

# The collapse of water, sanitation, and hygiene systems in Gaza: Public health implications and global security perspectives

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**Abstract.** Since the escalation of large-scale conflict in October 2023, severe destruction of civilian infrastructure has occurred in the Gaza Strip, including the collapse of Water, Sanitation, and Hygiene (WASH) systems. This breakdown has rapidly triggered a public health emergency with short-, medium-, and long-term consequences. Short-term impacts included marked increases in infectious diseases such as diarrhea and hepatitis A, acute malnutrition, and elevated risks to maternal and child health. Medium-term impacts involved ecological degradation through groundwater contamination and sanitation system failure, which in turn contributed to rising clean-water prices and widening socio-economic inequalities, disproportionately affecting women and children. Long-term impacts generated intergenerational risks, including the potential emergence of a “lost generation” due to stunting and increased global health security concerns associated with transboundary disease spread. Comparative evidence from Yemen, Syria, Sub-Saharan Africa, and Indonesia (Aceh and Papua) indicates similar epidemiological patterns, in which WASH destruction is associated with cyclical epidemics, malnutrition, and deepening structural vulnerability. Using a descriptive qualitative approach based on a review of academic literature, international organizational reports, policy documents, and credible media sources, this study systematically examines the implications of WASH system collapse for public health in Gaza during the ongoing genocide. The analysis develops a conceptual framework that positions the WASH crisis not only as a humanitarian concern but also as a public health emergency with regional and global ramifications. On this basis, the study concludes that effective WASH reconstruction should be prioritized as a humanitarian and global health security strategy and integrated with nutrition, maternal-child health, and social protection programs. The findings also underscore the need for comprehensive international policy responses and reinforce arguments for recognizing the protection of WASH infrastructure as a fundamental human right in armed conflict.

**Keywords:** Armed Conflict, Global Health Security, Humanitarian Infrastructure, Public Health Crisis, Water Sanitation and Hygiene (WASH)

## Introduction

Since the escalation of large-scale conflict in October 2023, civilian infrastructure in the Gaza Strip has suffered extensive destruction, including critical Water, Sanitation, and Hygiene (WASH) systems such as water supply networks, pumping stations, wastewater treatment facilities, and solid waste management services (Hall et al., 2024). The collapse of these vital systems has created a serious public health threat in both the short and long term. Beyond the direct casualties of attacks, WASH disruption opens pathways for the spread of infectious diseases, exacerbates malnutrition, and increases maternal and child morbidity, potentially resulting in substantial indirect mortality.

The situation has been further aggravated by fuel shortages and restrictions on humanitarian aid, which have disrupted the operation of water and wastewater treatment facilities (Anera, 2024). Recent reports estimate that more than 70% of Gaza's water and sanitation infrastructure has been damaged or destroyed, while nearly 96% of households lack access to safe drinking water (Hasimy, 2025; Idrus, 2025). This situates the water and sanitation crisis as one of the most visible dimensions of the ongoing genocide, with multidimensional impacts on public health (Al-Khishawi & Abed, 2024).

The collapse of WASH systems in Gaza affects not only public health but also the environment. Wastewater contamination of groundwater and marine environments poses long-term ecological risks, threatening freshwater resources for future generations. Meanwhile, inadequate sanitation increases the accumulation of solid waste, exacerbating air pollution and accelerating the spread of disease vectors.

From a socio-economic perspective, the breakdown of water and sanitation systems has contributed to rising clean-water prices and forced households to rely on unsafe alternatives, thereby deepening inequalities between vulnerable groups and those with better access. The heaviest burden falls on women, children, older persons, and persons with disabilities. Women, in particular, face additional risks related to reproductive health, menstrual hygiene management, and intensified caregiving responsibilities.

Previous studies have highlighted a strong link between WASH collapse and public health threats in conflict zones. For instance, Perlman et al. (2025) demonstrated that the destruction of pipelines and fuel shortages in Gaza led to a substantial reduction in water availability, triggering increases in diarrhea and skin diseases among children. Zinszer and Abuzerr (2024) emphasized that the breakdown of sanitation services accelerated wastewater contamination of groundwater—the only available resource for many communities—thereby significantly increasing the risk of waterborne diseases.

Khan et al. (2024) compared the experiences of internally displaced persons in Gaza with Syrian refugees, showing that WASH shortages were associated with epidemics of typhoid and hepatitis A. However, their study focused primarily on disease epidemiology without elaborating on the broader dimensions of public health crises. Studies by Efron et al. (2019) and Hall et al. (2024) examined international policy frameworks, particularly constraints on humanitarian response resulting from blockades and the implications for international humanitarian law. While important, these works primarily address political and governance aspects rather than the public health consequences of WASH system collapse.

Similarly, experiences in Yemen and Syria reveal a recurring pattern in which the destruction of WASH is followed by cholera, typhoid, and increases in indirect mortality (Tarnas et al., 2023). However, research focusing on Gaza has rarely integrated environmental, gender, and global health security perspectives into analyses of WASH-related crises. Recent empirical studies reinforce this observation. Most existing studies emphasize infrastructure collapse and communicable disease patterns, while only a limited subset—often narrow in scope—addresses environmental contamination or gendered vulnerabilities. This gap is significant because, without these multidimensional perspectives, analyses risk overlooking ecological deterioration, unequal burdens on women and girls, and broader security implications that shape the trajectory of WASH breakdown.

Zinszer and Abuzerr (2024) found that poor drinking water quality in Gaza was directly correlated with high rates of diarrhea and hepatitis A, particularly among children. Hamamra et al. (2025) demonstrated that the water and sanitation crisis in Gaza was associated with increased child morbidity, mirroring cholera epidemics in Yemen and water crises in Syria. This cross-regional comparison underscores that the collapse of WASH in armed conflict



contexts is not merely a localized issue but reflects a consistent epidemiological pattern across the region. Meanwhile, international humanitarian agencies such as OCHA and UNRWA have issued advocacy notes warning of a looming public health catastrophe if access to clean water and sanitation is not urgently restored. However, these notes remain policy-oriented reports and lack the depth of academically grounded, peer-reviewed analysis.

Accordingly, a clear research gap can be identified. Previous studies have tended to focus on (1) specific disease epidemiology (e.g., diarrhea, hepatitis A), (2) political and legal dimensions of warfare, or (3) descriptive advocacy reports that lack a conceptual public health framework. This study is distinct in that it introduces an Integrative WASH–Public Health Impact Framework that explicitly links the short-, medium-, and long-term consequences of the collapse of Gaza’s WASH system to broader global health security. Drawing on compound disaster theory, the framework positions WASH failure in conflict settings as a cascading, multilayered crisis that simultaneously produces acute infectious disease risks, accelerates ecological and socio-economic deterioration, and generates intergenerational and transboundary health threats.

By naming and applying this integrative framework, the study offers a conceptual contribution beyond the scope of existing literature. On this basis, the present research is designed to systematically examine the implications of WASH system collapse for public health in Gaza during the ongoing genocide. It offers a conceptual framework that positions the WASH crisis not merely as a humanitarian issue but as a public health emergency with transnational consequences. In doing so, it contributes to the global literature on the nexus between conflict, WASH infrastructure, and public health security. Ultimately, the study highlights the need for humanitarian interventions and global policy responses to safeguard public health, while also contributing to academic dialogue on redefining the protection of WASH infrastructure as a fundamental human right in armed conflict.

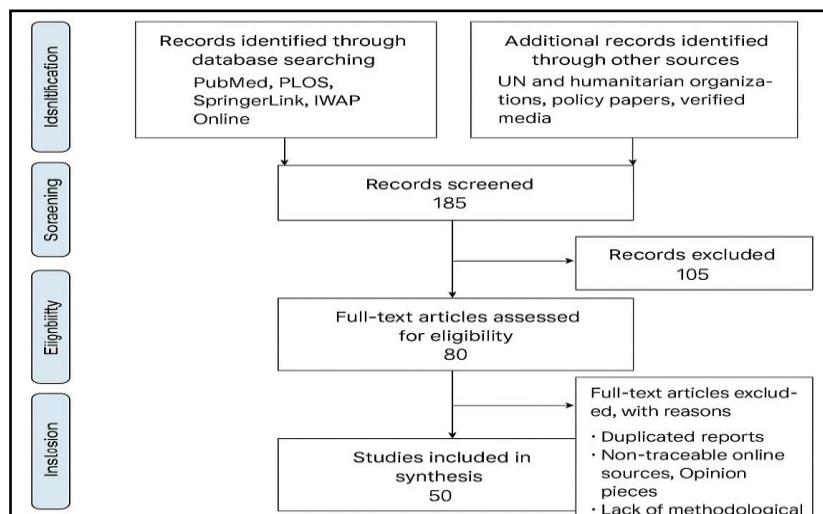
## Methods

This study employs a descriptive qualitative approach using a Thematic Synthesis framework to systematically integrate scholarly literature, humanitarian reports, policy analyses, and verified media sources in assessing the public health implications of WASH system collapse in Gaza from October 2023 to mid-2025. This study employs a descriptive qualitative approach using a Thematic Synthesis framework to systematically integrate scholarly literature, humanitarian reports, policy analyses, and verified media sources in assessing the public health implications of WASH system collapse in Gaza from October 2023 to mid-2025. Thematic Synthesis was applied because it allows diverse data types to be coded, compared, and aggregated into higher-order analytical themes relevant to health and WASH systems under conflict conditions.

Data sources were categorized into four groups: (1) peer-reviewed journal articles, (2) reports from UN and humanitarian agencies, (3) policy papers from international think tanks, and (4) verified media outlets. Source selection followed three inclusion criteria: direct relevance to WASH and public health, publication between 2020 and 2025, and credibility. Credibility of media sources was assessed based on institutional reputation, adherence to published fact-checking standards, cross-verification with humanitarian or UN data, and inclusion in international media monitoring lists (e.g., Reuters, BBC, Al Jazeera, and *The Guardian*). Only outlets with transparent editorial processes and traceable sourcing were included.

A reproducible search strategy was developed to ensure methodological rigor. Peer-reviewed literature was retrieved primarily from PubMed, PLOS, SpringerLink, and IWAP Online, while grey literature was collected from UN OCHA, WHO, UNICEF, UNRWA, and major humanitarian organizations. Searches used combinations of keywords such as “Gaza,” “WASH collapse,” “water insecurity,” “infectious disease outbreaks,” “gender and WASH,” “maternal and child health,” and “conflict-related public health.” Inclusion criteria consisted of (a) publication year 2020–2025, (b) English-language materials, and (c) documents addressing WASH, public health, epidemiology, gendered impacts, or humanitarian response. Exclusion criteria included duplicate reports, non-traceable online sources, opinion pieces without supporting evidence, and documents lacking methodological transparency.

Analysis followed a three-stage thematic process. First, data reduction was conducted by extracting key findings and coding them according to initial categories derived from the research questions (e.g., WASH infrastructure damage, disease epidemiology, gendered burdens, nutrition and child health, and long-term ecological impacts). Second, codes were iteratively refined and grouped into broader thematic clusters, such as short-term health impacts, medium-term service disruptions, and structural determinants of vulnerability. Third, a cross-study comparison was conducted to identify convergences, divergences, and regionally specific patterns, enabling a synthesis that integrates evidence from Gaza, Yemen, Syria, and related global contexts (Hsieh & Shannon, 2021). Validity and reliability were enhanced through data triangulation across academic, humanitarian, and media sources, with peer-reviewed evidence assigned the highest interpretive weight. Although the study did not involve human subjects and therefore did not require ethical clearance, ethical principles were upheld through reliance on open and credible data sources, adherence to conflict-sensitive reporting standards, and a commitment to factual integrity.



Picture 1. PRISMA-ScR Flowchart Diagram  
Source: Processed by Researchers, 2025

## Result and Discussion

### Short-Term Impacts: Infectious Diseases, Malnutrition, and Maternal and Child Health

Findings from the literature and field reports indicate that the collapse of WASH systems in Gaza has generated an acute public health emergency in the short term. WHO (2023)

estimates a significant increase in cases of diarrhea, hepatitis A, and skin diseases, primarily among children. Zinszer and Abuzerr (2024) confirm a direct correlation between poor drinking water quality and increased incidence of diarrhea and hepatitis A in Gaza. These patterns parallel the cholera epidemic in Yemen following the destruction of sanitation systems (WHO, 2023), as well as post-conflict diarrheal outbreaks in Syria (Abuawad, 2025).

Beyond infectious diseases, malnutrition has worsened, in part due to water insecurity—the lack of reliable access to safe water for drinking, food preparation, and hygiene—which undermines dietary diversity and food security, as documented in multiple recent studies. For example, a panel study across sub-Saharan Africa found that water insecurity was strongly associated with reduced dietary diversity and higher food insecurity (Miller et al., 2024). UNICEF (2022) reports that children in Gaza face a “triple burden” of malnutrition, infectious disease, and psychosocial trauma. Pregnant and lactating women are among the most vulnerable, as limited access to basic health services and sanitation increases the risk of pregnancy-related complications (Hamamra et al., 2025).

Comparative evidence from other conflict settings strengthens these findings and situates Gaza within a broader theoretical context. In Yemen, the 2016–2019 cholera epidemic illustrates a prototypical WASH system collapse: WHO (2023) documented over two million cases, with mortality highest among children, while Camacho et al. (2018) showed that 80% of cases were concentrated in regions where sanitation infrastructure had been destroyed by blockade. Similar patterns appear in Syria, where Abuawad (2025) reported spikes in acute diarrhea, hepatitis A, and leishmaniasis in displacement camps characterized by poor sanitation, and Eneh et al. (2023) found that nearly half of the country’s clean-water facilities had been destroyed.

Cases from Sub-Saharan Africa reinforce this evidence: in South Sudan, Groot et al. (2025) recorded diarrhea prevalence of up to 45% among displaced children due to contaminated water, while in the Democratic Republic of Congo, displacement and sanitation collapse triggered cascading risks of malnutrition and malaria (Cronin et al., 2009). Comparable dynamics also appear in Southeast Asia; in Papua, Indonesia, Sufri et al. (2023) documented marked increases in diarrhea, skin infections, and malnutrition among internally displaced populations who lost access to clean water during conflict.

Taken together, these cases demonstrate that WASH system collapse consistently produces overlapping epidemics, nutritional decline, and heightened maternal–child vulnerabilities; however, the Gaza case shows several important distinctions. While epidemiological patterns are broadly similar, the pace of collapse in Gaza appears more accelerated, driven by a convergence of dense urban populations, total blockade, and rapid destruction of utilities—factors that intensify exposure and leave minimal buffering capacity for public health systems. Likewise, although gendered impacts are observed across conflict settings, their manifestation in Gaza’s highly urbanized and densely populated environment differs from the predominantly rural displacement contexts of locations such as Papua or South Sudan. Women and infants in Gaza face compounded risks due not only to inadequate WASH access but also to the near collapse of hospital infrastructure, limited evacuation routes, and restricted mobility, indicating context-specific intervention points that diverge from those in rural conflict zones.

These cross-case comparisons underscore the importance of interpreting Gaza through the lens of a compound disaster (Wisner et al., 2012). Introducing this framework clarifies that the crisis is not merely a sum of isolated health outcomes but a cascading failure, in which the destruction of water and sanitation infrastructure triggers spiraling effects on infectious disease burdens, nutrition, maternal–child health, ecological contamination, and social resilience.

Using the compound disaster concept as an organizing structure elevates the analysis from a descriptive list of impacts toward a more theoretically grounded argument about how infrastructural collapse, conflict intensity, and population density interact to produce a rapid and multidimensional humanitarian emergency.

From psychological and sociological perspectives, WASH collapse not only contributes to physical morbidity but also deepens collective trauma. Christine et al. (2022) found that poor sanitation in displacement camps in Central Sulawesi, Indonesia, intensified insecurity, social stigma, and community powerlessness. Gaza exhibits similar dynamics, in which the destruction of WASH represents a breakdown of basic social structures and weakens community resilience.

Empirical evidence from Indonesia further supports this study's conclusions regarding the multidimensional impacts of WASH collapse. A systematic review by Satriani et al. (2022) mapped trends in WASH research and identified strong evidence linking WASH with nutrition and waterborne diseases, while also noting limited research on WASH in conflict and recovery contexts. A quantitative study in Papua (Astuti, 2022) demonstrated a significant association between sanitation access and child stunting, underscoring a life-course perspective in which disrupted WASH during critical periods produces cumulative, intergenerational effects. Clinical findings from Banda Aceh (Sari et al., 2024) reinforced mechanistic links between unsafe child feces disposal, inadequate hospital hygiene, and a high prevalence of stunting and diarrhea among young children.

Policy-focused studies in Aceh (Sufri et al., 2023) emphasize that nutrition interventions alone are insufficient without improvements in WASH, supporting recommendations that post-conflict recovery programs integrate WASH, nutrition, and maternal and child health. National policy analyses (Indonesia's Ministry of Health, 2023) and field studies by Kusumandari and Kurniawan (2023) add institutional insights, indicating that without multisectoral policy coordination, water subsidies, and gender-sensitive protections, WASH reconstruction risks exacerbating inequalities and entrenching water-poverty traps. Local studies, such as Musfira (2019) on water management in Jayapura and Wandik et al. (2025) on flooding in Sentani, highlight the need to integrate technical, ecological, and social considerations into WASH reconstruction. Wulandari et al. (2022) further stress that stunting-reduction strategies must integrate environmental determinants, including WASH, thereby offering relevant lessons for Gaza's post-conflict interventions.

Taken together, these findings confirm that the short-term impacts of WASH collapse in Gaza extend beyond infectious disease outbreaks to encompass multidimensional crises involving malnutrition, reproductive health risks, psychosocial trauma, and social disintegration. Cross-regional evidence from the Middle East, Africa, and Southeast Asia reinforces the argument that WASH is a critical determinant of public health in conflict settings and that its destruction consistently produces similar epidemiological and social patterns across diverse geopolitical contexts.

### Medium-Term Impacts: Ecological and Socio-Economic Dimensions

The collapse of WASH infrastructure in Gaza has generated semi-permanent ecological impacts: the destruction of wastewater treatment facilities, the overflow of domestic sewage, and seawater intrusion into aquifers have significantly reduced both the quantity and quality of available freshwater resources (UNRWA, 2024). This deterioration not only limits the availability of safe water but also undermines long-term water quality, making recovery costly and protracted—an environmental disaster phenomenon commonly described as a “water-poverty trap,” in which degraded water availability and quality, limited infrastructure, and



socioeconomic constraints mutually reinforce chronic water insecurity and poverty (Nongbri et al., 2025). Understanding Gaza's situation through this lens highlights that recovery requires more than restoring pipelines; it also requires aquifer rehabilitation, strengthened hazardous waste management, and investments in energy-resilient desalination and water treatment systems (WHO, 2023; UNRWA, 2024).

At the socio-economic level, the collapse of WASH systems exacerbates existing structural inequities. Limited access to safe water drives up water prices, forcing low-income households to divert income toward water purchases or bottled water consumption. This practice erodes household food security by reducing both meal frequency and nutritional quality. Similar dynamics have been documented in other conflict settings: cholera outbreaks in Yemen and sanitation failures in Syria generated household economic burdens and disrupted local markets, further undermining food security. Empirical evidence indicates that WASH system collapse can rapidly propagate economic shocks through lost income, rising health expenditures, and declining medium-term productivity (Camacho et al., 2018).

Gendered impacts and inequalities are particularly pronounced. Women and children, who are traditionally responsible for water collection and caregiving, bear the brunt of increased time burdens (longer distances to fetch water), exposure to violence during water collection, and heightened unpaid care work. These burdens compromise educational attainment and income-generating opportunities. Studies by Khan et al. (2024) and reports from Indonesia (Kusumandari & Kurniawan, 2023; Indonesia's Ministry of Health, 2023) emphasize that WASH interventions should integrate gender perspectives (e.g., safe facilities, targeted subsidies, and protection of maternal services) to prevent recovery efforts from entrenching inequality.

Cross-conflict comparisons reinforce this systemic pattern. In Yemen, the collapse of sanitation systems triggered a nationwide cholera epidemic (over one million reported cases during 2016–2018), which in turn intensified malnutrition and public health burdens—a classic illustration of conflict-driven WASH collapse, epidemic spread, and socioeconomic shock. Epidemiological analyses of cholera in Yemen highlight a direct link between sanitation destruction and infectious disease outbreaks. In Syria, water infrastructure destruction facilitated the resurgence of previously controlled diseases, thereby worsening maternal and child health outcomes. Evidence from South Sudan (Curtis & Davey, 2025) similarly shows a high prevalence of diarrhea and malnutrition among displaced populations lacking adequate WASH, reflecting a broader pattern (Camacho et al., 2018).

From the perspective of disaster and conflict theory, these dynamics illustrate compound and cascading disasters: WASH infrastructure collapse is not a single technical failure but a trigger for mutually reinforcing systemic breakdowns (e.g., epidemics, malnutrition, economic disruption, ecological degradation, and social insecurity). The framework of interacting vulnerabilities explains why already fragile communities—characterized by high population density, dependence on vulnerable aquifers, and structural poverty—become trapped in prolonged cycles of vulnerability that short-term sectoral aid alone cannot resolve (Checchi et al., 2007; Wisner et al., 2012).

On the psychosocial dimension, environmental degradation and the loss of WASH access undermine social cohesion and collective coping capacity. Evidence from Central Sulawesi and among internally displaced populations in Papua shows that poor sanitation in camps amplifies insecurity, stigma, and helplessness, factors that delay community-led recovery. In Gaza, these effects are likely to be magnified by war-related trauma and limited access to mental health services, suggesting that WASH reconstruction should be integrated with psychosocial support and community recovery programs (Phiri et al., 2024).

The practical policy implications are clear: medium-term responses must be multisectoral and layered. Evidence from Gaza, Yemen, Syria, Africa, and Indonesian case studies consistently indicates that an effective recovery pathway requires a combination of infrastructure development, social protection, public health integration, and system resilience. Based on the evidence synthesis, several operational recommendations can be highlighted as follows:

1. Infrastructure reconstruction that combines aquifer restoration, waste treatment, and desalination or alternative water sources.
2. Temporary water subsidies and equitable distribution mechanisms to ensure that vulnerable households remain protected during periods of instability.
3. Integration of WASH, nutrition, and maternal and child health programs through a life-course approach to reinforce long-term population resilience.
4. Gender-sensitive WASH facility design that ensures safety, privacy, and accessibility for women and girls.
5. Guaranteed access to energy supplies and essential spare parts through secure humanitarian corridors to prevent renewed operational collapse.
6. Investment in environmental surveillance and laboratory capacity to detect, trace, and contain outbreaks before they escalate into wider regional epidemics.

Collectively, these measures illustrate the need for coordinated and sustained interventions that can operate across technical, social, and institutional domains. Implementing these recommendations not only mitigates immediate risks but also strengthens the structural foundations necessary for long-term recovery. Their effectiveness ultimately depends on the commitment of governments, humanitarian actors, and local communities to work collaboratively. With a comprehensive and evidence-driven approach, medium-term response strategies can evolve into durable systems of resilience capable of withstanding future crises.

### Long-Term Impacts: Global Health Security and Intergenerational Risks

The collapse of Gaza's WASH system cannot be understood merely as a local problem but rather as part of a broader pattern observed across multiple conflicts and disasters. A recurring mechanism emerges, involving the destruction of water and sanitation infrastructure, ecological degradation, nutritional and health shocks, and long-term societal vulnerability. This illustrates that WASH breakdown in armed conflict is not solely a technical issue but has implications for both intergenerational and global health security.

From an environmental perspective, recent studies highlight that the destruction of wastewater treatment facilities in Gaza has accelerated aquifer salinization and contamination (Hall et al., 2024; Kann et al., 2024). This mirrors experiences in Aceh following the tsunami, where damaged water systems heightened exposure to contaminated sources and increased diarrheal disease among children (Sari et al., 2024). In Papua, Musfira (2019) similarly documented how weak water infrastructure forced communities into long-term reliance on unsafe water sources. Thus, whether in the context of conflict or natural disaster, WASH disruption consistently produces cumulative ecological effects that are difficult to reverse and generate chronic exposure to waterborne diseases.

One of the most visible intergenerational impacts lies in the nexus between sanitation, nutrition, and stunting. A systematic review by Satriani et al. (2022) confirmed that inadequate WASH is consistently associated with child undernutrition in Indonesia. Empirical work in Papua and West Papua (Astuti, 2022) and Aceh (Sari et al., 2024) reinforces the association between poor sanitation and increased stunting prevalence. Theoretically, this aligns with the life-course epidemiology framework, which posits that early-life health disruptions can



diminish long-term productivity and health capacity in adulthood. If similar patterns unfold in Gaza, the crisis may extend beyond immediate humanitarian concerns, raising the risk of a “lost generation” associated with WASH collapse. Yemen offers evidence of this trajectory, where repeated cholera epidemics exacerbated chronic childhood malnutrition (WHO, 2023). Ukraine shows parallel warning signs, as thousands of children in Donetsk and Luhansk face chronic diarrheal risks with potential long-term consequences for growth and development (UNICEF, 2022).

These long-term impacts are particularly concerning because they are transboundary in nature. WHO (2023) and Efron et al. (2019) warn that when WASH systems collapse, the spread of communicable diseases is rarely contained within conflict zones and can spill over into neighboring countries. Gaza exemplifies this risk, as mass displacement and weakened surveillance systems heighten the potential for regional epidemics. Sudan in 2023 provided a similar case, in which the collapse of clean water supplies in Khartoum triggered a cholera outbreak that crossed borders (Idrus, 2025). In Myanmar, the forced displacement of Rohingya populations into Bangladesh repeatedly produced sanitation crises with cross-border disease threats (Anera, 2024). Thus, WASH collapse in conflict should be recognized as a matter of global health security rather than solely a localized humanitarian emergency.

Theoretically, this crisis can be examined through the lens of compound disasters and interacting vulnerabilities (Wisner et al., 2012). The destruction of basic infrastructure sets in motion cascading effects, including disease outbreaks, malnutrition, socio-economic degradation, and the erosion of social cohesion. Evidence from Kusumandari and Kurniawan (2023) on internally displaced populations in Papua illustrates similar dynamics, in which inadequate WASH worsened gender inequality, mental health burdens, and community resilience. Literature on Sudan and Syria adds a dimension of collective trauma, in which the collapse of essential services undermined social bonds and obstructed reconstruction (Efron et al., 2019). Literature on Sudan and Syria adds a dimension of collective trauma, in which the collapse of essential services undermined social bonds and obstructed reconstruction (Efron et al., 2019).

The policy implications are clear: WASH reconstruction must not be treated solely as physical infrastructure repair but should be integrated with nutrition, maternal and child health, and social protection programs. Indonesia’s Ministry of Health (2023), in its Crisis Health Response Profile, emphasizes the need for cross-sectoral coordination in restoring basic services. Post-tsunami Aceh likewise demonstrated that nutrition interventions were ineffective without parallel improvements in WASH (Sufri et al., 2023). By comparing Gaza with contexts in Indonesia, Yemen, Sudan, Myanmar, and Ukraine, this study reinforces the view that WASH reconstruction is a cornerstone of global health security. Safeguarding WASH infrastructure must therefore be framed not only as a humanitarian imperative but also as a fundamental human right in conflict settings.

## Conclusion

The collapse of the WASH system in Gaza demonstrates that armed conflict not only destroys physical infrastructure but also undermines the foundations of public health, thereby creating intergenerational vulnerabilities. Comparative analysis with other conflict-affected regions, such as Yemen, Syria, and Sub-Saharan Africa, highlights a broader pattern, whereby the degradation of basic services consistently triggers infectious disease outbreaks, exacerbates malnutrition, and generates complex long-term health burdens.

From a global health perspective, these findings underscore that WASH is not merely a technical issue but also a strategic component of social stability, human security, and sustainable development. The relevance for Indonesia is also evident, as experiences from disasters in Aceh and Papua reveal that similar vulnerabilities can emerge even outside war zones when public infrastructure is fragile and humanitarian responses remain inadequate. Thus, this study underscores that WASH recovery should be positioned as a priority intervention in humanitarian response and post-conflict reconstruction. Without such efforts, communities may remain trapped in cycles of health vulnerability that undermine national resilience and regional stability.

Based on these findings, strategic measures are needed to strengthen WASH resilience in contexts of conflict and disaster. First, international actors and humanitarian agencies should prioritize WASH recovery on par with food provision and emergency medical care, including actions to secure humanitarian access to essential operational supplies, such as fuel, spare parts, and treatment chemicals—critical inputs whose disruption has repeatedly triggered system collapse in Gaza and other conflict zones. Second, national governments, including Indonesia, should integrate WASH recovery strategies into disaster management and national security policies, ensuring alignment with international standards while incorporating local knowledge and community-based practices. Third, sustained investment in resilient WASH infrastructure, particularly decentralized and energy-flexible water and sanitation technologies, is essential to maintain service continuity even under conditions of large-scale destruction. Together, these measures provide a multidimensional policy pathway for preventing recurrent WASH failures and safeguarding public health in future crises.

In addition, further research is needed to explore the long-term linkages between WASH collapse, political stability, and regional security. While this study primarily focuses on immediate public health consequences, the findings intersect with broader global health security concerns, particularly how sustained infrastructure breakdown can destabilize governance systems and exacerbate cross-border risks. Integrating these dimensions into future work would not only clarify the downstream political implications of WASH failure but also provide a more comprehensive evidence base for designing prevention-oriented, intergenerational international policies.

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