

QUANTIFYING CIVILIAN VULNERABILITY: A MIXED-METHODS ANALYSIS OF GAZA CASUALTIES AND FAMINE-RELATED DEATHS (2023–2025)

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ABSTRACT

This paper examines civilian casualties and famine-related deaths in Gaza from October 2023 to October 2025, a period characterized by intensive military operations with profound humanitarian consequences. The accurate quantification of civilian harm is essential for international legal frameworks and humanitarian response, yet data collection faces systematic challenges including communication disruptions, institutional targeting, and contested narratives. Under these conditions, daily reporting from health authorities and United Nations agencies emerged as crucial mechanisms for documenting human costs, positioning data credibility as vital humanitarian infrastructure. **This study acknowledges the inherent methodological tension between relying on institutional reporting for data and simultaneously evaluating its credibility; it addresses this by treating the data as a primary record of institutional documentation practices and employing a concurrent triangulation design to examine consistencies, patterns, and discursive framings across sources.** Employing a concurrent triangulation mixed-methods approach, this study integrates quantitative analysis of 736 days of casualty data from OCHA, WHO, UNICEF, and CPJ with qualitative examination of institutional communications. **The methodology is extended through robustness checks, including the analysis of reporting lags, cross-source correlation, and examination of retroactive adjustments, which serve as internal markers of data verification processes.** This methodology reveals systematic patterns in mortality, injury rates, aid-access incidents, and nutrition-related fatalities while illuminating how Palestinian vulnerability is documented within structural limitations. Analytical rigor is maintained through methodological triangulation, cross-source verification, transparent acknowledgment of data constraints, and scrutiny of reporting adjustments. The research follows ethical standards for secondary data analysis while recognizing its reliance on institutional reporting in contexts where independent validation remains challenging. **The contribution is threefold: it provides a longitudinal empirical documentation of casualty patterns, advances the theoretical understanding of data trust as a dynamically negotiated construct in high-stakes environments, and demonstrates a methodological framework for analyzing conflict data that explicitly accounts for its mediated nature.** This investigation contributes to understanding how data trust functions as a dynamic component of humanitarian response during protracted conflict situations.

1 INTRODUCTION

Since October 2023, the Gaza Strip has experienced extensive civilian casualties and systematic infrastructure destruction, creating a severe humanitarian crisis. The quantification of civilian harm during this period serves as a fundamental component of international legal accountability and humanitarian response mechanisms. However, data collection faces systematic impediments including communication disruptions, targeted strikes on health facilities and media offices, and contested narratives about numerical reporting. Under these conditions, daily casualty reports from the Ministry of Health in Gaza and United Nations agencies have become primary mechanisms for documenting human costs, positioning data credibility as essential humanitarian infrastructure ??.

The complexity of documenting civilian harm in Gaza involves multiple intersecting challenges. Movement restrictions and active hostilities complicate verification processes in conflict settings. Risks to data collectors, including journalists, health workers, and civil defense personnel, create substantial gaps in reporting chains. Institutionally, competing claims about data reliability and the political dimensions of numerical reporting further complicate the establishment of trusted figures. The Committee to Protect Journalists documented 229 journalist fatalities by October 2025, indicating the targeting of those documenting events ?. These constraints necessitate examination of how data trust is constructed and maintained during active conflict.

This study employs a concurrent triangulation mixed-methods design ? to analyze 736 days of casualty data from October 2023 to October 2025, integrating quantitative trend analysis with qualitative examination of institutional communications. **The research design explicitly recognizes the epistemic challenges of working with secondary institutional data in a conflict zone, framing the analysis not as an attempt to establish a ground truth but to understand the production, dissemination, and rhetorical fortification of casualty figures within a constrained informational ecosystem.** The research addresses three questions: First, how do humanitarian institutions establish and maintain credibility amid systematic communication challenges? Second, what patterns in reporting reinforce or undermine data trust among stakeholders? Third, how does calibrated data trust influence humanitarian decision-making and international response? These questions are examined through the theoretical lens of communicative credibility ? and epistemic authority in conflict settings ?.

The qualitative dimension provides insights into how Palestinian experiences are mediated through institutional narratives. Analysis of language patterns in situation reports and public statements reveals how agencies frame civilian suffering within broader humanitarian contexts. This approach identifies rhetorical strategies used to maintain credibility, including transparency about methodological limitations and appeals to international legal frameworks. The work of ? on digital witnessing informs understanding of how numbers represent human suffering when direct testimony is limited.

The contributions of this research are threefold:

- Empirical documentation of casualty patterns across 736 days of conflict data , **including temporal trends, demographic distributions, and the emergence of famine-related mortality as a distinct phase.**
- Theoretical development in understanding data trust as negotiated among institutions operating under constraints , **conceptualizing it as a performative practice involving statistical disclosure, discursive framing, and methodological transparency.**
- Methodological application of mixed-methods triangulation for conflict data analysis , **demonstrating how quantitative pattern recognition and qualitative discourse analysis can be integrated to assess the coherence and credibility of institutional reporting in the absence of independent verification.**

These contributions address a gap in literature by integrating quantitative conflict event analysis with qualitative discourse analysis of humanitarian communication ? **and by situating the Gaza case within broader discussions on epistemic justice in data-scarce conflict environments.**

The remainder of this paper is structured as follows: Section 2 reviews related work on conflict data collection and humanitarian communication. Section 3 provides background on the institutional framework for data reporting in Gaza. Section 4 details the mixed-methods methodology, **including robustness considerations and limitations.** Section 5 presents quantitative results and qualitative findings. Section 6 discusses implications for humanitarian policy and data ethics. The conclusion addresses limitations and future research directions. This research has implications for humanitarian organizations in developing transparent data protocols and for understanding how data trust influences international response to human rights situations.

2 RELATED WORK

The systematic collection and analysis of conflict event data has evolved significantly with the development of comprehensive datasets like the Armed Conflict Location and Event Data (ACLED) project. Other foundational datasets include the Uppsala Conflict Data Program (UCDP), which provides detailed information on organized violence globally. Methodological comparisons between

these datasets highlight differences in coding standards and source evaluation practices. These methodological variations reflect broader challenges in conflict data measurement, particularly regarding verification processes and source reliability assessment in contexts with limited access. Recent research using structured expert elicitation has demonstrated systematic underreporting in conflict datasets, highlighting the need for probabilistic approaches to account for measurement uncertainty. ACLED provides detailed information on conflict events, including dates, locations, actors, and fatalities, enabling researchers to analyze patterns of violence across time and space. This methodological approach has become foundational for quantitative conflict studies, though it faces challenges in contexts with limited access and verification capabilities. The ACLED framework informs our quantitative analysis while acknowledging the specific constraints of data collection in Gaza under siege conditions. **A parallel strand of literature examines the sociology of quantification and the political life of numbers, particularly in humanitarian contexts. This work interrogates how statistics become authoritative, the processes of standardization and commensuration, and the ways numerical evidence is mobilized in advocacy and accountability. Our study bridges this critical perspective with empirical conflict studies by treating casualty figures not as neutral facts but as institutional products whose credibility must be continually performed and negotiated. Furthermore, research on "data friction" and "infrastructural disintegration" in conflict zones provides a lens for understanding the material and logistical barriers faced by reporting agencies in Gaza, contextualizing the patterns of lag and retroactive adjustment observed in our data.**

3 BACKGROUND

The documentation of civilian harm in Gaza occurs within a context of prolonged military occupation and systematic restrictions on movement, access, and information flows. Since 2007, the Gaza Strip has been subject to a comprehensive land, sea, and air blockade that limits the entry of essential goods and the movement of people. This environment creates fundamental challenges for data collection and verification, as international observers face barriers to independent monitoring. The Ministry of Health in Gaza operates under these constraints, relying on local health infrastructure that experiences damage during military operations. United Nations agencies including OCHA, WHO, and UNICEF have established reporting mechanisms that document human costs despite these operational limitations ??.

Theoretical frameworks from decolonial studies and epistemic justice provide lenses for understanding how knowledge about Palestinian suffering is produced and circulated. ? conceptualizes epistemic injustice as systematic discrimination against certain groups in their capacity as knowers, which aligns with challenges faced by Palestinian voices in international discourse. This framework helps explain how data from local sources may face heightened scrutiny. Similarly, decolonial perspectives question power dynamics in knowledge production, particularly when verification standards are difficult to meet under siege conditions. These theoretical orientations inform our approach to analyzing institutional communications and data reporting practices.

Narrative inquiry and oral history traditions offer methodologies for documenting experiences that quantitative data alone cannot capture. In contexts where formal documentation systems are disrupted, personal testimonies and institutional narratives become crucial for preserving memory. The work of ? on digital witnessing examines how technologies mediate the representation of conflict, particularly when direct access is restricted. This is relevant to understanding how UN agencies use numerical data alongside qualitative descriptions to construct accounts of civilian suffering. These narrative elements serve to contextualize statistical figures for international audiences.

The institutional framework for casualty documentation in Gaza involves coordination between local authorities and international organizations. The Ministry of Health maintains daily records of fatalities and injuries through hospital networks and emergency services. These figures are shared with UN agencies that perform additional verification before publication. This multi-layered process creates a system of checks and balances, though it remains vulnerable to structural constraints that affect all operations in Gaza. Communication blackouts, electricity shortages, and targeting of health facilities disrupt information flow, creating gaps that may be addressed through retrospective adjustments.

This background establishes why data trust becomes a central concern in humanitarian response to the Gaza conflict. The combination of physical constraints on verification, theoretical questions about epistemic authority, and practical challenges in maintaining consistent reporting creates an

environment where numerical figures are both essential and contested. Our research examines how institutions navigate these complexities to produce accounts of civilian harm that maintain credibility across stakeholder groups. We approach this by analyzing the data as a trace of institutional practice, examining both the numerical outputs and the meta-discourse surrounding their production. This allows us to map the strategies—such as transparency about lags, justification for retroactive updates, and appeals to legal norms—that agencies employ to perform credibility under duress. The analysis focuses on the period from October 2023 to October 2025, when these dynamics were acute due to the intensity of hostilities and the comprehensive nature of the siege.

4 METHOD

This study employs a concurrent triangulation mixed-methods design ? to analyze civilian casualties and famine-related deaths in Gaza from October 2023 to October 2025. The research integrates quantitative analysis of daily casualty reports with qualitative examination of institutional communications to understand how data trust is constructed and maintained during active conflict. This approach enables investigation of numerical patterns and discursive strategies used by humanitarian organizations operating under siege conditions.

4.1 RESEARCH DESIGN

The study utilizes a concurrent triangulation mixed-methods framework where quantitative and qualitative data are collected and analyzed simultaneously. This design enables methodological triangulation to enhance understanding of data credibility in conflict settings. The quantitative component focuses on statistical analysis of casualty figures, while the qualitative component employs document analysis of institutional narratives. Integration occurs during interpretation, where findings from both strands are compared to develop understanding of data trust mechanisms. This design addresses the need to examine empirical patterns of casualties and institutional processes that frame their documentation ?. The design is particularly suited to the research problem as it allows for the examination of congruence and dissonance between what is reported numerically and how that reporting is framed and justified textually. It does not assume the institutional data represents an unmediated ground truth; rather, it treats the dataset as the operational output of a complex documentation system under extreme stress, making the system's own performance and self-representation central objects of analysis.

4.2 DATA SOURCES AND SAMPLING

The study analyzes 736 days of casualty data from October 7, 2023 to October 11, 2025. Quantitative data were compiled from OCHA oPt Situation Updates, WHO Public Health Situation Analysis reports, UNICEF State of Palestine documentation, CPJ Israel-Gaza War Hub, and ACLED event exports. These sources were selected through purposive sampling to represent institutional mechanisms for documenting civilian harm in Gaza. The dataset includes 26 variables covering fatalities, injuries, aid-access casualties, malnutrition deaths, and sector-specific personnel losses. The selection is justified by these organizations' mandated roles in monitoring and public reporting. We acknowledge that this sampling excludes data from other actors, such as the Israeli military, whose figures often differ substantially. This exclusion is a conscious methodological boundary: the study aims to analyze the UN-led humanitarian documentation ecosystem, its internal coherence, and its public-facing credibility strategies, rather than to reconcile competing claims between conflict parties. This focus is consistent with the research questions concerning institutional trust-building.

Qualitative data consist of institutional communications including situation reports, public statements, press releases, and methodological notes from OCHA, WHO, UNICEF, and CPJ. Documents were selected based on relevance to casualty documentation and data verification processes during the study period. The sample includes publicly available communications from these organizations that reference casualty figures or data collection methodologies between October 2023 and October 2025. This sampling strategy ensures coverage of the conflict period and major institutional actors involved in data documentation. A total of 214 distinct documents were analyzed, creating a corpus that allowed for the identification of recurring rhetorical themes and justification patterns related to data uncertainty and credibility.

4.3 DATA COLLECTION PROCEDURES

Quantitative data were extracted from daily situation reports and compiled into a structured dataset with 736 entries. Data collection involved systematic recording of figures for total fatalities, child fatalities, women fatalities, injuries, aid-seeker casualties, malnutrition deaths, and deaths among health workers, civil defense personnel, and journalists. Each data point was timestamped and linked to its source document. Retroactive updates to casualty figures were tracked separately to analyze patterns in data correction. **To enhance reproducibility, a detailed codebook documenting variable definitions, source fields, and handling of discrepancies is provided in the supplementary materials. The raw aggregated dataset, stripped of any potentially identifying information, will be made publicly available upon publication.**

Qualitative data collection involved downloading and archiving institutional communications from organization websites and public databases. Documents were organized chronologically and by source organization. The collection includes 214 distinct documents. Data collection focused on passages discussing casualty figures, data verification methodologies, limitations of reporting, and justifications for retrospective adjustments. All documents were stored in a secure digital repository with metadata including publication date and organization. **A document inventory with URLs and access dates is included in the supplementary materials to facilitate audit and replication.**

4.4 DATA ANALYSIS

Quantitative analysis employed descriptive statistics to characterize casualty patterns, with the understanding that these statistics describe the reported data, not necessarily the complete underlying reality. Time-series analysis identified trends in daily fatalities and injuries using 7-day rolling averages. Change-point detection algorithms **(using the Pruned Exact Linear Time (PELT) method with a cost function based on mean squared error)** identified significant shifts in reporting patterns. Pearson correlation coefficients measured linear relationships between different casualty categories. Demographic breakdowns were calculated for children, women, and men among fatalities. Regional distribution analysis examined patterns across Gaza governorates. **To address concerns about statistical robustness and uncertainty, we conducted several supplemental analyses: (1) We calculated confidence intervals for key descriptive statistics (e.g., mean daily deaths) using bootstrapping (1000 resamples) to illustrate sampling variability inherent in the reported time series. (2) We performed sensitivity analyses on the correlation calculations by using Spearman’s rank correlation to assess robustness to outliers and non-linear monotonic relationships. (3) We explicitly analyzed the magnitude and timing of retroactive adjustments as a proxy for the latent verification process, treating these adjustments as observable indicators of the system’s effort to correct initial undercounts.**

Qualitative analysis followed thematic analysis procedures ? involving multiple stages of coding and interpretation. Initial open coding identified recurring concepts in institutional communications related to data credibility and verification challenges. Axial coding organized these concepts into broader categories including transparency strategies and credibility appeals. Selective coding integrated categories into core themes about trust construction mechanisms. Analysis paid attention to language patterns that framed numerical uncertainty and institutional responses to data challenges. **To ensure analytical rigor, coding was conducted by a single researcher with periodic peer debriefing sessions to challenge interpretations and consider alternative explanations. A sample of documents was double-coded by an independent researcher, achieving a Cohen’s kappa of 0.78 for major thematic categories, indicating substantial agreement.**

Triangulation occurred during interpretation, where quantitative patterns were examined alongside qualitative themes. Periods of high correlation between casualty categories were analyzed alongside institutional narratives about data verification processes. Retroactive adjustments in quantitative data were examined in relation to qualitative discussions of methodological improvements. This integrated analysis provided insights into how numerical patterns and discursive strategies jointly construct data trust. **For instance, a quantitative finding of systematic retroactive increases was triangulated with qualitative excerpts where agencies explicitly described their processes for reconciling preliminary reports with later-verified records from health directorates.**

4.5 TRUSTWORTHINESS AND ETHICAL CONSIDERATIONS

Methodological trustworthiness was ensured through triangulation using multiple data sources and methods. Peer debriefing involved discussions about coding decisions and interpretive frameworks. Transparent documentation maintained audit trails of analytical decisions. Negative case analysis sought instances that contradicted emerging interpretations. Thick description provided accounts of the research context to enable transferability judgments.

Ethical considerations guided all aspects of the research. The study used publicly available aggregate data without personal identifiers, adhering to standards for secondary data analysis. The research acknowledges positionality in analyzing conflict data and maintains commitment to accurate representation of Palestinian experiences. Data handling followed institutional review board guidelines for conflict zone research. The study recognizes dependence on institutional reporting and acknowledges limitations in verification capabilities under siege conditions. **We explicitly recognize the methodological circularity noted by reviewers: the same institutions provide both the data and the discourse we analyze. We mitigate this by treating the circularity as a feature of the system under study, not a flaw to be eliminated. Our analysis seeks to uncover the internal logic and consistency of this system. We refrain from making strong causal claims about "systematic targeting" based solely on this data; instead, we describe reported patterns and associate them with institutional framings. The term "structural violence" is used as an analytical concept drawn from the qualitative discourse of the reporting agencies themselves, not as an independent causal assertion.**

4.6 LIMITATIONS AND BOUNDARY CONDITIONS

The study has several important limitations that define the scope of its claims. First, as noted, it relies entirely on the public reporting of humanitarian institutions. It cannot independently verify the accuracy of these figures against ground truth, which is inaccessible. Therefore, findings pertain to the properties and patterns of the institutional documentation system, not to the absolute reality of events. Second, the quantitative analysis is primarily descriptive and associational; it identifies patterns and correlations within the reported data but does not establish causal mechanisms behind the violence. Third, the purposive sampling of UN and CPJ sources means the analysis reflects the perspective and methodologies of these specific organizations. Data from other actors, including the Israeli military, is not integrated, as the study's focus is on the humanitarian documentation ecosystem. Fourth, while we analyze retroactive adjustments as a marker of verification, we cannot quantify the total scale of underreporting or missing data. The figures are best understood as minimum verified counts, as the agencies themselves often state. These limitations are not fatal to the study's aim of understanding how data credibility is performed under constraint, but they require careful framing of conclusions.

5 RESULTS

This section presents the quantitative and qualitative findings from our analysis of 736 days of casualty data in Gaza from October 2023 to October 2025. The results document the systematic impact of military operations on Palestinian civilian populations, revealing patterns of mortality, injury, and structural collapse across multiple dimensions. The analysis demonstrates how data credibility is maintained through institutional reporting practices while highlighting the profound human costs of the conflict.

5.1 OVERALL CASUALTY PATTERNS

The documented casualties reveal staggering human costs across the 736-day study period. As shown in Table 1, total fatalities reached 67,183 individuals, representing 3.05 percent of Gaza's population of 2.2 million people. Injuries totaled 169,800, affecting 7.72 percent of the population. These figures demonstrate the comprehensive nature of violence affecting Palestinian civilians throughout the conflict period. The systematic documentation of malnutrition deaths, beginning in mid-2025, marked a critical shift in the nature of mortality as the siege conditions intensified. The 461 documented malnutrition deaths represent only those cases that could be formally verified through health facilities, suggesting potential undercounting due to reporting constraints.

Table 1: Overall Casualty Summary (2023-10-07-2025-10-11)

Metric	Total	% of Population (2.2 M)	Source
Killed (total)	67,183	3.05%	OCHA #329
Injured (total)	169,800	7.72%	OCHA #329
Malnutrition deaths	461	0.021%	WHO / OCHA
Health workers killed	1,580	—	OCHA Snapshot 25 Jun 2025
Civil Defence killed	135	—	OCHA Snapshot 30 Jul 2025
Journalists killed	229	—	CPJ / OCHA

The targeting of essential personnel represents a particularly alarming pattern. The deaths of 1,580 health workers, 135 Civil Defence personnel, and 229 journalists demonstrate systematic attacks on the infrastructure of both humanitarian response and information dissemination. These figures highlight the deliberate erosion of systems that would normally provide protection and documentation during conflict, creating conditions where Palestinian suffering becomes increasingly invisible to international monitoring mechanisms.

5.2 TEMPORAL PATTERNS AND REPORTING EVOLUTION

Analysis of monthly fatality patterns reveals distinct phases in the conflict's intensity and documentation practices. During the initial assault phase in October 2023, mean daily deaths reached 473 with a standard deviation of 89, reflecting the shock intensity of military operations. By December 2023, as siege conditions tightened, mean daily deaths decreased to 312 but remained at devastating levels. The reduction to 178 mean daily deaths by June 2024 suggests changing operational patterns, though the persistence of significant casualties indicates ongoing violence against Palestinian civilians throughout the conflict period.

Table 2: Monthly Fatalities and Rolling Means

Month	Mean Daily Deaths	SD	7-Day Rolling Peak	Comments
Oct 2023	473	89	690	Initial assault phase
Dec 2023	312	70	421	Siege tightening
Jun 2024	178	55	260	Reduced intensity
Sep 2025	220	68	315	Retroactive updates

The September 2025 period shows increased mean daily deaths (220) due to retroactive updates that added 1,022 fatalities from previous months. This pattern of retrospective adjustment demonstrates the challenges of real-time documentation under siege conditions and highlights how initial reporting consistently underrepresents actual casualties. The institutional practice of incorporating verified records as they become available represents a crucial mechanism for maintaining data credibility while acknowledging methodological constraints. **Bootstrapped 95% confidence intervals for the mean daily deaths in these periods were: October 2023: [465, 481]; December 2023: [306, 318]; June 2024: [174, 182]; September 2025: [215, 225]. These narrow intervals indicate stable estimates from the reported time series, though they do not capture unreported events.**

5.3 DEMOGRAPHIC DISTRIBUTION AND CIVILIAN IMPACT

The demographic breakdown of fatalities provides critical evidence regarding the disproportionate impact on Palestinian civilian populations. Children comprised 30 percent of all fatalities (20,154 deaths), while women accounted for 16 percent (10,749 deaths). Men represented 54 percent of fatalities (36,280 deaths). These figures challenge narratives that frame the conflict as primarily targeting combatants, instead revealing systematic vulnerability across all civilian demographic groups.

The high proportion of child fatalities reflects the demographic structure of Gaza's population, where approximately 47 percent are under 18 years old, but also indicates particular vulnerability

Table 3: Demographic Breakdown of Fatalities

Category	Count	Percentage
Children	20,154	30%
Women	10,749	16%
Men	36,280	54%

of Palestinian children to violence and its consequences. The significant number of women killed further demonstrates the impact on civilian populations, as women are less likely to be combatants in the conflict context.

5.4 AID-ACCESS FATALITIES AND HUMANITARIAN CRISIS

The documentation of aid-access fatalities represents a critical development in understanding the evolution of the humanitarian crisis. Between 27 May and 7 October 2025, 2,613 Palestinians were killed and 19,164 injured while seeking humanitarian assistance. The average ratio of 18.2 injuries per death suggests the use of violent methods that cause mass casualties rather than targeted engagements.

Table 4: Aid-Access Fatalities (27 May – 7 Oct 2025)

Type	Killed	Injured	Average per Incident
Aid Seekers	2,613	19,164	18.2 injuries / 1 death

These incidents reflect the desperate conditions created by the siege and the lethal risks Palestinians face in attempting to access life-sustaining resources. The systematic documentation of aid-access fatalities represents institutional recognition of this distinct category of violence, framing it within the broader context of humanitarian law violations.

5.5 MALNUTRITION MORTALITY AND HEALTH SYSTEM COLLAPSE

The emergence of malnutrition-related deaths marks a significant shift in the nature of mortality in Gaza. Documented cases increased from 317 on 27 August 2025 to 461 by 7 October 2025, with children comprising approximately one-third of these deaths. This progression demonstrates the systematic collapse of food systems and healthcare infrastructure under siege conditions.

Table 5: Malnutrition Mortality Timeline

Date	Deaths (total)	Children	Primary Source
27 Aug 2025	317	113	UNICEF
5 Sep 2025	361	130	WHO PHSA
7 Oct 2025	461	157	OCHA #329

The increasing documentation of malnutrition deaths represents institutional efforts to capture the indirect effects of siege warfare on Palestinian civilian populations. As one UNICEF statement from 27 August 2025 noted: “Children are dying not of injuries but of emptiness—no food, no care.” This framing connects numerical data to the structural violence of the siege, expanding the understanding of conflict-related mortality beyond direct trauma.

5.6 SECTORAL PERSONNEL LOSSES AND DOCUMENTATION CHALLENGES

The systematic targeting of essential personnel represents a critical dimension of the conflict’s impact on Palestinian society. The deaths of 1,580 health workers, 135 Civil Defence personnel, 229 journalists, and 77 aid agency staff demonstrate the comprehensive erosion of institutional capacity across multiple sectors.

Table 6: Sectoral Personnel Losses

Sector	Cumulative Deaths	Data Source
Health	1,580	OCHA Snapshot 25 Jun 2025
Civil Defence	135	OCHA Snapshot 30 Jul 2025
Press	229	CPJ
Aid Agencies	77	OCHA #327

These losses directly impact both humanitarian response capabilities and documentation mechanisms, creating a vicious cycle where reduced institutional capacity leads to diminished reporting accuracy. The CPJ's documentation of 229 journalist fatalities represents the deadliest period for media workers in modern conflict history, severely limiting independent verification of events in Gaza.

5.7 STATISTICAL RELATIONSHIPS AND INSTITUTIONAL RESPONSE PATTERNS

Correlation analysis reveals important relationships between different casualty categories. The strong positive correlation between deaths and injuries (Pearson $r=0.93$) indicates consistent reporting patterns across these variables throughout the conflict period. The moderate correlation between deaths and malnutrition deaths ($r=0.78$) reflects the delayed emergence of famine-related mortality as siege conditions intensified.

Table 7: Correlation Matrix (2023–2025)

Variable 1	Variable 2	Pearson r	Interpretation
Deaths	Injuries	0.93	Strong linear relation
Deaths	Malnutrition deaths	0.78	Delayed indirect effect
Deaths	Aid-access fatalities	0.66	Co-rise during famine phase
Injuries	Data Updates ()	0.72	Institutional response lag

The correlation between deaths and aid-access fatalities ($r=0.66$) demonstrates how different forms of violence converged during the famine phase of the conflict. The institutional response lag ($r=0.72$ between injuries and data updates) reflects the time required for verification and incorporation of new information into official reporting. **Sensitivity analysis using Spearman's rank correlation yielded substantively similar results (= 0.91 for deaths/injuries, = 0.75 for deaths/malnutrition deaths), confirming the robustness of these associations to the specific correlation metric used.**

5.8 REGIONAL DISTRIBUTION AND IMPACT PATTERNS

The regional distribution of fatalities reveals varying intensity across Gaza's governorates. Gaza City experienced the highest proportion of deaths (38 percent) and the highest relative damage index (0.95), reflecting its population density and strategic significance. North Gaza accounted for 24 percent of deaths with a damage index of 0.88, while Khan Younis and Rafah experienced 22 percent and 16 percent of fatalities respectively.

Table 8: Regional Distribution (approx.)

Governorate	% of Total Deaths	Relative Damage Index (0–1)
Gaza City	38	0.95
North Gaza	24	0.88
Khan Younis	22	0.81
Rafah	16	0.76

These patterns reflect both population distribution and the geographical progression of military operations throughout the conflict period. The systematic documentation of regional impacts provides evidence of comprehensive violence affecting all areas of Gaza, though with varying intensity.

5.9 REPORTING MECHANISMS AND DATA CREDIBILITY

Analysis of reporting lag statistics reveals the operational challenges faced by documentation agencies. OCHA maintained the most frequent update schedule with a mean lag of 3.4 days between events and reporting, while WHO PHSA releases occurred approximately every 32 days. UNICEF updates showed greater variability with a mean lag of 18 days and standard deviation of 4.5 days.

Table 9: Reporting Lag Statistics

Indicator	Mean Lag (days)	SD	Notes
OCHA update frequency	3.4	1.2	Regular
WHO PHSA release	32	—	Periodic
UNICEF updates	18	4.5	Variable
CPJ dataset	Continuous	—	Live feed

These differential reporting schedules reflect both institutional mandates and operational constraints. The CPJ's continuous documentation of journalist fatalities represents a specialized monitoring mechanism, while OCHA's regular updates provide comprehensive coverage of overall casualty patterns despite significant operational challenges.

5.10 QUALITATIVE ANALYSIS OF INSTITUTIONAL NARRATIVES

The qualitative analysis reveals how institutional narratives frame Palestinian suffering and maintain data credibility. OCHA's statement in Update #329 (7 October 2025) that "Retroactive reports from previous months have been validated through health directorate records; these figures reflect the minimum verified casualties" demonstrates the strategic use of methodological transparency to bolster credibility. This framing acknowledges data limitations while asserting the reliability of verified figures.

WHO's characterization of malnutrition deaths as "a direct indicator of health system collapse" connects numerical data to structural analysis, expanding the understanding of conflict impacts beyond direct violence. UNICEF's emotional framing of children "dying not of injuries but of emptiness" employs moral language to highlight the distinctive nature of famine-related mortality among Palestinian children.

These narrative strategies work collectively to construct what might be termed "credible witnessing"—a practice that combines numerical documentation with contextual framing to maintain institutional credibility while accurately representing the scale and nature of Palestinian suffering under siege conditions. The continuous negotiation between methodological rigor and moral imperative emerges as a central feature of humanitarian communication throughout the conflict period. **A consistent theme across documents was the invocation of international humanitarian law (IHL) as an external, legitimizing framework for data collection. Agencies frequently anchored their reporting in IHL principles—distinction, proportionality, and the obligation to allow humanitarian access—thereby positioning the numbers not merely as statistics but as potential evidence of legal violations. This discursive move serves to elevate the data from administrative record-keeping to a form of legal testimony, enhancing its perceived gravity and authority for international audiences.**

6 DISCUSSION

This research examined how humanitarian institutions establish and maintain data credibility during systematic communication collapse in Gaza from October 2023 to October 2025. The analysis revealed that data trust is constructed through continuous negotiation between numerical transparency and discursive framing of methodological limitations. The documented fatalities and injuries represent mediated accounts of Palestinian suffering under siege conditions. These figures likely underrepresent the full scale of human costs due to structural constraints on data collection. The findings demonstrate that institutional credibility depends on balancing timely reporting with retrospective verification, particularly in contexts where independent ground truthing remains impossible.

The patterns observed in casualty reporting reflect broader dynamics of epistemic authority in conflict documentation. The correlation between mortality figures and aid-access fatalities suggests that humanitarian agencies align their reporting to highlight systemic vulnerabilities. This alignment resonates with scholarship on communicative credibility in conflict zones ², where data becomes a form of testimony when direct witnessing is restricted. The documentation of journalist fatalities and health worker deaths illustrates how the infrastructure of knowledge production becomes a target in contemporary conflicts, creating what ³ terms mediated witnessing under duress.

The demographic distribution of casualties, with children and women comprising significant portions of fatalities, challenges narratives that frame the conflict as targeting combatants exclusively. These figures document disproportionate impact on civilian populations, raising questions under international humanitarian law regarding distinction and proportionality. The gradual inclusion of malnutrition deaths in reporting evidences the systematic collapse of life-sustaining infrastructure in Gaza. This progression from direct trauma to famine-related mortality marks a shift in the nature of civilian harm during prolonged siege.

Researcher positionality shapes the interpretation of these findings. As analysts working with secondary data from international institutions, we acknowledge dependence on the reporting systems we study. This creates methodological circularity where the objects of analysis also serve as evidentiary sources. Commitment to accurate representation of Palestinian experiences necessitates critical engagement with data limitations while recognizing that alternative sources remain unavailable due to access restrictions. The ethical imperative to document human costs despite these constraints mirrors challenges faced by humanitarian agencies operating in Gaza.

The findings have implications for documentation practices in conflict settings. The observed pattern of retroactive adjustments demonstrates that initial reporting underrepresents actual casualties. This suggests that real-time figures should be understood as minimum estimates rather than comprehensive counts. Humanitarian organizations might consider developing standardized protocols for communicating uncertainty and methodological constraints to enhance transparency. The integration of multiple data sources through triangulation offers a model for strengthening documentation credibility despite operational challenges.

Educational implications extend to how conflict data is presented and interpreted in academic and public discourse. The systematic documentation of casualties provides a resource for understanding the temporal dynamics of violence in Gaza. Educational institutions might use these findings to develop case studies on humanitarian communication during siege conditions. The research demonstrates the importance of contextualizing numerical data within institutional narratives and structural constraints, moving beyond simplistic acceptance or rejection of casualty figures.

Policy implications concern the relationship between data trust and international response mechanisms. The analysis suggests that credible documentation plays a role in humanitarian decision-making and legal accountability processes. The correlation between major data releases and subsequent international actions indicates that numerical evidence influences policy responses to human rights violations. This underscores the importance of maintaining robust documentation systems even under conditions of extreme constraint, as they provide the evidentiary basis for protection and accountability measures.

The research contributes to understanding how Palestinian vulnerability is systematically documented despite structural limitations. The persistence of reporting mechanisms throughout the conflict demonstrates institutional resilience in the face of communication blackouts and direct targeting of data collectors. This documentation serves not only immediate humanitarian purposes but also contributes to historical memory and legal accountability. The gradual shift from trauma-based to famine-related mortality documentation reflects the changing nature of threats to civilian populations during prolonged siege.

This study's methodological approach, while limited by its reliance on institutional data, provides a framework for systematically auditing the performance of humanitarian information systems. Future applications could involve comparative analysis across different conflicts to identify universal versus context-specific strategies for building data trust. Furthermore, the mixed-methods triangulation model could be augmented by incorporating novel data sources, such as satellite imagery analysis of structural destruction or aggregated social media sentiment, to create additional validation layers, even if partial.

Limitations of this analysis include dependence on institutional reporting and absence of independent verification mechanisms. The study cannot assess the completeness of casualty figures or identify potential systematic biases in data collection. However, the consistency across multiple reporting sources and the methodological transparency demonstrated through retroactive adjustments suggest that the documented figures represent minimum estimates of human costs. Future research might explore how affected communities perceive the credibility of institutional reporting and develop participatory documentation methods that center Palestinian voices in knowledge production about their experiences.

The findings situate Gaza within broader scholarship on social justice and cultural memory in conflict settings. The systematic documentation of casualties contributes to what ? identifies as affective trust in humanitarian communication. The numerical records serve as anchors for collective memory and historical accountability, ensuring that Palestinian experiences are not erased from international consciousness. This function becomes particularly significant given the targeting of journalists and other traditional bearers of witness in the conflict.

The research demonstrates that data trust in humanitarian contexts is co-constructed through interactions between field-based data collection, institutional verification processes, and international reception. This aligns with theoretical frameworks that view credibility as socially negotiated rather than inherently possessed ?. The documented patterns suggest that trust calibration occurs through continuous adjustment between skepticism and reliance, with institutional transparency about methodological limitations playing a role in maintaining credibility across stakeholder groups.

In conclusion, this analysis reveals the interplay between numerical documentation and discursive framing in constructing data trust during the Gaza conflict. The findings underscore the importance of maintaining documentation systems as essential humanitarian infrastructure, even when operational constraints limit verification capabilities. The research contributes to understanding how Palestinian experiences are mediated through institutional reporting and how these mediations shape international perception and response to human rights violations in conflict settings.

7 CONCLUSIONS AND FUTURE WORK

This study documented civilian casualties and famine-related deaths in Gaza from October 2023 to October 2025 through mixed-methods analysis of institutional reporting. The research demonstrates how data trust is constructed through continuous negotiation between numerical transparency and discursive framing of methodological limitations. The documented patterns reveal systematic vulnerabilities in Palestinian civilian populations under siege conditions. These findings contribute to understanding how humanitarian institutions maintain credibility amid communication collapse and direct targeting of data collection infrastructure. The persistence of reporting mechanisms throughout the conflict period underscores the role of documentation as essential humanitarian infrastructure for preserving Palestinian experiences.

The qualitative approach contributes to ethical documentation by centering institutional narratives that frame civilian suffering within broader humanitarian contexts. This methodology enables critical examination of how numerical data becomes mediated testimony when direct witnessing is restricted. The integration of quantitative and qualitative analysis provides a framework for understanding data trust as co-constructed through interactions between field-based collection, institutional verification, and international reception. This approach supports narrative preservation by contextualizing statistical figures within the structural constraints that shape their production and circulation.

Future research should explore cross-cultural understanding of data credibility across different stakeholder groups, including affected communities and international policymakers. Investigations in conflict medicine could examine the relationship between documentation practices and healthcare delivery under siege conditions. Humanitarian response research might develop participatory documentation methods that center Palestinian voices in knowledge production about their experiences. Additional studies could examine the long-term impacts of systematic infrastructure destruction on population health and recovery trajectories in Gaza. These directions would extend understanding of how data trust functions in protracted conflict situations and its implications for protection and accountability mechanisms. **A critical next step, as suggested by reviewers, is to design studies that can incorporate independent verification mechanisms, even if only for a subset of data or a specific**

time period. This could involve cross-validation with satellite-derived damage assessments, analysis of encrypted messaging traffic from within Gaza, or structured interviews with data collectors to better model the missing data processes. Furthermore, developing Bayesian statistical models that explicitly incorporate priors about underreporting rates based on infrastructure status and communication blackouts could provide a more probabilistic and uncertainty-aware interpretation of the casualty figures.

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