and management. *Discoveries* 2023; 11:e179.
 39. Llor C. C-reactive protein point-of-care testing to guide antibiotic prescribing for respiratory tract infections. *Expert Rev Respir Med* 2025;19:863–77.
 40. Rafiq S, Shi C, Ghosal S, Dark P, Felton T, Kontopantelis E, et al. Clinical effectiveness of procalcitonin- or C-reactive protein-guided antibiotic discontinuation protocols for adult patients who are critically ill with sepsis: a rapid systematic review and meta-analysis. *Anaesthesia* 2026; 81:556–69.
 41. Raja HAA, Afridi MJ, Asad F, Yasin K, Uzair M, Saleem Y, et al. Efficacy and safety of procalcitonin-guided antibiotic therapy versus standard of care for sepsis: a systematic review and meta-analysis. *Med Princ Pract* 2026;16:1–17.
 42. Yimer SA, Booij BB, Tobert G, Hebbeler A, Oloo P, Brangel P, et al. Rapid diagnostic test: a critical need for outbreak preparedness and response for high priority pathogens. *BMJ Glob Health* 2024;9:e014386.
 43. Lippi G, Henry BM, Mattiuzzi C. The crucial role of laboratory medicine in addressing future public health infectious threats: insights gained from the COVID-19 pandemic. *Diagnostics* 2025;15:323.
 44. Lippi G, Lavie CJ, Sanchis-Gomar F. Detecting cardiac injury: the next generation of high-sensitivity cardiac troponins improving diagnostic outcomes. *Clin Chem Lab Med* 2025;63:1941–51.
 45. Cullen L, Mair J, Hammarsten O, Stengaard C, Boeddinghaus J, Daniels LB, et al. High-sensitivity point-of-care measurement of cardiac troponin. *Eur Heart J* 2026;47:1392–402.
 46. Montagnana M, Trenti T, Aloe R, Cervellin G, Lippi G. Human chorionic gonadotropin in pregnancy diagnostics. *Clin Chim Acta* 2011;412: 1515–20.
 47. Čepelak I, Dodig S, Pavić I. Bilirubin - new insights into an old molecule. *Biochem Med* 2025;35:020501.
 48. Sonntag O, Lippi G. Clinical implications of conjugated vs. direct bilirubin testing: analytical limits and clinical consequences. *Diagnosis (Berl)* 2025;13:137–8.
 49. Basnayake C, Ratnam D. Blood tests for acute pancreatitis. *Aust Prescr* 2015;38:128–30.