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Evolution of child acute malnutrition during war in the Gaza Strip, 2023-2024: retrospective estimates and scenario-based projections

Briefing note

Pre-print: <https://doi.org/10.1101/2024.12.10.24318783> (under peer review)

# Background

The ongoing war in Gaza has resulted in alarming **food insecurity** due to restrictions on humanitarian and commercial deliveries. The extent to which food scarcity has resulted in **malnutrition** has been difficult to quantify due to limited ability by humanitarian actors to carry out robust data collection to measure nutritional outcomes across Gaza. Moreover, since 6 May 2024, when Israel took control of customs points, the amount of food reaching Gazans has also been **unclear**. Since October, an offensive in northern Gaza and ongoing constraints on southern crossings have led to **renewed concerns** about a serious nutritional emergency.

To improve situational awareness, we developed a **mathematical model** that simulates **acute malnutrition (wasting)** among children aged below 5 years as a function of food intake (which we estimated in a [previous analysis](https://gaza-projections.org/docs/report3/wartime_food_availability_in_the_gaza_strip.pdf)) and other factors including infectious disease, availability of nutritional treatment, non-exclusive breastfeeding and the extent to which adults sacrifice food available to them to make sure that children receive sufficient calories. The model is partly based on an existing, validated model of weight as a function of caloric intake, but its application within a crisis context and the addition of the above factors is, to our knowledge, novel.

The analysis is divided into two periods: (i) **retrospective estimates** between 7 October 2023 and 6 May 2024, and (ii) **scenario-based projections** from 7 May to 31 December 2024. We also looked at northern (Gaza City, North Gaza) and south-central (Deir al Balah, Khan Younis, Rafah) governorates separately. For the projection scenarios, we made assumptions about caloric intake (**Figure 1**) and treatment availability with a view to capturing a range of possible trajectories from reasonable-worst to reasonable-best. More detail is provided in the pre-print paper (see link above).

# Key findings

## Validating the model

* The model closely **replicates pre-war values** of nutritional status among children (**Table 1**), when compared to a dataset of ≈2.2 million growth monitoring observations collected by UNRWA between 2019 and 2023.
* The model also replicates the **expected weight trajectory** of a well-nourished child, as per the WHO growth standards.

**Table 1.** Model-predicted versus observed (UNRWA growth monitoring) pre-war anthropometry (children 6-59 months old).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| index | source | mean | % below -2 Z-scores | % below -3 Z-scores |
| height-for-age Z-score | model | -0.31 | 3.9% | 0.8% |
| observed | -0.29 | 5.3% | 1.3% |
| weight-for-age Z-score | model | -0.19 | 3.8% | 1.1% |
| observed | -0.16 | 4.2% | 1.1% |
| weight-for-height Z-score | model | -0.04 | 2.5% | 1.0% |
| observed | +0.01 | 3.5% | 0.8% |

A graph of a graph

Description automatically generated with medium confidence

**Figure 1.** Retrospectively estimated and assumed values of mean caloric intake, by scenario and region.

Crisis estimates

* As shown in **Figure 2 (top)**, the model estimates that northern governorates in Gaza experienced a very serious increase in global acute malnutrition prevalence (GAM; children with a weight-for-height Z-score < 2) between **January and April 2024**; in the south-central governorates, a more moderate increase is likely to have occurred;
* Malnutrition levels are likely to have remained low from **May to August 2024**, a period during which northern crossings were reopened and caloric intake is likely to have been sufficient if one assumes that adults consistently sacrificed some of their food to maintain a healthy diet among children;
* During the last quarter of 2024, we project that GAM prevalence could rise to **alarming levels** of about 25% in the north, under reasonably pessimistic assumptions of food restrictions;
* Generally, model estimates during the retrospective period feature high **uncertainty** (see paper), reflecting the wide confidence intervals in estimates of food availability;
* Model estimates cannot be directly compared to **ground data**, as the latter (**Figure 2, bottom**) do not come from representative surveys and rely on a different anthropometric index (middle-upper arm circumference or MUAC). Ground observations suggest that malnutrition has remained **stable** during the second half of 2024, but there are very scant data on the situation earlier in the year, and it is unclear to what extent ground data actually represent the population of children in different governorates.

A screenshot of a graph

Description automatically generated

**Figure 2.** Top panel: Retrospective estimates and scenario projections of GAM prevalence among children 6 to 59 months old. Bottom panel: Ground estimates of GAM prevalence from MUAC-based screenings of children 6 to 23 months old, as summarised by the Nutrition Cluster.

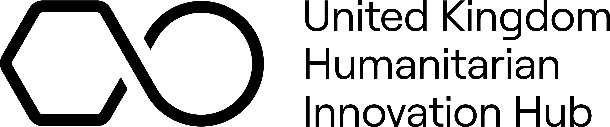
# Implications

## Nutrition in Gaza

* It is likely that the Israel’s campaign in Gaza, and in particular the restrictions placed on food availability, caused a **serious but short-lived nutritional emergency** in northern governorates during the first half of 2024;
* The model offers few certainties on the likely evolution of malnutrition during the second half of 2024, but suggests that a severe nutritional emergency is, at least in northern Gaza, **possible** if caloric intake remains low;
* While ground data from Gaza suggest a stable nutritional situation up to mid-November 2024, **representative sample surveys** or surveillance would be required to properly monitor the evolution of acute malnutrition, and their secure conduct should be facilitated by Israel as the occupying power; similarly, it is imperative that the United Nations’ role of systematically monitoring shipments of food into the Gaza Strip be reinstated, so that objective information is once again available upon which to predicate decision-making.

## Model applicability

* We believe that the simulation approach presented here holds promise as a source of information for decision-making that can complement ground surveys and surveillance across humanitarian responses; **potential applications** of the model include exploring the consequences of different operational scenarios (e.g. varying levels of treatment access) and intervention package choices (e.g. whether to offer treatment for moderate acute malnutrition), and planning nutritional service needs on the basis of forward-projected levels;
* However, different aspects of the model need to be **improved**, including the reverse effects of malnutrition on infectious disease, the added risk of infection when non-exclusively breastfeeding and the relationship between food scarcity and adult caloric sacrifice (currently, this parameter heavily influences model estimates).
* More generally, the model should be **validated** on additional ground data from different settings.

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The findings do not necessarily represent the views of the funder, or the London School of Hygiene & Tropical Medicine. Queries relating to the project should be directed to [info@gaza-projections.org](mailto:info@gaza-projections.org).