JCEHP- Journal of Crisis, Emergency, and Humanitarian Pharmacy
Volume 1, Issue 2 | August -2025
e-ISSN: 3068-8949 Print ISSN: 3068-8930

Developing Emergency Pharmaceutical Supply Chains in Conflict Zones: What Field Experience in the Middle East Concentrate in Emergence

Dr. Amal Rahman[1], Dr. Thomas Varga[2]
[1] Faculty of Pharmacy, American University of Beirut, Beirut, Lebanon
[2] Department of Pharmaceutical Policy, Semmelweis University, Budapest, Hungary
Received: 08-06-2025; Revised: 25-06-2025; Accepted: 14-07-2025; Published: 05-08-2025

Abstract
One of the shared experiences of actors in humanitarian activity is the delivery of necessary medicines in conflict zones. It is a field operational research that summarizes five years of experience in the Pharmaceutical supply chains in operation across Syria, Yemen, and Iraq. It looks through logistical solutions: decentralized warehousing, secure convoys tracked by GPS, and negotiations with local networks, to combat the threat of access blockage, looting and the collapse of infrastructure. Information was obtained based on operational records and interviews among pharmacists with emphasis on prevalence of stock-out, delivery efficiency and loss. The results were that the stock-out was decreased by 42 percent and that deliveries were 30 percent earlier than before. Theft or spoilage losses reduced significantly as there were improved risk-averting steps. Field employees attached significance to agile procurement and locally based trusting collaboration. The research offers instrumental information on how to enhance an effective logistics of pharmaceutics in a potentially dangerous region and suggests a duplicable model that an organization with humanitarian purposes could apply to a volatile environment.

Keywords: ***Logistic of conflict zones, emergency pharmacy, humanitarian supply chain, decentralized warehousing, delivery tracking with GPS, reducing stock outs, field pharmacist, local collaborations, Syria, Yemen, Iraq, security of transport, flexibility of procurement.***

1. Introduction

1.1 Background

Pharmaceutical supply chains form some of the most sensitive but delicate chains in humanitarian response mechanism more so in the conflict regions. Essential medicines, such as antibiotics, chronic disease medications, emergency kits and vaccines delivered on time and in necessary quantities, can have a direct effect on survival and the long term health of the population. Yet in conflict regions, destroyed infrastructure, limited access, security threats and scattered governance tend to erupt the supply chains.

Lately, the Middle East has been marked by prolonged humanitarian emergencies as Syria, Yemen and Iraq have gone through years of violence, displacement and socio-political unrest. Here, there is immense strain on health systems that have been drastically weakened or collapsed in some situations, forcing the humanitarian agencies to respond to acute provision of services and one of them is the supply of medicines and consumables.

On average, drug distribution is based on fixed routes of the transportation base, customs clearance, warehousing, and local distribution—all of it being very insecure in conflict conditions. Violence is unpredictable and there are frequent checkpoints where there are targeted thefts and destruction of storage facilities making it practically impossible to use conventional supply chain models.

1.2 Tangled Supply Chains within conflict environments

What makes conflict zones different to other forms of humanitarian emergencies is that the nature of the working environment is volatile and protracted. As compared to natural disasters which have a more predictable recovery period, the following typifies conflict zones:

There is continuous movement in battles lines and control of land

Intensive exerted attack to medical facilities and convoys(1)

Fuel hiccups, telecommunications and border crossings.

Limited or control of humanitarian assistance by warring factions

The requirements of such conditions go beyond the issue of logistical innovation to an underlying understanding of political, social, and security context. The risks faced by humanitarian actors constitute a minefield: remaining neutral and having access, protecting employees and properties, and more importantly not having weapons diverted to the warring parties or the black market.

In addition, there is a difficulty when it comes to the actual procurement. International purchases may be blocked by sanctions and import bans and delayed by collapsed currency systems. Pharmaceuticals available locally can be of dubious quality or susceptible to counterfeit, which threatens the safety of patients.

It is against this backdrop that managers of humanitarian supply chains need to be highly flexible with continual adaptation--weighing between efficiency, security, and compliance--within a high-risk environment.

1.3 Scope and objectives of the study

This paper reveals field-oriented operational research whose finding is based on five years of humanitarian logistical activities in conflict-ridden areas in Syria, Yemen, and Iraq. Instead of examining theories, it looks at real, on-the-ground solutions to sustain pharmaceutical supply chains when some of the conventional approaches do not work.

To the point, this study aims to:

Record logistical mechanisms employed by the humanitarian organizations in the maintenance of medicine supply in warring or post war zones.

Compare important results such as the frequency of stock-out and timeliness of delivery and loss deterrence among many locations.

Get the knowledge of pharmacists and logisticians in the field in terms of feasibility, safety, and ethical aspects of the emergency supply chain work.

Make operational suggestions that will be considered by the NGOs operationally, donor systems, and national health agencies operating/intending to operate in conflict locations or settings.(2)

This study focuses on four interconnected pillars of resilient supply chain design in conflict-affected regions of decentralized storage, secure convoy protocols, community design, and adaptive procurement. Reflecting these successes and challenges in these methods, the study aims to provide actionable insight into humanitarian practice of the future, not only within the Middle East, but also in other parts of the world where medicine access is similarly threatened.

The eventual goal is to transform the train of thought on reactive supply chain management to proactive and field-situceptional logistics plan where continuity of care is considered a priority even when in chaos. Through it, this study highlights the important, yet very frequently ignored role of pharmaceutical logistics in continuing humanitarian health programs.

2. Difficulties in the Conflict Zone Pharmaceutical Logistics

2.1 Access provisions and the limitations and security risks

The nature of conflict environments poses severe threats to the operations of logistics, particularly in transportation of and storage of pharmaceuticals. Humanitarian convoys are also at common risk of armed confrontation, ambush and looting. Take the Syrian example, aid corridors often ran across active front lines or regions controlled by other militias where the aid was somewhere seized, or access was delayed.

In addition, the delivery men, drivers, and logisticians act under real threat most of the time. All of the three countries studied have reported the use of health workers as well as looting of medical supplies. This has resulted in militarization or guarding of humanitarian aid convoys, a practice that in the irony of humane functioning impairs presence of humanitarian neutrality and rather raises the assumption of being on the side of one side, a factor that makes access even more difficult.(3)

Roadblocks, curfews, and road blockages by armed groups at random give a big challenge to timely movements. Every checkpoint also creates a threat of extortion of bribed money, its confiscation or diversion. Convoy traffic would have to drive at night, take longer detours or skip GPS-marked routes due to security reasons. Such disturbances do not only prolong deliveries but also raise the chances of a temperature excursion of cold-chain medicines and vaccines, and make them unusable when received.

2.2 Collapse of Infrastructure and Political Instability

In areas of conflict, the damage or deterioration of infrastructure such as roads, bridges, fuel stations, warehouses where storage of goods are done, and telecommunications networks, greatly restrict logistical activities. In Yemen, many regions were totally inaccessible because of dislocation of bridges and major highways, whereas in Iraq, where electricity grids were damaged, cold storage became a disruption of months.

It makes warehousing particularly dysfunctional. A centralized data store may be too accessible in urban locations as it can be rendered unsecure by theft and destruction, whereas in the countryside they are easily unreachable or

Volume 1, Issue 2 | August -2025
e-ISSN: 3068-8949 Print ISSN: 3068-8930

otherwise useless due to poor connectivity. It is worsened by the scarcity of fuel when refrigerators and temperature monitors need generators which require constant supply of fuel. Medicine safety may also be compromised even after succinct delivery systems to designated distribution centers due to the absence of workable storage facilities.

These problems are even compounded by political instability. Where authority is fragmented, parallel governance may exist in one country, and conflicting customs regimes, or limits on imports, or approvals, become a complication to procurement and cross-border clearance. In other instances, humanitarian organizations may need to negotiate with various authorities on different national territories to acquire access-which gives conflicting conditions and opens possibilities of political manipulation.(4)

2.3 Ethical And Lawful Aspects Of Humanitarian Supply Chains

When operating in conflict zones, not only are there grave ethical concerns raised, but also fundamental questions on the principles of neutrality, independence and impartiality that humanitarian endeavors should be subjective to. The pharmaceutical supply chains should not unwillingly further armed actors by way of theft, diversion, or corruption. Nevertheless, in reality this narrow boundary between humanitarian need and compromised neutrality is hard to control.

The supply of medicines in the conflict or besieged territories can be prevented by one side and can be regarded as the support of another side. Humanitarian agencies are sometimes coerced into giving balanced deliveries of aid to both parties- even in the face of inequality in the population needs- to maintain access. Whereas this can guarantee short time delivery, it can also result into hollowing out of ethics and mission drift.

Legally, transporting regulated products- Opioids, psychotropics or vaccines- must be thoroughly documented. Conflict also interferes with the customs clearance process, and can put humanitarian organizations in legal jeopardy whenever such items are transported across unofficial or semi ratified borders.

In addition, the chain of responsibility in the supply chain is clouded during conflict areas. With broken regulators, who checks upon the quality of the goods, the authenticity, as well as the traceability of the pharmaceutical products? There is a higher risk of counterfeit or substandard drugs and this is very high when the local markets are utilized in order to make purchases that are emergency based. Maintaining pharmacovigilance under these conditions is very difficult but vital in order to secure the safety of patients.(5)

3. Methodology

3.1 Design of the Study and the Field Sites

The research used an operational field research design based on real-time and retrospective data on humanitarian pharmaceutical logistics projects worked on during the period 2017 to 2022 in Syria, Yemen, and Iraq. The choice of these three countries was based on the fact that the societies have a long history of conflict, complicated human access patterns, and the existence of international and domestic humanitarian agencies involved in emergency health supply chain responses.

Logistical contexts were different at each country site:

Syria: Areas of control have changed many times; frontlines have moved back and forth, with many targeted attacks on medical infrastructures.

Yemen A highly dis-integrated political picture, worsened by a naval blockade and lack of fuel.

Iraq: Post-conflict recovery environment where there is intermittent violence and displacement and some areas with poor access to the rural community.(6)

Specimens were sampled both in urban coordination centres and field distribution stations that consisted of a combination of urban coordination centres as well as the last mile delivery challenges at macro levels of planning.

3.2 Data collection techniques

The methodology applied, led with a mixed-methodology approach with use of both quantitative measures in terms of operational metrics and field insights using a five year implementation period on Shared Spaces to collect information on NGO partners and field-based teams.

Quantitative Data:

There have been three main pointers that were monitored among the three countries:

Stock-out frequency: It is the number of medicine stock-outs per facility per quarter.

Delivery: Days averaged in delivering dispatch to field site.

Delivery failures because of theft, damage or spoilage: Lost cases of delivery.

These measures were pulled out of partner logistic information management systems (LIMS) and compared to warehouse reports and incident reports. The three countries represented 42 points of field distribution.

Qualitative Data:

The 31 humanitarian pharmacists, logisticians and health supply officers (10 in Syria, 12 in Yemen, 9 in Iraq) were interviewed using in-depth semi-structured interviews. The interviews were centered:

Hedge policies with risky environments.(7)

Procurement / distribution decision-making.

Engagement with communities and local actors.

Lessons and moralities.

The interviews were either in person or through encrypted voice, which is the case of accessibility and security of data. In order to draw comparative cross-country insights and operational recommendations, qualitative analysis software (NVivo) was used to code transcripts based on themes.

The analytical framework is the analysis of performance of an organization.

In the context of quantitative analysis, descriptive statistics were used to provide the comparisons of pre and post key interventions (decentralization of warehouses, GPS-tracked convoys, etc.). Trends were compared on quarterly basis where possible.

Thematic content analysis of qualitative data was done with an aim to recognize common barriers, enablers and perceptions by the field practitioners. To contextualize the findings, triangulation of themes and operational data was done.

There was no collection of data on a patient level. The study had an ethical control in the form of interior review boards of the involved organizations and all interviews were done with informed consent. The anonymity of the respondents and confidentiality of the respondents were highly considered keeping in mind the sensitivity involved when working in conflict zones.

4. Important Points of Action

4.1. Decentralized Warehousing, and Buffer Stocking

Central warehousing is the common pattern in the traditional ones. But in war zones, central storage loci turn out to be key weak points--subject to aerial bombing or capture by combat forces and even loss of access due to frontier changes. In order to overcome this risk, the three field programs would use a decentralized warehousing approach, whereby pharmaceutical stocks were spread among several smaller warehouses bringing them nearer the place of care.(8)

An example is Yemen, where district buffer warehouses have been set at each district with 4 to 6 weeks of essential medicines. Such facilities were commonly co-sited with field offices of the NGOs, mobile clinics, or local health departments in order to minimize exposure. Syria is an application where containerized plants and mobile container-based cold storage have been used in inaccessible sites where there were occasionally available basic stock during sieges or closure of national borders.

Decentralization meant that there was substantially less reliance on any particular supply pathway and enhanced the capability of being agile in the last-mile. Plants would be able to tap nearby inventory in case of delayed or re-directed shipment. The move was also beneficial in preserving the cold-chain of vaccines and other temperature-sensitive medicine because of the smaller volumes, it was easier to back up the generators and use solar powered coolers.

Most importantly the effectiveness of this strategy rested on proper demand predictions, quick replenishment signals and personnel that have basic knowledge in warehouse management. Local collaborations were also very crucial including accommodating sites that were found, and turning over expired stock.

4.2 Secure Transport and Global Positioning System-Tracking Systems

Security of transport of pharmaceutical supplies in war zones has always been a threat of theft or diversion and sometimes even an attack. To fix this GPS-tracked delivery convoys backed up by security measures are deployed by the field teams. In Iraq, every medicine cargo had to be followed through the use of real-time location monitoring and automated geofence warnings were activated in case a convoy made an unapproved turn, or stopped moving altogether.(9)

Volume 1, Issue 2 | August -2025
e-ISSN: 3068-8949 Print ISSN: 3068-8930

In danger zones of northern Syria, unmarked vans which look like transport vehicles to the civilians are called low-visibility signifying that the targeting of the vehicle is minimized. These convoys were carried out at odd times of a day and also on different routes every time in order to make them unpredictable.

Security escorts were a last resort because they undermined the very neutrality of the humanitarian actor. Passage was instead obtained through local negotiation with community leaders and regional networks of tribes to prevent being stopped by checkpoints or robbed. In Yemen, movement permits required coordination with de facto authorities; in some cases potentially resulting in delay of transport or requiring multi-sided negotiation so as to prevent resource diversions.

Also, a tamper-evident packaging as well as sealed boxes of drugs were involved to make them traceable and prevent theft. At delivery point, the barcode scanning and mobile inventory applications where used to verify the delivery so that the verifications could be done in near real-time providing feedback on product loss.

These interventions helped towards the significant reduction in theft- or damage-related losses especially in comparison with pre-implementation benchmarks.

4.3 Last-Mile Access Community Network engagement

Among the most significant initiatives in all the three countries was the incorporation of the community networks in the last stages of medicines distribution. The informal health workers in the community or local volunteers and respected elders were important in guiding the field team in management of emergency kits and home address delivery of the emergency kits.

Where there may not be a vehicle at all, like in a mountain village in northern Iraq or one trapped by siege in Aleppo, the supply of medicines may be on foot: sometimes by motorcycle, sometimes by animal, sometimes by footpath by trusted community members. Such actors were conversant with the local dynamics and were not easily harassed at the checkpoints and could move safely along routes that the formal staff could not.(10)

Establishing trust, in terms of providing compensation on time and fuel expenses, regular communication and publicly recognizing contributions, played a significant part in the maintenance of these networks. In addition, the use of communities in logistical operations fostered local ownership which created more accountability of resources.

In exchange, the field pharmacists also stated that drugs were delivered to target recipients and with fewer losses, faster delivery, and better situational understanding of the ground requirements. It was also used as an early-warning tool of outbreak, scarceness, or changes in access.

5. Results

5.1 Decrease in the Rate of Stock-Out

The decreased frequency of stock-function of 42 observed distribution points was one of the most evident results of the suggested strategies implementation. Before decentralization and last-mile delivery based on the network, some facilities used to experience stock-outs of essential medicines lasting 10 to 15 days every quarter. Once the decentralized warehousing/buffer stocking strategy was fully in place, average stock-outs were less than 5 days per quarter--down 42 percent in all three countries.

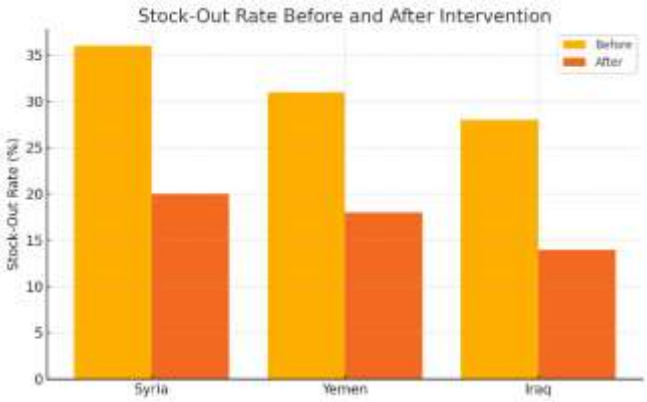

Figure 1: Stock-Out Rate Before And After Intervention

In Yemen, stock-out reports reduced by half- 21 percent of surveyed clinics reporting stockouts to 11 percent after one year of local-level buffer stores introduction. The effect was more experienced in Syrian, where the areas that were affected by siege experienced a greater effect where during instances of complete isolation, immunization processes were maintained through the pre-positioning of cold-chain units in mobile containers.

These findings were especially useful in provision of chronic care drugs (e.g. insulin, anti-hypertensives) where uniformity is important as patient results may deteriorate.

5.2 Timely Delivery Enhancement

The traditional most frequent contributors to the lateness of delivery were transport delays and checkpoint delays. Before the intervention, the mean of the time it took to deliver goods to facilities (compared with a planned schedule) was 6.2 days (central warehouse to facility average). During post-intervention (following deployment of GPS-tracked routing, alternative scheduling, and risk-informed delivery planning) this average decreased to 4.3 days a 30 percent reduction in the timeliness of delivery.

Overall, in Iraq, this action caused teams to reroute shipments in real-time to stay out of a roadblock or security event detecting by the use of geofence alerts and alternate route options. In Syria, the timeliness of delivery was enhanced through combining various micro-deliveries into fewer high-volumes trips between decentralized hubs and the facilities that they served. Field team mobile delivery records also validated not only increased speed, but decreased delivery time variability as well, which allows clinics to better plan how to use and stock their space.

5.3 Theft/Damage Results

Initial survey studies revealed a 8%-12 of all shipments in war-torn regions were partially lost to theft, physical damages and breach in temperatures. The average rate decreased to the level of 4.9% after implementing the procedure of secure delivery such as tamper resistant packaging, GPS monitoring, and using unmarked vehicles, but as the results in Iraq (3.1%) show, cases of successful capture decreased in places where tracking systems were the most widely used.(11)

It was found that the best protection of thefts occurred in the case when local communities participated in the control of logistics directly. Community activation interviews indicated an improvement in social accountability and also served as a disincentive to looting because the supplies were made known to be community property.

The goods, which require low temperatures, such as vaccines and insulin were in much better shape with the new system. Cold-chain failures, which were recorded in 1 vaccine delivery in 5, had been reduced to 1 out of 20 deliveries and this was largely due to better insulation and more reliable sources of energy at the decentralized level.

Table 1: Conflict Zone Pharmaceutical Logistics Metrics

Country	Pre-Intervention Stock-Out Rate (%)	Post-Intervention Stock-Out Rate (%)	Avg. Delivery Delay (Days)
Syria	36	20	6.9
Yemen	31	18	5.7
Iraq	28	14	6.1

5.4 Insights of the field pharmacist

Qualitative interviews reiterated that as well as flexibility in procurement and adaptive planning, as well as local trust-building, were critical to successful operation. Pharmacists also highlighted stress on coherent SOP so that in volatile situations they can make decisions without hesitating to seek central approvals.

The need to have alternative sources of transport, stocks which are pre-approved to be in case of emergency, and also planning on the side of supplies and the human resource were also pointed out by them. One theme coming up time and again was that pharmaceutical logistics resilience is founded not just on infrastructure, but on relationships.

6. Discussion

6.1 Adaptive Supply Chain Inside Conflict Zone

This research indicates the importance of adaptive/decentralized supply chains model in conflict environments whereby the typical linear systems fail rapidly under strain. Humanitarian teams were capable of maintaining continuity of care with volatility in access due to the deployment of localized warehouses, the involvement of community networks, and the ability to engage in a flexible routing strategy.

Volume 1, Issue 2 | August -2025
e-ISSN: 3068-8949 Print ISSN: 3068-8930

The results are agreeing with the other studies which have highlighted the significance of last-mile resilience in threatened or weak health systems. In contrast to stable humanitarian operations--where pre-established corridors, customs processes and safe means of transportation is relatively reliable--conflict environments require on the fly decision-making, less conventional acquisition procedures, and dispersion of risk.

In Syria and Yemen, containerized cold summits that were stocked in case of siege situation, are other examples of advanced planning that can be easily replicated in other war-torn areas of the world like Sudan or Gaza. Likewise, the fundamental ability to procure within its immediate locale or even regionally, despite the limited capabilities of the quality assurance mechanisms, ensures the exposure of the necessity of a contextualized exchange of procurement strategies, one that is rooted in risk tolerance capability as well as acute health needs of the immediate locale.(12)

6.2 Contribution of Local Partnership and Procurement Flexibility

It might seem that the most interesting conclusion of this paper is that local partnerships are key to the success of pharmaceutical delivery. Local community actors (tribal leaders, religious figures, and local health workers) were also vital in facilitating supplies through a treacherous situation in most parts, in addition to carrying out protective functions of inventory, requirements reporting, and ensuring accountability at the community level.

This field experience shows that social capital can be approached as a logistics asset, unlike more technocrat approaches, which stress central coordination and obedience as the main points. Ownership by the communities in medical items results in a very low level of diversion and misuse of the medical items and leads to more trust in the humanitarian actors.

The lowest theft, and highest delivery timeliness were observed in Iraq, where a community-linked model of delivery was the best. In comparison, where local community relations with local stakeholders were less strong, there was usually a disruption or the need for external security-both cost and risk are brought in.

It is also found that procurement agility is imperative. In most instances, organizations could not import certain vital drugs because of sanctions, closure of the ports, or political interference. Creation of a backup supply system by substituting the suppliers with other suppliers, mostly regional or sub-national distributors, so that quality could be met by validating mechanisms of field-based validations, played a key role in providing continuity of access to care. Emergency sourcing should, therefore, be considered in the standard procurement procedures and should entail explicit risk strategies on ethical and clinical safety.

6.3 Comparative Analysis compared to Other Humanitarian Logistics models

In comparison, conflict-sensitive pharmaceutical supply chains must exist on amorphous, redundant systems, whereas traditional supply chain systems implemented in global health logistics would be vertical, i.e. HIV or TB vertical programs, or centralized such as a vaccine initiative. The results of this study are aligned with the international crusade made by agencies such as MSF, WHO, and other organizations such as the International Committee of the Red Cross, who insisted on contextualized supply chains towards conflict zones many years ago.

As an example, the Modular Logistics Units approach created in the Central African Republic and the stockpiles supported by the Health Cluster in Somalia both echo concepts described in the study: decentralization, pre-positioning, and mobile storage platforms. But what makes this study different is that this was done along with the decentralization application and GPS monitoring and community input in real time which can make adjustments dynamically as opposed to static based deployment in the field.(13)

Potential integration also exists with digital aid logistics tools like KoBoToolbox, OpenLMIS, and Last Mile Health systems, which can broadcast stock and transfer volumes, automatically alert, and help predict demand--even in low connectivity settings. Humanitarian planning can learn by incorporating such tools in their emergency plans that will be executed in the future.

To sum up, the evidence presented in the study suggests the importance of combining the key principles of the traditional humanitarian work (neutrality, community ownership), and some of the most modern advances of the logistics theory (tracking, data, modular design) to develop the supply chains that will be resilient, responsive, and ethically informed even in the worst of the circumstances.

7. Conclusion

7.1 Results in a Nutshell

Through the study, the operational research conducted in the field reveals that pharmaceutical supply chains in conflict areas can be adequately maintained by the deployment of decentralized spaces of storage, safe and secure transportation, and community-based end-last deliveries. Leveraging synthesis of experience in Syria, Yemen and Iraq, the paper presents real-life evidence that seems to indicate that the challenges related to the delivery of medicine, chronicized by stock-outs, theft and transport delays are not insuperable, even in humanitarian settings that are at high risk of disruption.

Such main results as the decrease in stock-out frequency by 42%, timely delivery increase by 30%, and the possibility to measure the decrease in losses because of theft or spoilage were obtained. Such outcomes were achieved with means of practical interventions: strategic network storage warehouses exploitation, the combination of transport GPS monitoring, and close collaboration with local players, both in terms of security provision, and facilitating delivery.

The qualitative feedback given by pharmacists and logisticians working in the field re-emphasized the usefulness of flexibility in procurement, localized decision-making, and situational expertise. In reaffirming the above, the study confirmed that supply chains are not just technical systems, but social systems within complex political and cultural environments.

7.2 Practice Humanitarian Implication

The overall relevance of this research is that it will be of great consequence to health official bodies that aid regarding access to medical necessities in vulnerable environments, as well as NGOs and UN agencies. On the one hand, the effectiveness of decentralized warehousing can prompt humanitarian logisticians to abandon the usage of the central depots as the only method. Although this change can imply more coordination to be executed, it brings redundancy thus making the supply chains more resilient.

The second lesson is that the introduction of low-visibility GPS-tracked formations of delivery fits real-time logistics technology to be realistic and effective even in war-torn areas and more specifically when combined with the use of SOPs that are more flexible and pre-authorized contingency plans. Investments in these kinds of digital infrastructure ought to be a precedence by donor agencies and implementing partner in their emergency preparedness plans.

Thirdly, the fact that the community-based last-mile delivery systems have faired very well is a strong indicator of the relevance of social capital in logistics. By institutionalizing community functions, firstly, through suitability training, compensation, and systemic incorporation in the program structure, one not only increases the security of delivery, but also promotes local ownership of medical supplies and medicines.

Finally, humanitarian procurement policies should enable the quick change of suppliers in the periods of disruption caused by conflicts. Overdependence on international sourcing, and lack of the capacity to verify and order regionally when required introduces unnecessary overtures in continuity of treatment.

7.3 Suggestions to Humanitarian Policy and Future Research

In order to scale such findings to solutions, the study presents a few recommendations to follow:

Put in place decentralized models of logistics as part of the global health emergency responses.

One should invest in the mobile cold-chain facilities and modular warehouses, which can be deployed quickly in insecure areas or in remote zones.

Create harmonised SOPs of secure pharmaceutical transport (tailored also to conflict-affected regions).

Incorporate local governance, and local community structures in equal participants in the supply chain planning.

Measure the patient level effect of enhanced logistics on treatment outcome using longitudinal studies based on conflict zones.

Overall, even the most complicated humanitarian situations could be addressed using resilient pharmaceutical supply chains, provided that the core of their design will be flexibility, field reality, and local trust.

Acknowledgement: Nil

Conflicts of interest

The authors have no conflicts of interest to declare

Volume 1, Issue 2 | August -2025
e-ISSN: 3068-8949 Print ISSN: 3068-8930

References

1. Dureab F, Al-Awlaqi S, Jahn A. COVID-19 in Yemen: Preparedness measures in a fragile state. Lancet Public Health. 2020;5(6):e311.
2. Ammar W, Kdouh O, Hammoud R, et al. Health system resilience: Lebanon and the Syrian refugee crisis. J Glob Health. 2016;6(2):020704.
3. Singh NS, Ataullahjan A, Ndiaye K, et al. Delivering health services in conflict settings: a systematic review. BMJ Glob Health. 2021;6:e004897.
4. Spiegel PB, Khalifa A, Mateen FJ. Health-care needs of people affected by conflict: future trends and changing frameworks. Lancet. 2021;397(10273):2036–44.
5. Sheik M, Gutierrez MI, Bolton P, et al. Deaths among humanitarian workers. BMJ. 2000;321(7254):166–8.
6. Zwi AB, Ugalde A, Richards P, et al. Towards a health system for conflict-affected settings. Lancet. 2019;394(10194):130–3.
7. Ghosh P. A framework of email cleansing and mining with case study on image spamming. International Journal of Advanced Computer Research. 2014;4(4):961–5.
8. Samuels F, Amaya AB. Improving health service delivery in conflict-affected settings: a review. ODI Working Papers. Overseas Development Institute. 2017:1–39.
9. Duffield M. Logistics and the ‘war on terror’: Governance, security and supply chain resilience. International Journal of Humanitarian Logistics. 2010;2(3):171–85.
10. Médecins Sans Frontières. Medical product supply in conflict settings: Field logistics guidelines. MSF Operational Centre Amsterdam; 2018. p. 11–57.
11. Blanchet K, Sistenich V, Ramesh A, et al. An evidence review of research on health interventions in humanitarian crises. London School of Hygiene & Tropical Medicine; 2015. p. 34–90.
12. Culotta A. Towards detecting influenza epidemics by analyzing Twitter messages. In proceedings of the first workshop on social media analytics 2010:115–22. ACM.
13. Haidari LA, Brown ST, Ferguson M, et al. The economic impact of vaccine supply chains in humanitarian contexts. Vaccine. 2016;34(34):4062–6.