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Universally inadequate antenatal coverage and the paradox of facility-based delivery in conflict-affected Gaza: a cross-sectional study

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Abstract

Background

Armed conflicts disproportionately affect women and newborns by disrupting perinatal care. Since 7 October 2023, the Gaza Strip has faced one of the most severe protracted humanitarian emergencies, with collapse of its health system. Data on access to perinatal care among women reaching primary healthcare facilities, and on early neonatal outcomes during the war, remain scarce.

Methods

We did a multicentre, cross-sectional study of Palestinian women who conceived and delivered during the war, consecutively recruited at primary healthcare clinics run by Médecins du Monde France in Gaza between 17 March and 6 July 2025. The primary outcome was inadequate access to essential antenatal care, defined per the WHO 2016 recommendations as incomplete coverage of antenatal visits, supplements, blood tests, ultrasound, and vaccination. Proportions are reported with Wilson 95% CIs.

Results

95 women were included. All 88 evaluable women had inadequate access (100.00%, 95% CI 95.82–100.00). Although 87.23% delivered in hospital, only 61.70% had postnatal contact within 48 h. At least one maternal complication occurred in 83.16%; 30-day neonatal mortality was 9.57% (95% CI 5.12–17.20) and moderate-to-severe newborn malnutrition affected 67.74%. Severe environmental exposure affected 50.55% of women and 93.55% had limited or no access to clean water in pregnancy.

Conclusions

Among Palestinian women reaching a primary healthcare facility in Gaza during the 2023–2025 war, access to essential antenatal care was universally compromised. The persistence of facility-based delivery without adequate antenatal, intrapartum, postnatal, and neonatal infrastructure indicates that facility-based delivery alone is no longer a reliable marker of safe pregnancy and birth.

Background

Armed conflicts impose a disproportionate burden on women and newborns. The destruction of healthcare infrastructure, the displacement of populations, the disruption of supply chains, and the erosion of social support systems converge to undermine every component of the perinatal continuum of care, from preconception nutrition and care through antenatal surveillance to skilled birth attendance, postnatal follow-up, and early neonatal care [1, 2]. More than half of all maternal deaths and stillbirths globally now occur in fragile and conflict-affected settings: in 2023, an estimated six in ten maternal

deaths worldwide arose in such settings, despite their accounting for only around one in ten of global live births, and the risk of dying from a maternal cause was approximately five times higher for each pregnancy than in stable countries [3]. The underlying mechanisms are multifactorial and remain incompletely characterised, with overlapping biological, environmental, and health-system pathways that are difficult to disentangle [4, 5].

The Gaza Strip, with a pre-conflict population of approximately 2.1 million in a 365-square-kilometre territory and one of the highest population densities in the world, exemplifies these vulnerabilities in extreme form. Approximately 47% of residents are under 18 years of age, and the annual number of live births before October 2023 was estimated at approximately 57,000 [6, 7]. The Palestinian healthcare system in Gaza, although chronically underfunded and structurally fragmented, had achieved relatively favourable maternal and neonatal indicators by regional standards prior to the war, with reported antenatal-care (ANC) coverage above 95%, skilled birth attendance (SBA) above 99%, and a neonatal mortality rate (NMR) of approximately 8.5 per 1,000 live births [8, 9]. Despite chronic structural constraints, including a prolonged blockade and recurrent military escalations, Gaza's pre-conflict NMR was substantially lower than the global average of approximately 17 per 1,000 live births and below the regional average for the Middle East and North Africa, although it remained two to three times higher than the rates of 2 to 3 per 1,000 reported in high-income settings [10, 11].

Since 7 October 2023, the war in the Gaza Strip has produced a protracted humanitarian emergency, with mass casualties, repeated internal displacement, and progressive collapse of the healthcare system (Fig. 1) [12, 13]; in September 2025, the United Nations Independent International Commission of Inquiry on the Occupied Palestinian Territory concluded that the conduct of hostilities met the legal threshold of genocide [14].

The war has produced a near-total collapse of Gaza's health infrastructure. As of October 2025, only 14 of the 36 hospitals remained functional, and even these were operating only partially, amid severe shortages of electricity, clean water, medicines and equipment; of the 176 primary health-care centres, only about one third remained partially functional [15]. This destruction has fallen directly on frontline maternal and neonatal services. The central server for the national health information system was destroyed in November 2023, severely limiting routine surveillance and the capacity to monitor maternal and neonatal indicators in real time [7].

A small body of literature has begun to document the impact of the current war on maternal and neonatal health in Gaza [7, 16]. Several specific aspects of this experience remain under documented. First, the perinatal continuum of care for women who, because of restricted mobility, displacement or active hostilities, do not reach a hospital but reach the network of primary healthcare clinics is not currently described. Second, information on the postnatal and early neonatal phases of the continuum of care, and in particular on outcomes assessed at thirty days of life, is scarce. Third, the perinatal experience of women interviewed during a period characterised by repeated breakdowns of ceasefire arrangements and progressive depletion of healthcare and humanitarian capacity, has not yet been

systematically reported. Fourth, environmental and direct conflict-exposure variables, including access to clean water, hygienic conditions, exposure to extreme weather and direct physical trauma, have not been measured at the level of the maternal-newborn dyad in this setting. Together, these gaps limit the capacity of the international community to quantify the perinatal impact of the protracted phase of the war, to compare it against the pre-conflict baseline of the Palestinian health system, and to inform the perinatal component of the humanitarian response.

To address these gaps, we conducted a multicentre, facility-based cross-sectional survey of Palestinian women who had conceived and delivered during the war, recruited consecutively through primary healthcare clinics operated by Médecins du Monde France (MdM-F) across all five governorates of the Gaza Strip, with field activities conducted between March and July 2025, during the protracted phase of the war. The primary aim was to quantify the prevalence of inadequate access to essential antenatal care during the war, defined a priori according to the World Health Organization 2016 antenatal-care recommendations [17]. Pre-specified secondary aims were to quantify neonatal mortality at 30 days of life and the prevalence of moderate-to-severe newborn malnutrition, to characterise the burden of maternal pregnancy and postpartum complications, and to describe direct conflict and environmental exposures across the perinatal period. We hypothesised that, in a population of women who had reached a primary healthcare facility, and therefore represented the more accessible end of the spectrum of women living in Gaza during the war, access along all components of the perinatal continuum of care would be severely compromised, and that the high rate of facility-based delivery characteristic of pre-conflict Gaza would be partly preserved but would no longer translate into adequate intrapartum, postnatal or early-neonatal outcomes.

Methods

Study design and reporting

We conducted a multicentre, facility-based, cross-sectional descriptive study of women who had conceived and delivered or experienced spontaneous abortion during the war in the Gaza Strip. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies.

Setting

The study was conducted at primary healthcare clinics operated by Médecins du Monde France in the five governorates of the Gaza Strip: North Gaza, Gaza City, Deir al-Balah, Khan Younis, and Rafah, providing geographical coverage of the principal population centres and internal-displacement sites within the territory. Data collection took place between 17 March 2025 and 6 July 2025, a period characterised by repeated breakdowns of ceasefire arrangements, intense military activity in proximity to civilian and healthcare facilities, recurrent temporary closures of health services, severe restrictions on humanitarian aid and supply chains, and worsening food insecurity. Field activities were conducted whenever clinical operations were feasible and safe for both participants and personnel.

Participants

Eligibility criteria were: (i) self-reported residence in the Gaza Strip throughout the index pregnancy and delivery; (ii) conception and live birth, stillbirth or spontaneous abortion occurring after 7 October 2023; (iii) age 15 years or older (the youngest participant actually enrolled was 16 years of age); and (iv) capacity to provide informed consent in Arabic, English, French or Italian. Women in acute medical or psychological distress at the time of clinic contact were excluded. Recruitment was consecutive: every eligible woman attending a participating MdM-F clinic during the study period was invited to participate.

Data collection

A structured digital questionnaire was administered to each participant by trained MdM-F healthcare personnel in private clinic spaces. The questionnaire was originally drafted in English, translated into Arabic, and back-translated into English by independent bilingual translators; the final Arabic version was pilot-tested with five women not included in the analytic sample, with minor wording adjustments retained. The data-collection platform was developed specifically for low-connectivity environments and supported offline completion with local browser-based storage and subsequent synchronisation when connectivity was restored, in order to mitigate data loss in the unstable digital infrastructure of the Gaza Strip caused by the war.

Maternal questionnaire

The maternal questionnaire was developed de novo for the present study and has not been published elsewhere. It was drafted by the investigators on the basis of the 2016 World Health Organization antenatal-care recommendations and of the indicators of the perinatal continuum of care; its translation and pilot testing are described above. The full English-language version of the instrument is provided in Additional file 1. The maternal questionnaire comprised 36 items grouped in five sections:

- Demographic information: nationality, age, gravidity, parity and plurality of the index pregnancy.
- Prenatal care and nutrition: antenatal visit attendance, intake of essential supplements, blood-test coverage, ultrasound coverage, vaccination during pregnancy, access to emergency care, signs of maternal malnutrition and balanced-diet adequacy.
- Pregnancy and delivery: complications during pregnancy (anaemia, infection, fetal growth restriction, hypertensive disorders, gestational diabetes, antepartum and postpartum haemorrhage), place and type of delivery, attendance at birth and postpartum complications.
- Postnatal and neonatal care: postnatal contact within 48 hours of delivery, breastfeeding initiation, formula availability, newborn evaluation within 24 hours of birth, infant illnesses, newborn malnutrition, dehydration, skin and respiratory infections, fever, access to medications, and reported health status of the infant at one month of age.
- Conflict and environmental exposure: access to clean water, exposure to unhygienic conditions, exposure to extreme weather, and direct physical trauma due to bombing or debris.

Variables and outcome definitions

Primary outcome

The primary outcome was the prevalence of inadequate access to essential antenatal care, defined a priori according to the World Health Organization 2016 antenatal-care recommendations and operationalised, on the basis of the available items, as the proportion of women without complete access to all of the following components: at least four antenatal visits, regular intake of essential supplements, regular blood-test coverage, regular ultrasound coverage, and full vaccination during pregnancy.

Secondary outcomes

Pre-specified secondary outcomes were:

- Neonatal mortality at 30 days of life, defined as deaths from any cause among live-born infants, expressed as a proportion of live births reported by the mother at the one-month assessment.
- Moderate-to-severe newborn malnutrition at one month of age, as reported by the mother on a three-level ordinal scale (severe, moderate, absent).
- Prevalence of pregnancies complicated by anaemia, infection, fetal growth restriction, hypertensive disorders of pregnancy, or antepartum or postpartum haemorrhage.
- Prevalence of severe environmental exposure, defined as severe exposure to unhygienic conditions or severe direct physical trauma related to bombing or debris.
- Prevalence of limited or absent access to clean water during pregnancy.

Exploratory outcomes

Exploratory outcomes were the associations between inadequate antenatal access and a composite of adverse pregnancy outcomes (stillbirth, preterm death, dysmorphic infant or neonatal death at 30 days). These analyses are considered hypothesis-generating, given the sample-size constraints described above.

Statistical analysis

All analyses were performed in Python 3.11, using the pandas, scipy.stats and openpyxl libraries. Categorical variables are presented as absolute frequencies (n) over the variable-specific denominator (N), and as proportions (%) with 95% confidence intervals calculated using the Wilson score method, which is preferred over the Wald approximation for proportions estimated in samples of moderate size or close to the boundary values of 0 and 1. Continuous variables (maternal age, parity) are presented as means with standard deviations and as medians with ranges.

Denominators were computed for each item separately, with missing responses excluded. The proportion of missing data for each variable is reported in the footnote of the corresponding table and ranged from 0% to 5.3%. Where survey items allowed multiple responses (pregnancy complications, postpartum complications, newborn diseases), proportions for each category are reported as prevalences and may sum to more than 100%; this is indicated by an asterisk in the relevant tables.

Exploratory associations between adequacy of antenatal care and the composite adverse pregnancy outcome were assessed using logistic regression. Because the dichotomous adequate-versus-inadequate antenatal-care exposure had no variability in this cohort (all evaluable women met the inadequate criterion), an ordinal exposure was constructed as the count of inadequate antenatal-care components per woman (range one to five). Adjusted odds ratios were estimated with maternal age and parity included a priori as covariates. The Cochran-Armitage test for trend was used to assess monotonic dose-response. Given the limited sample size, these models are interpreted as exploratory and hypothesis-generating.

A sensitivity analysis was conducted by re-running the principal descriptive analyses after excluding records flagged as duplicate device submissions but retaining respondent-level uniqueness based on the combination of self-reported age, parity and timestamp. Results are presented in Additional file 1 (Table S6) and did not materially alter the principal estimates.

Mitigation of bias

Several measures were undertaken to minimise potential sources of bias. Selection bias was mitigated by recruiting consecutively across the five governorates of the Gaza Strip and across multiple MdM-F facilities, to capture a heterogeneous sample of women exposed to varying degrees of disruption. Recall bias was minimised by interviewing women in the postpartum period or shortly thereafter. Social-desirability bias and language bias were mitigated by administering the questionnaire in Arabic with locally trained personnel, by ensuring private interview spaces, and by emphasising the voluntary and confidential nature of participation.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki, with the principles of Good Clinical Practice, and with the United Nations Office for the Coordination of Humanitarian Affairs guidelines on data protection in conflict-affected settings. All participants provided written or witnessed oral informed consent in their preferred language prior to enrolment. Personal identifiers were not recorded; only an anonymised participant code, the date of interview and the clinic site were retained. Given the conflict context, no biological samples were obtained, no facial images were captured, and no personal locator information was recorded. Participants were informed that they could withdraw at any time without affecting their access to MdM-F services. The study did not provide direct material incentives for participation. The study was authorised by the Research Department of the Health Information Unit, Palestinian Ministry of Health (reference 25180117, 5 January 2025; renewed as

reference 2591540, 7 July 2025). Approval by a research ethics committee was not required: under the Health Research Procedures Guide endorsed by the Ministry of Health, approval by the Helsinki Committee is not mandated for research involving no interventional procedures and posing no potential risk of harm, and for such studies the review and opinion of the Ministry's own internal committee is considered sufficient for authorisation (Ministry of Health confirmation, reference 26372786, 20 August 2026). The study was non-interventional, involving no clinical intervention, no biological sampling and no recording of personal identifiers. No participant was under 16 years of age.

Data and code availability

De-identified individual-participant data and the analysis code will be made available upon reasonable request to the corresponding author, subject to a data-access agreement and approval of the responsible authorities, in order to comply with the data-protection requirements of the operating humanitarian agencies in the Gaza Strip.

Results

Participant flow

Between 17 March 2025 and 6 July 2025, 97 women attending Médecins du Monde France primary healthcare clinics in the Gaza Strip provided a maternal questionnaire response. Two records were excluded because residence in the Gaza Strip throughout pregnancy and delivery could not be confirmed, leaving 95 women in the final analytical sample. The maternal questionnaire was administered as a single contact and no participant was lost to follow-up; outcomes referring to the first 30 days of life were collected retrospectively at the time of the postpartum visit. The participant flow is summarised in Fig. 2.

Baseline characteristics

The 95 women included had a mean age of 27.6 years (standard deviation 5.5; median 28, range 16 to 45). Their baseline demographic and obstetric characteristics are presented in Table 1, and key access and outcome indicators across the perinatal continuum of care are summarised in Table 2.

Table 1
Baseline characteristics of the analytical sample (n = 95)

Variable	Category	n	N	Statistic / %	95% CI
Maternal age (years)					
	Mean (SD)		95	27.6 (5.5)	
	Median (range)		95	28 (16–45)	
Age class					
	< 20 years	4	95	4.21	1.65–10.33
	20–29 years	57	95	60.00	49.93–69.27
	30–39 years	32	95	33.68	24.98–43.66
	40 years or older	2	95	2.11	0.58–7.35
Obstetric history					
	Number of children, mean (SD)		95	3.6 (2.0)	
	First pregnancy	20	95	21.05	14.00-30.43
	Multiple pregnancy	8	95	8.42	4.33–15.75

SD, standard deviation. 95% CI, Wilson score 95% confidence interval.

Table 2
Access and outcomes across the perinatal continuum of care (n = 95)

Indicator	% (n/N)	95% CI
Antenatal care		
Inadequate access to essential antenatal care (primary outcome)	100.00 (88/88)	95.82–100.00
Complete coverage of regular blood tests (lowest component)	15.96 (15/94)	9.92–24.67
Complete coverage of vaccination during pregnancy (highest component)	44.44 (40/90)	34.62–54.73
Maternal health during pregnancy		
At least one pregnancy complication	83.16 (79/95)	74.38–89.36
Anaemia	58.95 (56/95)	48.90–68.30
Delivery		
Facility (hospital) delivery	87.23 (82/94)	79.00–92.54
Postpartum haemorrhage	30.85 (29/94)	22.42–40.79
Postnatal and neonatal care		
Postnatal contact within 48 h	61.70 (58/94)	51.60–70.89
Neonatal mortality at 30 days	9.57 (9/94)	5.12–17.20
Moderate-to-severe newborn malnutrition	67.74 (63/93)	57.70–76.38
Complete access to essential neonatal medicines	6.59 (6/91)	3.06–13.65
Environment and conflict exposure		
Severe environmental exposure	50.55 (46/91)	40.46–60.59
Limited or absent access to clean water in pregnancy	93.55 (87/93)	86.63–97.01

n/N, number with the characteristic over the variable-specific evaluable denominator. 95% CI calculated using the Wilson score method. Full category-level data are provided in Additional file 1.

Primary outcome

The primary outcome of inadequate access to essential antenatal care, defined a priori as the absence of complete coverage of at least one of five components (regular antenatal visits, intake of essential supplements, blood-test coverage, ultrasound coverage, and full vaccination during pregnancy), was fully evaluable in 88 of 95 women. All 88 evaluable women met the criteria for inadequate access (100.00%, 95% CI 95.82 to 100.00); no single component reached complete coverage in more than 44% of women (Table 2; Additional file 1, Table S1).

Secondary outcomes

Neonatal mortality at 30 days of life was 9.57% (9 deaths among 94 live births, 95% CI 5.12 to 17.20), and moderate-to-severe newborn malnutrition at one month affected 67.74% of infants (95% CI 57.70 to 76.38). The granular distribution of neonatal status, illness, dehydration, infection, and access to medicines is presented in Additional file 1 (Table S4).

At least one maternal pregnancy complication was reported by most women, anaemia being the most common; the full distribution of pregnancy and postpartum complications is shown in Table 2 and Additional file 1 (Tables S2 and S3).

Severe environmental exposure was reported by about half of the women, and limited or absent access to clean water during pregnancy was nearly universal (Table 2; Additional file 1, Table S5).

Additional analyses

A composite adverse pregnancy outcome (stillbirth, preterm death, dysmorphic infant, spontaneous abortion or neonatal death at 30 days) occurred in 13.83% of evaluable pregnancies (13/94, 95% CI 8.26 to 22.24).

Because every evaluable participant met the criteria for the primary outcome, exploratory analyses based on the dichotomous adequate-versus-inadequate antenatal-care exposure were not estimable. A complementary exploratory analysis was therefore conducted using an ordinal exposure defined as the count of inadequate antenatal-care components per woman, with values ranging from one to five. The crude odds ratio for the composite adverse pregnancy outcome per additional inadequate component was 0.93 (95% CI 0.60 to 1.46, p = 0.767). After adjustment for maternal age and parity, the odds ratio was 0.89 (95% CI 0.57 to 1.40, p = 0.617). The Cochran-Armitage test for trend was not significant (z = -0.296, p = 0.767). The exploratory association between severe environmental exposure and the composite adverse pregnancy outcome was not statistically significant either, both before adjustment (crude odds ratio 0.62, 95% CI 0.16 to 2.36, p = 0.482) and after adjustment for maternal age and parity (adjusted odds ratio 0.55, 95% CI 0.14 to 2.22, p = 0.404).

A sensitivity analysis excluding records flagged as duplicate device submissions but retaining respondent-level uniqueness on the basis of the combination of self-reported age, parity and timestamp did not materially alter the principal estimates and is reported in Additional file 1 (Table S6).

Adverse events potentially related to study participation were monitored throughout data collection by the local field team. No participant withdrew because of distress or security concerns during the interview, and no incident requiring referral or notification was recorded.

Discussion

In this multicentre cross-sectional survey of Palestinian women who had conceived and delivered or experienced spontaneous abortion during the 2023–2025 war in the Gaza Strip, every woman fully evaluable for the primary outcome (88 of 88) met the criteria for inadequate access to essential antenatal care according to the World Health Organization 2016 recommendations. The prevalence of the primary outcome (100.00%, 95% CI 95.82 to 100.00) was not driven by isolated failures of a single component of antenatal care but reflected a generalised collapse across visits, supplements, blood tests, ultrasound monitoring and vaccination during pregnancy, with component-specific complete adequate coverage that never exceeded 44%. Neonatal mortality at 30 days of life reached 9.57%, moderate-to-severe newborn malnutrition affected 67.74% of infants, and 93.55% of women had limited or no access to clean water during pregnancy. These findings, collected during the protracted phase of the war and in a population of women who had managed to reach a functioning primary healthcare facility, are likely to underestimate, rather than overestimate, the perinatal burden of women who could not access any healthcare contact at all.

Placed against the pre-conflict baseline of the Palestinian health system [8, 9], the magnitude of the deterioration is substantial. Antenatal-care coverage above 95% (mainly through the MoH and UNRWA primary healthcare centres) which are now mostly destroyed [15], skilled birth attendance above 99% and a neonatal mortality rate of approximately 8.5 per 1,000 live births had positioned the perinatal performance of the Gaza Strip among the strongest in the Eastern Mediterranean region by 2022. Within less than two years, these indicators have effectively been displaced by a perinatal scenario in which complete adequate antenatal care has become a residual phenomenon, in which approximately one in ten newborns does not survive the first month of life among women who have reached a primary care facility, and in which the routine information system needed to monitor these outcomes has itself been destroyed.

A central finding of this study is the divergence between the persistence of facility-based delivery and the apparent absence of the intrapartum, postnatal and neonatal infrastructure that conventionally accompanies it. Although 87.23% of women in our sample delivered in a hospital and 30.85% delivered with midwifery rather than physician attendance, postpartum haemorrhage was reported by 30.85% of women, postnatal contact within 48 hours was secured by only 61.70% of women, and complete access to essential medications during the neonatal period was reported by 6.59% of mothers. In a stable health system, facility-based delivery is the principal proxy for safe birth. In the present setting, facility-based delivery appears to have become decoupled from the continuum of services that gives it clinical meaning. This decoupling is, in our view, the single observation with the highest policy relevance: in conflict-affected settings where hospitals continue to operate but where the surrounding antenatal, postnatal and neonatal infrastructure has been damaged or destroyed, facility-based delivery should no longer be used in isolation as an indicator of safe pregnancy and birth.

Environmental and direct conflict-exposure variables, measured at the level of the maternal-newborn dyad, complete this picture. Half of the women in the sample were severely exposed to unhygienic conditions, approximately half were severely exposed to extreme weather conditions, and almost one in

four reported physical injuries due to bombings or debris during pregnancy. Limited or absent access to clean water was nearly universal. These exposures are not background context but biologically plausible drivers of the burden of neonatal skin and respiratory infections, dehydration, malnutrition and early mortality observed in our cohort. The integration of environmental and conflict-exposure variables into the maternal questionnaire allowed us to document, at the level of the dyad rather than at the level of the territory, the convergence of clinical and environmental determinants that the broader literature on the health effects of armed conflict has long described [1].

Our findings are coherent with, and add granularity to, the small but growing body of evidence on maternal and neonatal health in Gaza during the current war [7, 16]. They extend that evidence in three directions: by anchoring the description of the perinatal continuum of care on a primary care, multi-governorate sample collected during the protracted phase of the war in 2025; by quantifying outcomes at thirty days of life rather than restricting the analysis to events occurring at delivery; and by jointly measuring environmental and conflict exposures alongside clinical events at the level of the mother-newborn dyad.

Two recent primary studies help to situate our findings. In a large cohort of UNRWA-registered women who were pregnant at the onset of the war, the pregnancy-related mortality ratio rose to more than 30 times the pre-conflict level and the population neonatal mortality rate was 9.4 per 1000 livebirths, while facility-based delivery remained near-universal (97.3%) but shifted from government to non-governmental facilities with shorter hospital stays [18]. A hospital-based study conducted in 2025 documented pervasive food scarcity, displacement, smoke exposure, and recent bombardment alongside obstetric and neonatal care [19]. Our 30-day neonatal mortality of 9.57% is substantially higher than the population neonatal mortality rate reported by Jamaluddine and colleagues; this is expected rather than contradictory, because our smaller sample was drawn from women reaching primary care during the later, famine-affected phase of the war and outcomes were ascertained at one month of life rather than at or shortly after birth, so the two estimates reflect different populations and time windows. To our knowledge, ours remains the first study to follow the perinatal continuum to 30 days of life in a primary-care, multi-governorate sample, and it complements these population- and hospital-based analyses.

The high prevalence of moderate-to-severe newborn malnutrition (67.74%, including 24.73% classified as severe) should be read against the famine conditions documented in the Gaza Strip during the data-collection period, when most pregnant and breastfeeding women were reported to be acutely malnourished [15]; this context is likely to have contributed directly to the neonatal malnutrition and early-mortality burden observed in our cohort.

Strengths. Several strengths of this study deserve mention. First, the data are primary and were collected in real time during the active protracted phase of the war and famine, between March and July 2025, a window that included repeated breakdowns of ceasefire arrangements and progressive depletion of healthcare and humanitarian capacity, and that has typically been considered not feasible for structured

data collection. Second, recruitment was distributed across all five governorates of the Gaza Strip and across multiple primary healthcare facilities operated by Médecins du Monde France, reducing the risk of single-site bias. Third, the structure of the questionnaire and the present analysis follows the perinatal continuum of care from preconception nutrition through antenatal surveillance, intrapartum care, postnatal contact and early neonatal outcomes, allowing identification of the specific segment of the continuum at which the system breaks for individual mother-newborn pairs. Fourth, the digital data-collection platform was developed for low-connectivity environments and supported offline completion with local browser-based storage and subsequent synchronisation when connectivity was restored, a methodological choice that may be relevant for future research in other conflict-affected settings in which network infrastructure cannot be relied upon.

Limitations. This study also has several limitations that must temper interpretation. First, the achieved sample size, 95 women against a planned target of 200 to 300, is smaller than originally projected. The resumption of intense military activity during the data-collection window, repeated facility closures and displacements, restrictions on movement and disruption of digital connectivity made it unfeasible to reach the originally planned target; precision of the estimates, although adequate to characterise the central findings, including the saturation of the primary outcome, is reduced for the less prevalent indicators. Second, although eligible women were recruited consecutively, the sample is by its nature a convenience sample, since it was confined to women who were able to reach a primary healthcare facility and were available to participate, and is therefore biased towards the more accessible end of the spectrum of women living in Gaza during the war; the experience of women who, because of displacement, restricted mobility or active hostilities, did not reach any healthcare contact at all is likely to be more severe than that reported here. Third, no internal pre-conflict control group was feasible in this design; the comparison with pre-conflict performance therefore relies on aggregate published baselines from the Palestinian Ministry of Health and from the Multiple Indicator Cluster Survey 2019–2020, with the inherent limitations of comparisons made across different sampling frames and time periods. Fourth, governorate of residence and displacement status were not systematically captured in the version of the questionnaire administered during the study period, and pre-specified subgroup analyses by these dimensions were therefore not possible. Fifth, the cross-sectional design does not allow causal inferences; the exploratory associations between an ordinal measure of antenatal-care inadequacy and the composite adverse pregnancy outcome are hypothesis-generating in nature, and the absence of a statistically significant trend in our cohort should be interpreted in light of the saturation of the primary exposure rather than as evidence of absence of effect.

Implications. The findings of this study have implications across three distinct but interrelated domains. For the humanitarian response, the documented collapse of essential antenatal coverage and of postnatal contact, together with the persistence of facility-based delivery, suggests that perinatal interventions in the Gaza Strip should not be limited to maintaining hospital capacity but should explicitly restore the antenatal and postnatal segments of the continuum of care at the primary care level, including the upstream availability of supplements, vaccines, ultrasound and laboratory services, and the downstream availability of essential neonatal medications and life-saving devices. For health policy in

conflict-affected settings more broadly, the present data support a redefinition of facility-based delivery as a necessary but no longer sufficient indicator of safe pregnancy and birth, and reinforce the case for monitoring a structured set of continuum-of-care indicators rather than single-point performance measures. For the application of international humanitarian law and human-rights monitoring, the present study contributes a primary, peer-reviewable evidence base on the perinatal consequences of the war, complementing aggregate reporting by humanitarian agencies and providing a documentary record that can be referenced in subsequent legal, policy and accountability processes.

Conclusions

Among Palestinian women who reached a primary healthcare facility in the Gaza Strip during the protracted phase of the 2023–2025 war, access to essential antenatal care was universally compromised, the burden of maternal pregnancy and postpartum complications was substantial, and early neonatal outcomes deteriorated markedly compared with the pre-conflict baseline of the Palestinian health system. The persistence of facility-based delivery in the absence of adequate antenatal, intrapartum, postnatal and neonatal infrastructure indicates that, in this setting, facility-based delivery alone no longer constitutes a reliable marker of safe pregnancy and birth. Restoring the perinatal continuum of care for the women and newborns of Gaza, and routinely measuring its components, should be regarded as essential elements of any humanitarian, health-system or policy response in this and in other protracted conflict settings.

Abbreviations

ANC
antenatal care
SBA
skilled birth attendance
NMR
neonatal mortality rate
CI
confidence interval
MdM-F
Médecins du Monde France
MoH
Ministry of Health
UNRWA
United Nations Relief and Works Agency for Palestine Refugees in the Near East
WHO
World Health Organization
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology.

Declarations

Ethics approval and consent to participate

The study was reviewed and authorised by the Research Department of the Health Information Unit, Palestinian Ministry of Health, State of Palestine, the authority responsible for authorising health research in the Gaza Strip. Authorisation was granted on 5 January 2025 (reference 25180117) and renewed on 7 July 2025 (reference 2591540). The authorisation required that informed consent be obtained from all participants, that no medical intervention or biological sampling be performed, and that the research be conducted in accordance with the ethics of scientific research. Approval by a research ethics committee was not required for this study. As confirmed in writing by the Research Department of the Health Information Unit, Palestinian Ministry of Health (reference 26372786, 20 August 2026), under the Health Research Procedures Guide endorsed by the Ministry of Health the Ministry does not mandate approval by the Helsinki Committee for research that involves no interventional procedures and poses no potential risk of harm to researchers, participants or the surrounding environment. For such studies the Ministry considers the review and opinion of its own internal committee sufficient for the purpose of granting authorisation, and the present study was reviewed and authorised on that basis. The study was non-interventional: it consisted solely of a questionnaire administered by trained clinical staff during routine care, no clinical intervention or biological sampling was performed, and no personal identifiers were recorded. The study was conducted in accordance with the Declaration of Helsinki. All participants provided written or witnessed oral informed consent in their preferred language before enrolment. No participant was under 16 years of age; the youngest woman enrolled was 16 years old.

Consent for publication

Not applicable. No individual-level identifying information is reported.

Competing interests

The authors declare no competing interests.

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This study received no specific funding. No funding body had any role in the study design, data collection, analysis, interpretation, or writing of the report.

Author Contribution

MEB, MDC and GT conceived and designed the study. MEB coordinated the study and, together with IS, KAM, RRA, ISh and ESD, collected the data at the primary healthcare clinics in the Gaza Strip. MDC, AD

and MEB analysed and interpreted the data. MEB and MDC drafted the manuscript. FG, AD, IS and GT critically revised the manuscript for important intellectual content. GT and MDC supervised the study. All authors read and approved the final manuscript.

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Data Availability

De-identified individual-participant data and the analysis code are available upon reasonable request from the corresponding author, subject to data-access approval by the responsible authorities.

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Figures

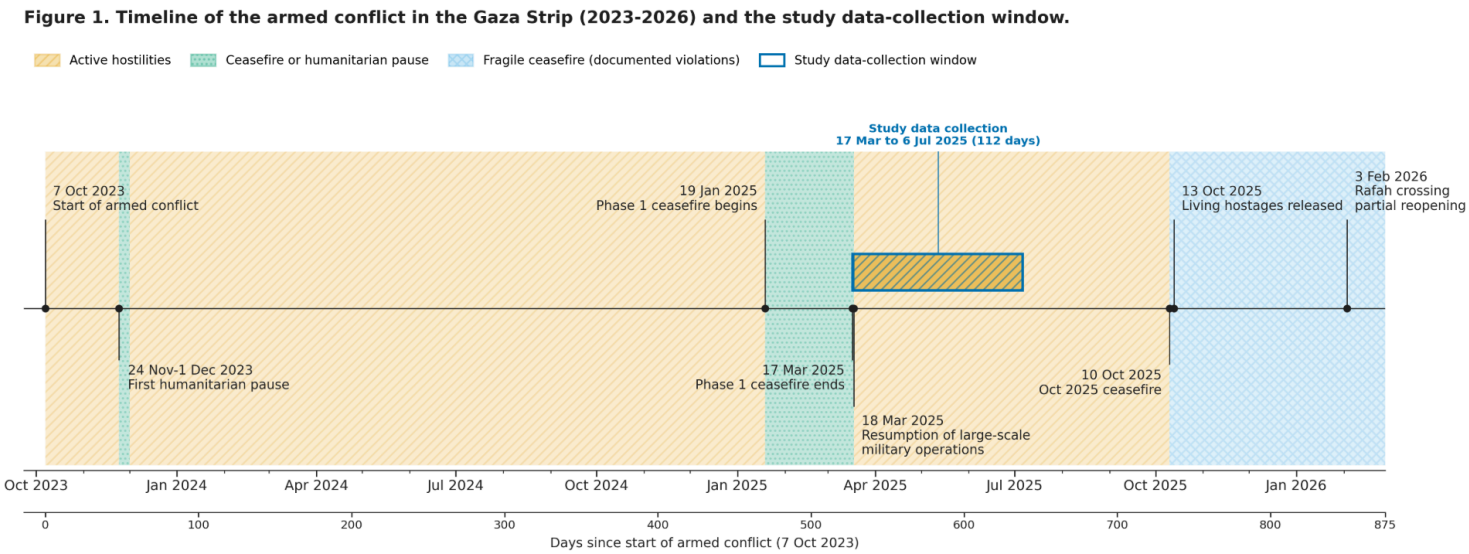


Figure 1

Timeline of the armed conflict in the Gaza Strip (2023 to 2026) and the study data-collection window. Horizontal bands denote periods of active hostilities, ceasefires or humanitarian pauses, and the fragile ceasefire that followed October 2025; key events are annotated along the timeline. The blue-outlined box marks the study data-collection window (17 March to 6 July 2025, 112 days), which fell almost entirely within a period of active hostilities (111 of 112 days). The lower axis shows the number of days elapsed since the start of the armed conflict on 7 October 2023.

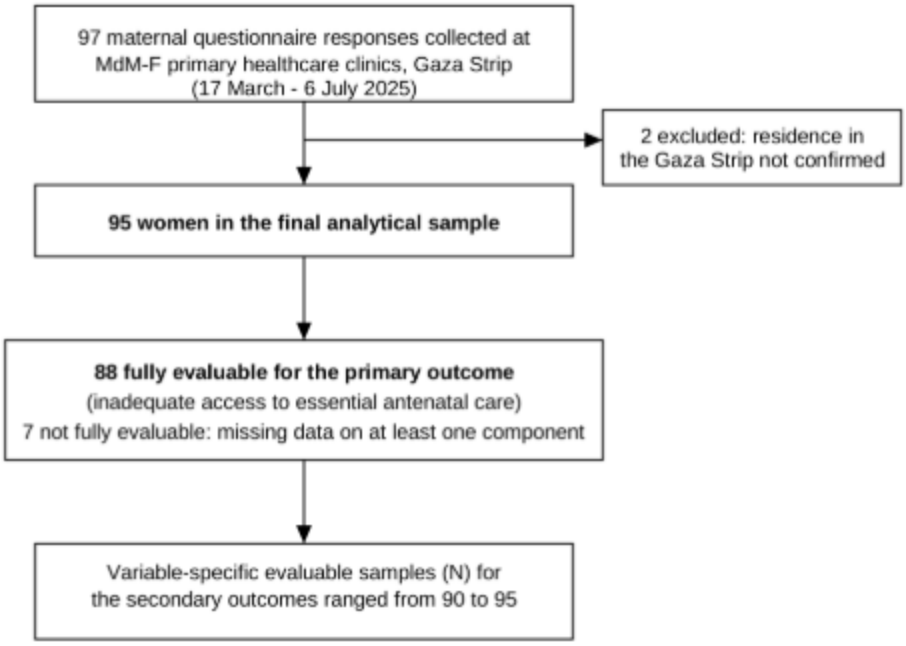


Figure 2

Participant flow diagram. Of 97 maternal questionnaire responses collected at primary healthcare clinics operated by Médecins du Monde France in the Gaza Strip between 17 March and 6 July 2025, two were excluded because residence in the Gaza Strip could not be confirmed, leaving 95 women in the final analytical sample. Of these, 88 were fully evaluable for the primary composite outcome of inadequate access to essential antenatal care; the remaining seven were not fully evaluable owing to missing data on at least one component. Variable-specific evaluable samples (N) for the secondary outcomes ranged from 90 to 95.

Supplementary Files

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