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War-Related Infectious Disease Outbreaks: Dynamics, Determinants, and Public Health Responses

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ABSTRACT

Armed conflict creates unique epidemiological conditions that intensify the emergence, transmission, and impact of infectious disease outbreaks. This review synthesizes evidence on the historical evolution, transmission dynamics, and public health challenges associated with war-related epidemics. Conflict settings alter disease patterns through mass population displacement, overcrowding, degradation of water, sanitation, and hygiene (WASH) infrastructure, collapse of governance, and disruption of routine health services, including vaccination. Surveillance and laboratory capacities are weakened, leading to delayed outbreak detection and distorted epidemiological visibility. Using a combination of epidemiological models, case studies from Nigeria, Syria, and other conflict zones, and documented humanitarian responses, the paper explores how conflict-driven determinants shape outbreak trajectories and complicate interventions. The findings highlight persistent operational barriers, including restricted access to affected populations, inadequate supply chains, and limited vaccination coverage in insecure regions. The review underscores the need for strengthened surveillance systems, coordinated humanitarian action, and resilient health systems capable of withstanding crisis-induced shocks. Ultimately, effective management of war-related infectious disease outbreaks hinges on integrating emergency response with long-term system recovery, governance reinforcement, and ethical humanitarian engagement.

Keywords: War-related outbreaks, Conflict epidemiology, Public health response, Disease surveillance, and Humanitarian health systems.

INTRODUCTION

Modern conflict gives rise to infectious disease outbreaks resulting from population movement, aggregation, and compromised public health systems, counterintuitive phenomena with root causes embedded within broader warfare dynamics [1]. Refugee flows introduce pathogens to new locations. Combatants enter population centers, disrupting normal health-seeking behavior and triggering disease if pathogens are present. Stigmas attached to disease labels exacerbated through laboratory capacity erosion and media inaccuracy lead to non-reporting of outbreaks and distort epidemiological visibility, further magnifying human toll [3, 4]. "Outbreaks" designates war-related epidemics exceeding baseline endemic incidence yet not necessarily endemic in affected regions [2]. Such conditions emerge from troop movement and military public health measures targeting malnutrition, endemic pathogens, and war injuries; after fighting ceases, heightened access to shelter and reduced population density often lowers infectious pressure [1].

Historical Overview of War-Related Outbreaks

Armed conflicts are often accompanied by the emergence or re-emergence of outbreaks of infectious diseases, which exert a profound impact on military operations [2]. Examples include malaria among United States troops in Somalia, dengue during U.S. military operations in the Philippines and Afghanistan, and gastroenteritis among Marines during Operation Iraqi Freedom. Disease outbreaks challenge military effectiveness and public health preparations, while simultaneously altering the health infrastructure and socio-economic conditions of affected areas [3]. The World War II experience illustrates the potential consequences of the exacerbation of infectious disease recurrence in conflict zones and the effectiveness of preventive measures against their emergence [5, 12].

A chronology of epidemic outbreaks during warfare reveals temporal patterns, the conflict-epidemic nexus, and the scope of affected regions and involved actors [8]. Transmission dynamics in conflict environments differ in several crucial dimensions from those occurring under natural disasters and in humanitarian emergencies. In essence, armed conflicts create supplementary determinants that facilitate the spread of infectious diseases, which are termed war-related outbreaks [9]. War, military engagement, and armed conflict represent interchangeable terms describing the politico-military situation leading to contagious disease dissemination, depending on the definitions and time frame of the broader analysis [9]. For the observation of infection propagation during warfare, the spread of contagious diseases in strictly defined military zones (including frontlines and defensive positions) is not considered a war-related outbreak. War may also be understood as a broader category that encompasses professional military deployments, partial military presence, sub-conflict situations, civil unrest, and protracted hostile scenarios [11].

Epidemiological Dynamics in Conflict Settings

The patterns and determinants of infectious disease dynamics in war environments differ sharply from those in non-war settings [4]. Among the factors influencing dynamics are war-related population movements, disruptions in public health intervention coverage and delivery mechanisms, and the nature of host and vector interactions at the affected sites [5]. War-induced population displacement often enhances contact rates among individuals, thus accelerating the spread of infections with having low Basic Reproductive Number (R0)[5]. In the post-conflict phase, prolonged attendance at educational facilities reduces the probability of curtailing personal contacts with peers, particularly among young age-groups [8]. Additional drivers of disease dynamics during war include the nature of the conflict, the extent of state authority, geographical area exposed to the conflict, the level of humanitarian access, and the socioeconomic status of the population [9]. At the early stages of an outbreak, the impulse-response function may behave differently compared to subsequent phases [12]. A susceptible-infected-susceptible (SIS) framework is frequently employed to represent pathogen transmission often inherent to war settings, such as army worms and tuberculosis [10]. In addition to the SIS paradigm, a susceptible-infected-recovered (SIR) model could also be utilized, particularly for those pathogens capable of imparting long-lasting immunity upon recovery, including cholera, hepatitis A, and typhoid. When the immediate goal of public health intervention is to avert a second peak, the transmission model remains prominent since the time-lapse between the occurrence of the first and subsequent peaks offers predictive knowledge towards curbing further spread [12].

Determinants and Drivers of Transmission

Outbreaks of infectious diseases in conflict-affected regions can intensify when war disrupts water and sanitation infrastructure, governance structures, and social norms [5]. Damage to water, sanitation, and hygiene (WASH) facilities, which typically provide bacteriologically safe water and assured hygiene cleaning for households, creates environments conducive to the transmission of waterborne, water-washed, and foodborne diseases [5]. Damage to WASH facilities, coupled with weakened household conditions such as reduced mobility, access to markets, and nutrition, increases the risk of both the microbiological and food challenges associated with WASH-related diseases [6]. Other risk factors that contribute to the transmission of infectious diseases during war include the destruction of shelters, deterioration of food availability and quality, disruption of vaccination coverage, civil unrest (social distancing), closure of recommended health establishments, and stripping of health subsidies and assistance from the government [7]. The absence or vacuum of security and governance leads to public distress, prompting acts of public violence, war movements, armed robbery, migrations, and rural-urban or intra-border movements [8]. Such disintegration of governance leads communities to turn to local leaders for resolutions, which form alternative types of government structures [8]. These newly formed structures might not be fully recognized and supported, leading to delays in the arrival of humanitarian assistance and services, further impeding normal health-seeking behavior [10]. During such periods, people find themselves in need of assistance and protection; hence, the absence of an armistice or intervention to regain security and order during conflict can prolong the requirement for humanitarian assistance and adversely influence the transmission and distribution of outbreaks [4].

Surveillance, Detection, and Laboratory Capacity in Crisis Contexts

The outbreak of infectious disease during conflicts is facilitated by the breakdown of international and national surveillance systems, coupled with limited laboratory detection capacity and insufficient epidemiological variables [7]. Central recommendations include adopting ready-to-use specimen transport kits, establishing rapid-response teams grounded in governmental ministries or humanitarian organizations, sharing epidemic intelligence through accessible and immediate platforms, implementing simplified reporting and case definitions in both health and veterinary structures, and exchanging knowledge and standards across all health venues for the prevention, detection, and control of biological threats [6]. Crisis-based monitoring initiatives implemented in Afghanistan, Iraq, Niger, and various emergency situations underscore the need for comprehensive methods of disease analysis and response [7]. Crises impede the monitoring of human health and animal diseases, yet certain events

nevertheless attain recognition as public health emergencies [9]. Investment is essential to create an information strategy to improve health security and surveillance at the intersection of human, animal, and ecosystem areas. Establishing high-performance pathogenic surveillance with minimal effort dictates a balanced program able to fulfil both manageable short- and long-term objectives under the continuing aggravation of crisis circumstances. Eventually, laboratory capacity, analysis, and individual management are favorable to communal health security [11]. The implementation of a public health investigation system during a crisis that emphasizes coverage within a public health framework can be readily and rapidly executed, and once developed, will not only ameliorate health coverage but also present national health partners concerned with surveillance, detection, reassurance, and awareness of communication capacities supporting protective measures and crisis prevention [8].

Public Health Interventions and Operational Challenges

Interventions typically comprise nonpharmaceutical actions first, followed by vaccinations when conditions permit. Initial measures involve outbreak containment, field investigations, case management, and sanitary improvements alongside risk communication to guard against misinformation and complacency [4]. Operational realities restrict vaccine use and escalation, although supply chains can adapt to availability. Public health responses in wars face complex challenges; foundational interventions often lack full implementation before vaccination becomes feasible [6, 9].

Vaccination Strategies and Immunization Gaps

Immunization is a cost-effective strategy for disease prevention and control, saving millions of lives annually. Comprehensive vaccination coverage not only protects individual children but also prevents the spread of outbreaks that can affect surrounding populations [11]. Despite great advances in vaccine development and delivery, children and communities in conflict zones often remain unvaccinated and at high risk for outbreaks of vaccine-preventable diseases [12]. In these situations, the need to reach and vaccinate vulnerable populations in conflict and humanitarian emergencies is more urgent than ever, as unvaccinated individuals are poorly protected against infections and susceptible to outbreaks of diseases such as measles, diphtheria, cholera, and polio [10].

Case Studies of Recent Conflicts and Outbreaks

Epidemiological data from several recent war-related outbreaks shed light on the disease dynamics, the factors that shaped transmission, and the public health responses that were attempted. Conflict settings are expected to influence infectious disease outbreaks [3]. The situation is complex, since strategic considerations and environmental factors determining disease spread vary widely across conflicts. Yet, case studies can offer insights into the types of interventions that are likely to be effective and inform future efforts [6]. The Boko Haram insurgency in Nigeria, ongoing since 2009, has been accompanied by violence against the population and armed conflict between the insurgents and the military [7]. These events have caused mass displacement toward camps and host communities, restricting movement outside for many and greatly hampering access to public services. With more than 4,000,000 people currently displaced and approximately 100,000 formal deaths recorded attributed to the violence, humanitarian support inside Nigeria remains limited, and security incidents affecting humanitarian workers continued to occur in 2022 [6]. Cholera outbreaks linked to mass population movements and disruptions of WASH infrastructure have afflicted Nigeria, Burkina Faso, and Chad, with the largest outbreak registered in Nigeria due to the number of affected states and the mortality rate [9]. The first cholera cases of the ongoing outbreak were reported in 2010. Although the outbreak had been confirmed in several states prior to the insurgency, incidence was limited and did not constitute a sufficient public health problem [10]. From 2012 onward, cholera transmission in the 18 northern states of Nigeria increased during the rainy season, with humanitarian access severely compromised [4]. In the Syrian Arab Republic, mass demonstrations and subsequent armed conflict resulted in a division of the country into five areas controlled or contested by various militant factions [9]. The population has been greatly affected by direct violence, while widespread disruption of the public water supply led to a sharp increase in infectious diseases [5]. The northern area has been targeted by cross-border aerial bombardments as well as ground assaults. However, important bacteriological detection efforts, public communication of the outbreak risk, and rapid vaccination through cooperation with the Turkish authorities have enabled a considerable degree of control of vaccine-preventable diseases despite the ongoing armed conflict and restrictive security measures [8].

International Collaboration, Humanitarian Response, and Ethical Considerations

Conflicts often produce unprecedented humanitarian crises that threaten the safety and well-being of civilians. Even in the absence of large-scale violence, the toll associated with armed disputes, including injury, death, and destruction of infrastructure, can be devastating [11]. Although contagious disease challenges arise during many humanitarian crises, epidemic risks surge during wars. Conflict erodes health systems and removes many vital public services from the humanitarian equation [4]. The resulting public health landscape resembles the conditions that preceded the establishment of a widely accepted health system in the early twentieth century. A look at past conflicts reveals the expansive scope of deadly, war-related outbreaks, the wide array of pathogens

that circulate, and the variety of possible public health responses [6, 9]. International institutions, governments, and humanitarian organizations around the world are increasingly coordinating efforts to respond to disease outbreaks estimated to occur soon after the onset of armed conflicts.

Resilience, Recovery, and Health System Reinforcement

During and after conflict, health systems remain under great stress, yet the war-related infectious disease dynamics persist. Resilience from the 2014-15 Ebola outbreak emphasized the need for health systems to withstand shocks [11]. Resilience measures the ability of people and systems to refocus and recover to lessen the effects of shocks. Aven and Zhang note that resilience reflects a system's cyclic motion toward equilibrium in the presence of shocks. The idea resonates temporally with stop-and-go or on-off system behaviour, yet the introduction of disorder or irregularity results in increasingly complex system behaviour rather than a uniformly stabilizing force [11-14]. A similar definition presents recovery as a state in which a certain level of health system performance prevails, even if different from pre-crisis conditions. Health systems face shocks from armed conflicts, direct destruction of health facilities and personnel, or the disruption of commercial supply chains for medical supplies and vaccines. However, secondary and tertiary recovery assessments acknowledge physical infrastructure, health personnel's well-being, governance, and social cohesion as equally important [15-17].

CONCLUSION

War-related infectious disease outbreaks represent a complex interplay between biological, social, environmental, and political determinants that are exacerbated by the unique vulnerabilities created by armed conflict. The collapse of public health systems, coupled with mass displacement, overcrowding, inadequate WASH infrastructure, and disrupted vaccination programmes, produces fertile conditions for epidemics of both endemic and emerging pathogens. These challenges are compounded by weakened surveillance systems and limited laboratory capacity, resulting in delayed detection, underreporting, and impaired response coordination. The case studies from Nigeria, Syria, and other conflict zones demonstrate that outbreaks in wartime contexts are not merely biological events but are deeply shaped by conflict dynamics, governance failures, and humanitarian access restrictions. However, they also show that effective, timely interventions such as targeted vaccination campaigns, cross-border collaboration, rapid-response surveillance, and community engagement can mitigate disease spread even under extreme insecurity. Strengthening resilience and recovery in post-conflict settings requires more than rebuilding infrastructure; it demands restoring governance systems, improving health workforce capacity, and enhancing social cohesion. Integrating emergency response with long-term health system strengthening is essential for preventing recurrent outbreaks and ensuring continuity of essential services. Ultimately, reducing the burden of war-related infectious disease outbreaks relies on sustained international cooperation, ethical humanitarian action, and investment in robust surveillance across human, animal, and environmental interfaces, and the political will to protect civilian health during conflict. A resilient, responsive, and well-coordinated public health system remains the most effective defense against the compounded threats of war and disease.

REFERENCES

1. Morens DM, Folkers GK, Fauci AS. The challenge of emerging and re-emerging infectious diseases. Nature. 2004 Jul 8;430(6996):242-9.
2. Ho ZJ, Hwang YF, Lee JM. Emerging and re-emerging infectious diseases: challenges and opportunities for militaries. Military Medical Research. 2014 Sep 24;1(1):21.
3. Ugwu CN, Ugwu OP, Alum EU, Eze VH, Basajja M, Ugwu JN, Ogenyi FC, Ejemot-Nwadiaro RI, Okon MB, Egba SI, Uti DE. Sustainable development goals (SDGs) and resilient healthcare systems: Addressing medicine and public health challenges in conflict zones. Medicine. 2025 Feb 14;104(7):e41535.
4. Mertens JE. A history of malaria and conflict. Parasitology Research. 2024 Mar;123(3):165.
5. Kraemer MU, Pigott DM, Hill SC, Vanderslott S, Reiner Jr RC, Stasse S, Brownstein JS, Gutierrez B, Dennig F, Hay SI, Wint GW. Dynamics of conflict during the Ebola outbreak in the Democratic Republic of the Congo 2018–2019. BMC medicine. 2020 Apr 27;18(1):113.
6. Ugwu OP, Alum EU, Ugwu JN, Eze VH, Ugwu CN, Ogenyi FC, Okon MB. Harnessing technology for infectious disease response in conflict zones: Challenges, innovations, and policy implications. Medicine. 2024 Jul 12;103(28):e38834.
7. McPake B, Witter S, Ssali S, Wurie H, Namakula J, Ssengooba F. Ebola in the context of conflict affected states and health systems: case studies of Northern Uganda and Sierra Leone. Conflict and health. 2015 Aug 8;9(1):23.
8. Charnley GE, Kelman I, Gaythorpe K, Murray K. Understanding the risks for post-disaster infectious disease outbreaks: a systematic review protocol. BMJ open. 2020 Sep 1;10(9):e039608.
9. Ongesa TN, Ugwu OP, Ugwu CN, Alum EU, Eze VH, Basajja M, Ugwu JN, Ogenyi FC, Okon MB, Ejemot-Nwadiaro RI. Optimizing emergency response systems in urban health crises: A project management approach to public health preparedness and response. Medicine. 2025 Jan 17;104(3):e41279.

10. Ear S. Emerging infectious disease surveillance in southeast Asia: Cambodia, Indonesia, and the US naval area medical research unit 2. Asian Security. 2012 May 1;8(2):164-87.
11. Tambo E, Xiao-Nong Z. Acquired immunity and asymptomatic reservoir impact on frontline and airport ebola outbreak syndromic surveillance and response. Infectious diseases of poverty. 2014 Oct 29;3(1):41.
12. Ugwu CN, Ugwu OP, Alum EU, Eze VH, Basajja M, Ugwu JN, Ogenyi FC, Ejemot-Nwadiaro RI, Okon MB, Egba SI, Uti DE. Medical preparedness for bioterrorism and chemical warfare: A public health integration review. Medicine. 2025 May 2;104(18):e42289.
13. McKay G, Parker M. Epidemics. InHumanitarianism 2018 Jun 27 (pp. 81-95). Routledge.
14. Mantel C, Cherian T. New immunization strategies: adapting to global challenges. Bundesgesundheitsblatt-Gesundheitsforschung-Gesundheitsschutz. 2020 Jan;63(1):25-31.
15. Hanefeld J, Mayhew S, Legido-Quigley H, Martineau F, Karanikolos M, Blanchet K, Liverani M, Yei Mokuwa E, McKay G, Balabanova D. Towards an understanding of resilience: responding to health systems shocks. Health policy and planning. 2018 Apr 1;33(3):355-67.
16. Paul-Chima UO, Ugwu CN, Alum EU. Integrated approaches in nutraceutical delivery systems: optimizing ADME dynamics for enhanced therapeutic potency and clinical impact. RPS Pharmacy and Pharmacology Reports. 2024 Oct;3(4):rqae024.
17. Raslan R, El Sayegh S, Chams S, Chams N, Leone A, Hajj Hussein I. Re-emerging vaccine-preventable diseases in war-affected peoples of the eastern Mediterranean region—an update. Frontiers in public health. 2017 Oct 25;5:283.

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