

Managing Blood Transfusion Services During Armed Conflicts and Man-Made Disasters

Usman Waheed^{1*}, Akhlaq Wazeer², Noore Saba³

¹Department of Allied Health Sciences, Islamabad Medical & Dental College, Islamabad, Pakistan

²Mirpur Regional Blood Centre, Divisional Headquarters Teaching Hospital, Mirpur, Azad Jammu & Kashmir, Pakistan

³Safe Blood Transfusion Project, Provincial Ministry of Health, Peshawar, Pakistan

Conflict of interest: None

Funding source: None

Article received: 08-05-2025

Article accepted: 16-05-2025

*Correspondence:

drusman.waheed1@gmail.com

ORCID: <https://orcid.org/0000-0002-5760-5671>

ABSTRACT

Blood transfusion services (BTS) face unprecedented operational challenges during armed conflicts and man-made disasters. While natural calamities disrupt infrastructure, wars and terrorist attacks directly overwhelm medical services through mass casualties, psychological trauma, and logistical breakdown. From border conflicts to terrorism, the demand for blood increases sharply and unpredictably. This brief review outlines the operational preparedness, emergency protocols, and coordinated response mechanisms necessary for managing blood banks during conflict scenarios, using recent experiences from South Asia, especially the recent India-Pakistan context. It highlights donor management, inventory planning, national coordination, communication strategy, and institutional leadership as critical pillars of effective BTS functioning in emergencies. Pakistan's evolving experience with disaster response in BTS offers valuable lessons for the region, i.e. building a voluntary donor culture, strengthening national coordination, and never let logistics become the weakest link in crisis. As wars and man-made disasters remain an unfortunate reality in many regions, it is vital for blood services to move beyond reactive approaches toward institutionalized resilience.

Keywords: blood services, disaster, armed conflicts

Introduction

Armed conflicts and terrorism constitute some of the most disruptive forms of man-made disasters. Unlike natural calamities, these events are often unpredictable in location and intensity, demanding rapid mobilization of medical and blood transfusion resources.¹⁻³ Blood transfusion services (BTS), being at the frontline of trauma response, must maintain uninterrupted supply chains and safe practices despite collapsing infrastructure, mass panic, and overloaded health systems.⁴ The transfusion of red cell concentrates (RCC), either for stabilization prior to medical evacuation or perioperatively, is an essential element of military medical therapy in forward locations.^{5,6} Pakistan's historical and contemporary experience, whether through border tensions with India or major terrorist incidents, offers valuable lessons in managing BTS during such critical times.⁷

Nature of Man-Made Disasters

Man-made disasters impacting BTS may include armed conflict, terrorist attacks, civil

unrest, and biological threats.⁸ These situations lead to mass trauma and casualties requiring urgent transfusion support.⁸ Terrorist incidents such as bomb blasts or biological threats like anthrax can cripple regular donation channels and endanger staff and donors alike. Furthermore, war settings often result in transportation blockades, power failures, and communication breakdowns, factors that severely affect blood logistics (Table 1). An effective response must begin with anticipating these challenges and integrating BTS into the national disaster risk reduction and response framework.¹⁰

Preparedness and Planning

Emergency preparedness for BTS must begin well before the outbreak of war. This involves formulating national and provincial blood emergency plans that clearly define command hierarchies, designate regional buffer stocks, and establish partnerships with hospitals, trauma centres, military services, and humanitarian agencies.^{4,11}

Blood centres should maintain a minimum of 3 to 7 days' buffer stock of all critical blood components including red cell concentrates (RCC), platelet concentrates (PC) and fresh frozen plasma (FFP).¹² Essential supplies such as screening test kits, blood bags, reagents, and cold chain logistics must be audited and replenished regularly. Emergency drills and simulations help prepare staff and identify operational gaps.¹³ Most importantly, blood services must be embedded within the broader national disaster response system.

Table 1: Typology of Man-Made Disasters

Type	Impact on BTS
War (conventional conflict)	Mass casualties, need for large blood volumes, disruption of supply routes.
Terrorism (blasts, CBRN (chemical, biological, radiological or nuclear) threats,	Sudden influx of patients, panic-driven donor surges, compromised safety.
Civil unrest / Border skirmishes	Difficult access to facilities, intermittent demand surges.

Donor Management in Disasters

One of the defining features of war or terrorist-related emergencies is the sudden influx of willing donors, often in numbers exceeding immediate clinical need. While this reflects strong civic solidarity, it also poses risks if not properly managed.¹⁴

Effective donor management involves three critical stages: before, during, and after the crisis. Prior to an emergency, blood centres should develop and maintain an updated registry of regular voluntary non-remunerated blood donors (VNRBDs), particularly those with rare blood groups. Awareness campaigns, mobile apps, SMS-based donor alerts, and social media can be valuable tools to build this registry.

During the COVID-19 pandemic, the Regional Blood Centre in Mirpur, AJK, Pakistan, used WhatsApp to overcome donation challenges caused by lockdowns. Motivational messages and videos sent to potential donors led to a 31.65% response rate, with over half (56.34%) donating due to the WhatsApp messages. This strategy effectively engaged young adults (18-32 years) and increased female donor participation,

showing that low-cost digital tools can significantly boost blood donor outreach and mobilization efforts in disaster situations.¹⁵

During emergencies, donor flow must be regulated through appointments, staggered sessions, and triage stations.¹⁶ Preference should be given to regular donors due to their familiarity with procedures and lower risk profiles. Proper counseling, hydration stations, and first-aid provisions reduce the incidence of adverse donor reactions, especially in first-time donors and female donors in Pakistani context.¹⁷

Following the emergency, retention strategies should be employed to transform first-time donors into regular contributors. Appreciation certificates, health follow-ups, and public recognition can play a motivating role.

Media and Social Media

Communication through media, especially social media, is a double-edged sword. The role of media, both traditional and digital, is paramount in shaping public perception and mobilizing donor responses. While responsible media appeals can bridge urgent needs, uncoordinated announcements may lead to dangerous overcrowding, wastage of blood, and public confusion.¹² During the 2014 Army Public School terrorist attack in Peshawar, Pakistan, for instance, a surge of donors caused severe logistical congestion and resulted in wastage due to inadequate processing capacity. A unified media strategy, led by the national/provincial blood transfusion authority is essential. Real-time updates on requirements, safety protocols, and eligible blood groups should be disseminated through verified platforms.

Social media, if used strategically, can be a powerful tool for directing donors to appropriate locations, scheduling slots, and quelling misinformation.^{18,19} A successful example is the suicide bombing in Peshawar in January 2023, which created an immediate need for blood. Within 30 minutes of the incident, a call for donations was posted on the Peshawar Regional Blood Centre's Facebook page. The boosted post reached thousands, resulting in a threefold increase in donations compared to routine collections. Most notably, 70% of the

donors reported learning about the need through Facebook.²⁰ This case underlines the effectiveness of using social media for rapid mobilization, demonstrating how digital tools can bridge communication gaps and encourage first-time and female donors.

Inventory Management & Logistics

One of the most critical challenges during wartime is ensuring the availability and safe transport of blood and related supplies. This includes designation of cold-chain emergency vehicles for inter-city blood transfers. Blood centres must implement robust stock management protocols that align with emergency standards.²¹ It is paramount to implement First-In-First-Out (FIFO) strategy and color-coded expiry systems while maintaining buffer stocks in regional blood centres (Table 2).

Blood establishments must establish regional depots for essential supplies and pre-arranged contracts with logistics partners for emergency transport.²² Cold chain systems, mobile fridges, and power backup generators must be tested regularly. Moreover, each major city or district should maintain a list of approved suppliers and emergency contact points for reagents and consumables.²³

Table 2: Minimum Emergency Stock of Blood Components

Blood Component	Shelf Life	Minimum Emergency Stock
RCC	35 days	150–200 units
Platelets	5 days	75–100 units
FFP	1 year	50–100 units

Leadership and National Coordination

Leadership is a decisive factor in crisis response. A national blood command centre (NBCC) for blood services, linked to the Ministry of National Health Services (at the federal level), Departments of Health (at the province level) and the National Disaster Management Authority (NDMA), should be activated during crises. This centre (NBCC) must coordinate overall response, authorize media releases, manage stock movements, and liaise with military and civilian hospitals.

Leadership at the institutional level also involves training senior staff in crisis communication, decision-making under pressure, and ethical dilemmas, such as prioritizing transfusion recipients in a resource-limited scenario.²⁴

Technical Operations

In mass-casualty settings, time is of the essence for technical operations including blood grouping, cross-matching, and screening. Blood group typing and cross-matching protocols must be optimized for emergency use including electronic crossmatch algorithms. Where time permits, standard cross-matching should be followed. However, in life-threatening scenarios, group-specific or O-negative uncrossmatched blood may be issued with proper documentation.²⁵

Emergency release protocols should be integrated into the Blood Bank Management Information System (BBMIS), and a real-time inventory dashboard should allow immediate assessment of available units. All deviations from standard procedures must be documented and reported in post-crisis reviews, contributing to institutional learning and audit trails.²⁶

Staff Capacity Building

Human resources are the backbone of any BTS. During war or disasters, staff may face burnout, exposure to traumatic scenes, and moral fatigue. Capacity building of blood bank staff during disaster situations is a critical component of emergency preparedness. Staff must be trained in rapid decision-making, emergency blood testing protocols, and implementation of disaster-specific Standard Operating Procedures (SOPs). Additionally, training should cover stress management and equitable resource allocation.^{27,28}

Mock drills, rapid-response teams, and tabletop exercises simulate real-life pressures and improve readiness. Volunteer training, especially for crowd handling and post-donation care, enhances BTS performance during surges and maintains the continuity and safety of blood transfusion services during crises.^{29,30}

Table 3: Common Pitfalls and Recommendations

Challenge	Mitigation Strategy
Sudden donor surge	Controlled media messaging and pre-registration tools
Wastage of blood	Accurate forecasting and FIFO inventory handling
Lack of coordination	National Blood Command Centre
Untrained staff	Emergency refresher courses and SOP manuals
Infrastructure collapse	Mobile BTS vans and regional blood collection hubs

Conclusion

Effective management of blood services during wartime requires a synthesis of foresight, coordination, and adaptability. Blood transfusion services must be integral to national emergency preparedness frameworks (Table 3).

References

- Kuruppu KK. Management of blood system in disasters. *Biologicals*. 2010 ;38(1):87-90. <https://doi.org/10.1016/j.biologicals.2009.10.005>.
- Rajkarnikar M. Blood management post earthquake 25th April 2015. *Transfus Apher Sci*. 2016;55(2):184-185. <https://doi.org/10.1016/j.transci.2016.09.006>.
- Kruk ME, Ling EJ, Bitton A, Cammett M, Cavanaugh K, Chopra M, et al. Building resilient health systems: a proposal for a resilience index. *BMJ*. 2017;357:j2323. <https://doi.org/10.1136/bmj.j2323>.
- Zaheer HA, Waheed U. Blood transfusion service in disasters. *Transfus Apher Sci*. 2016;55(2):186-190. <https://doi.org/10.1016/j.transci.2016.09.007>.
- Crowley AE. The Medics' War: United States Army in the Korean War. Washington, DC: Center of Military History, US Army; 1987: 243.
- Kendrick DD. Preface. In: Blood Program in World War II. Washington, DC: Department of the Army, Medical Department, Office of The Surgeon General; 1964: xiii.
- Mujeeb SA, Jaffery SH. Emergency blood transfusion services after the 2005 earthquake in Pakistan. *Emerg Med J*. 2007;24(1):22-4. <https://doi.org/10.1136/emj.2006.036848>.
- Ohto H. What we have learnt from past disasters, how do we prepare for future calamities? *Transfus Apher Sci*. 2016;55(2):173-176. <https://doi.org/10.1016/j.transci.2016.09.005>.
- Abdella Y, Hajjeh R, Sibinga CTS. Availability and safety of blood transfusion during humanitarian emergencies. *East Mediterr Health J*. 2018;24(8):778-788. <https://doi.org/10.26719/2018.24.8.778>.
- Glasgow SM, Allard S, Doughty H, Spreadborough P, Watkins E. Blood and bombs: the demand and use of blood following the London Bombings of 7 July 2005--a retrospective review. *Transfus Med*. 2012;22(4):244-50. <https://doi.org/10.1111/j.1365-3148.2012.01173.x>.
- Gammon RR, Rosenbaum L, Cooke R, Friedman M, Rockwood L, Nichols T, et al. Maintaining adequate donations and a sustainable blood supply: Lessons learned. *Transfusion*. 2021;61(1):294-302. <https://doi.org/10.1111/trf.16145>.
- Doughty H, Green L. Transfusion support during mass casualty events. *Br J Anaesth*. 2022;128(2):e75-e79. <https://doi.org/10.1016/j.bja.2021.07.027>.
- Kaneko M, Nakao H, Morita K, Sone S, Masuda A, Yatomi Y. Emergency drills and exercises to prepare the initial response and countermeasures for a disaster: an evacuation simulation for the hospital's outpatient blood collection room in the event of an earthquake. *Rinsho Byori*. 2013;61(12):1101-6.
- Laermans J, O D, Van den Bosch E, De Buck E, Compennolle V, Shinar E, Vandekerckhove P. Impact of disasters on blood donation rates and blood safety: A systematic review and meta-analysis. *Vox Sang*. 2022;117(6):769-779. <https://doi.org/10.1111/vox.13255>.
- Waheed U, Wazeer A, Saba N, Qasim Z. Effectiveness of WhatsApp for blood donor mobilization campaigns during COVID-19 pandemic. *ISBT Sci Ser*. 2020;15(4):378-80. <https://doi.org/10.1111/vox.12572>.
- Schmidt PJ. Blood and disaster--supply and demand. *N Engl J Med*. 2002;346(8):617-20. <https://doi.org/10.1056/NEJM200202213460813>.
- Los APM, Waheed U, Kohorst P, Smid WM. Creation of an enabling environment for Voluntary Blood Donation in Pakistan. *Vox Sanguinis* 2012; 103 (Suppl. 1): p 100.
- Zaheer HA, Waheed U, Tahir S, Nasir K. Promotion of voluntary blood donation thorough Facebook blood donation feature in Pakistan. *Vox Sanguinis* 2019; 114 (Suppl. 1): p 23.

From preparing voluntary donor databases and managing sudden influxes, to ensuring quality control in emergencies and leading with clarity, every component matters. Pakistan's evolving experience with disaster response in BTS offers valuable lessons for the region, i.e. building a voluntary donor culture, strengthening national coordination, and never let logistics become the weakest link in crisis.

As wars, armed conflicts, and man-made disasters remain an unfortunate reality in many regions, especially in developing countries, it is vital for blood transfusion services to move beyond reactive approaches toward institutionalized resilience. Pakistan's experiences illustrate both vulnerabilities and opportunities in disaster preparedness for blood transfusion service.

19. Waheed U, Hosseini N. Social media and voluntary blood donation. *J Islamabad Med Dental Coll.* 2023;12(2):68-70. <https://doi.org/10.35787/jimdc.v12i2.1010>.
20. Saba N, Nisar M, Muhammad I, Waheed U. Use of Social Media (Facebook) to Mobilise Voluntary Blood Donors in Disasters: A Case of Suicide Bombing in Peshawar, Pakistan. *Vox Sanguinis* 2024; 119 (Suppl. S1): p 190-191. IF 2.34. <https://doi.org/10.1111/vox.13650>.
21. Stanger SH, Yates N, Wilding R, Cotton S. Blood inventory management: hospital best practice. *Transfus Med Rev.* 2012 Apr;26(2):153-63. <https://doi.org/10.1016/j.tmr.2011.09.001>.
22. Miller BT, Lin AH, Clark SC, Cap AP, Dubose JJ. Red tides: Mass casualty and whole blood at sea. *J Trauma Acute Care Surg.* 2018;85(1S Suppl 2):S134-S139. <https://doi.org/10.1097/TA.0000000000001831>.
23. Judd WJ. Requirements for the electronic crossmatch. *Vox Sang.* 1998;74 Suppl 2:409-17. <https://doi.org/10.1111/j.1423-0410.1998.tb05450.x>.
24. Bundy KL, Foss ML, Stubbs JR. Transfusion service disaster planning. *Immunohematology.* 2008;24(3):93-101.
25. Zaheer HA, Ahmed S, Waheed U, Wazeer A, et al. National guidelines for quality control in transfusion medicine. 3rd ed. Islamabad: Safe Blood Transfusion Programme, Ministry of National Health Services, Pakistan; 2020.
26. Nollet KE, Ohto H, Yasuda H, Hasegawa A. The great East Japan earthquake of March 11, 2011, from the vantage point of blood banking and transfusion medicine. *Transfus Med Rev.* 2013;27(1):29-35. <https://doi.org/10.1016/j.tmr.2012.07.001>.
27. Gorlin JB, Hick JL. Minneapolis bridges falling down: emergency transfusion preparedness. *Transfus Apher Sci.* 2013;49(3):403-7. <https://doi.org/10.1016/j.transci.2013.05.034>.
28. Zaheer HA, Waheed U, Ansari MA. Disaster management in blood transfusion services. In: A textbook on laboratory and clinical transfusion medicine. Volume 1: Organization and management. 1st ed. New York: Nova Science Publishers; 2016. p. [Chapter 15]. ISBN: 978-1-63485-004-9.
29. Nollet KE, Komazawa T, Ohto H. Transfusion under triple threat: Lessons from Japan's 2011 earthquake, tsunami, and nuclear crisis. *Transfus Apher Sci.* 2016;55(2):177-183. <https://doi.org/10.1016/j.transci.2016.09.009>.
30. Zaheer HA. Blood management in disaster situations in Pakistan. *ISBT Sci Ser.* 2012;7(1):226-9. <https://doi.org/10.1111/j.1751-2824.2012.01550.x>.