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Article

Tracking the Trends and Projection of Paediatric Malnutrition Towards GNTs by 2030—A Secondary Data Analysis of Low Middle-Income Countries (LMICs)

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Abstract

Objective: This study aimed to estimate the trends, projections, and determinants of standalone and Coexisting Forms of Malnutrition (CFM) at global, regional, national, and individual level among children under five in low- and middle-income countries (LMICs). The study also assessed the projection trajectory towards the 2030 GNTs (GNT) for child growth. **Methods:** Data from 48 LMICs were analysed using the Multiple Indicator Cluster Surveys (MICS) and Demographic & Health Surveys (DHS). Children with complete anthropometry were included for national and individual-level descriptive analyses. Projected prevalence of each form of malnutrition, including CFM, was calculated using the Annual Rate of Change (ARR). Inferential analyses employed generalized linear regression models (GzLM) with two-way interaction terms to identify determinants of each malnutrition type. **Findings:** By 2030, 22 of 48 LMICs are projected to achieve all three GNT, up from 10 countries currently, while Yemen and Zimbabwe are expected to remain off-track. Stunting is the most prevalent form, affecting 42 countries, with nine nations projected to have over 50% of children affected by any form of malnutrition. Wasting, obesity, and CFM are rising in several countries. Maternal education and household wealth were the strongest determinants, with children of uneducated mothers and from poorest households at highest risk. Inequalities are narrowing slowly, by 1–2% per year, and marked regional disparities persist. **Conclusion:** Many LMICs are off track to meet child growth targets when CFM is considered alongside standalone indicators. The government and global health partners must strengthen nutrition surveillance systems and equity-focused policies and programs to routinely capture CFM and prevent as well as manage all forms of malnutrition at national and individual levels.

Keywords: malnutrition; stunting; wasting; obesity; children; coexisting forms; trends; GNTs; low-and-middle income countries (LMICs); sustainable development goals (SDGs)

What is already known on this topic: The use of anthropometry in measuring nutrition profile of children is a cost-effective and widely used method. The nutrition related indicators, targets and goals devised globally are focused on tracking the progress of standalone forms of malnutrition at the national level. The GNT proposed six nutritional targets for improving the health and nutrition of women and children below five years. However, the targets related to CFM and its various types in an individual are not yet proposed by any local and international bodies.

What this study adds: This is the first study which measured the trends, projected prevalence and determinants of malnutrition and its different types including CFM among the among neonates, infants and young children across 48 LMICs, using combined DHS and MICS datasets spanning over two decades. By the year 2030, it would be expected that more than 20 LMICs will reach the nutritional targets of stunting, wasting and obesity. However, Yemen and Zimbabwe will have higher threshold of all forms of malnutrition by 2030. Male sex, lack of maternal education, poverty and rural residence were identified as major risk factor for various form of malnutrition including CFM. This study highlights an urgency for nutrition interventions, health promotion, and healthy food subsidiaries particularly among children under five years of age.

How this study might affect research, practice or policy: This study establishes a standardized method for measuring CFM using routine DHS and MICS anthropometric data. By completing GNT many LMICs show progress on standalone forms of malnutrition (stunting, wasting, and obesity). Policy makers should integrate CFM into surveillance and guidelines and support research into subclinical cases and intervention effects to achieve meaningful reductions by prioritising multisectoral strategies.

1. Introduction

Malnutrition is one of the pressing public health concerns contributing substantially around half of the deaths among children under five years of age [1]. It is characterised by the imbalance of undernutrition and overnutrition [2]. Recent Joint Malnutrition Estimates (JME) report of 2024 proposed by the UNICEF, WHO and World Bank underscored 23.2% stunting, 6.6% wasting and 5.5% overweight in children aged below five years [3]. This contributes to global malnutrition prevalence in more than a third of children below age five years.

The global burden of malnutrition among children under five years of age is not homogenous. Children living in low- and middle-income countries (LMICs) have disproportionally high prevalence of malnutrition [3]. In general, children living in Asia and Africa are highly vulnerable to various forms of malnutrition, where more than half children are susceptible to different types of nutritional adversities [4]. Poverty, food insecurity, limited access to quality healthcare, and inadequate water and sanitation systems continue to perpetuate the cycle of undernutrition and emerging overnutrition in these countries [3].

Malnutrition in children has profound consequences on their health and development. Paediatric malnutrition has a synergistic relationship with children's illness, including disability and cognitive impairment, which in turn are associated with negative economic outcomes [5]. Owing to this reason, controlling and eliminating malnutrition specifically among young children has been recognised as an urgent public health concern by various local and international bodies [3,6]. To combat malnutrition, several nutrition-specific and nutrition-sensitive interventions were employed by different countries [7,8]. Furthermore, the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) have set various indicators and targets for eliminating malnutrition by the year 2030 [9,10]. Similarly, the GNTs (GNT) also have set targets for reducing various forms of malnutrition, such as stunting, wasting and obesity by 2030 [11]. However, the progress of most of the countries for reducing malnutrition is not meeting the global malnutrition targets. Most of the LMICs are considered hotspots of malnutrition, where 59%, 73% and 35% children experience stunting, wasting, and obesity, respectively [3]. This depicts either slow or no progress to combat paediatric malnutrition in LMICs by 2030.

There is a pressing need for robust forecasting models that can better evaluate progress toward achieving the WHO-GNT and SDG-2.2 for each country [11,12]. There is a pressing need for robust forecasting models that can better evaluate progress toward achieving the GNT and SDG-2.2 for each country [11,13]. Therefore, this study forecasted the trends of nutritional outcome of children below five years at national, regional and global level by employing Generalized linear regression (GzLM) model.

2. Methodology

2.1. Study Design and Data Source

This is a community-based study, in which nationally representative datasets retrieved from the Demographic and Health Surveys (DHS) & Multiple Indicator Cluster Surveys (MICS) databases were utilized for tracking and forecasting the malnutrition burden among children under five years of age. The DHS programme was first promulgated in 1984 by the United States Agency for International Development (USAID), while the MICS survey programme was started in 1995 by the UNICEF [14,15]. Both the DHS and MICS surveys collected data related to demography, basic health, nutrition, and development indicators from over 90 LMICs [16]. These datasets provide evidence to the programme manager, policy makers and other stakeholders about the global development progress of different health and nutrition related indicators including those proposed in MDGs, Universal Health Coverage (UHC), and SDGs.

2.2. Study Population & Eligibility Criteria

This study targeted the anthropometric data of children aged between 0 to 59 months belonging to LMICs. A multistep inclusion and exclusion criteria were applied in this study. Firstly, a list of all countries of the world irrespective of their income classification was created. The list contained six different regions as per the World Health Organization (WHO) classification; the African Region (AFRO) with 47 countries, the Region of the Americas (AMRO/PAHO) with 35 countries, the South-East Asia Region (SEARO) with 11 countries, the European Region (EURO) with 53 countries, the Eastern Mediterranean Region (EMRO) with 22 countries, and the Western Pacific Region (WPRO) with 27 countries [17]. From this WHO regional classification list, LMICs were selected, as per the World Bank Income classification FY-2025 [18]. In the second step, data for all the LMICs and LICs were retrieved either from the DHS or MICS database. For inclusion, LMICs and LICs must have at least two datasets in total, with one around the year 2012 (± 5 years) and the other any time after 2012. In addition, data from each country must have anthropometric variables reported to be included in the study. All Upper Income Countries (UICs) and countries which had either one dataset or incomplete anthropometry were excluded. Furthermore, data of the certain countries, which were classified as an LMIC at time of data collection but are now removed from LICs and LMICs list were also excluded.

2.3. Conceptual Framework

The analysis of this study adopted a socio-ecological approach to child malnutrition, recognising CFM arise from interactions between immediate (age, sex), household (maternal education, wealth, family size), community (urban/rural residence), and macrolevel (WHO region, temporal trends) determinants acting across the complementary feeding window and early childhood [19]. CFM is conceptualised as a marker of nutritional transition and systems failure. Chronic stunting from early linear growth faltering coincides with acute wasting due to shifting dietary quality and care practices within the same population. The framework links observed patterns to GNT thereby hypothesising that population-level progress on standalone indicators masks persistent individual-level CFM burden. This necessitates surveillance, interventions, and structural vulnerabilities captured through harmonised covariates (Figure 1).

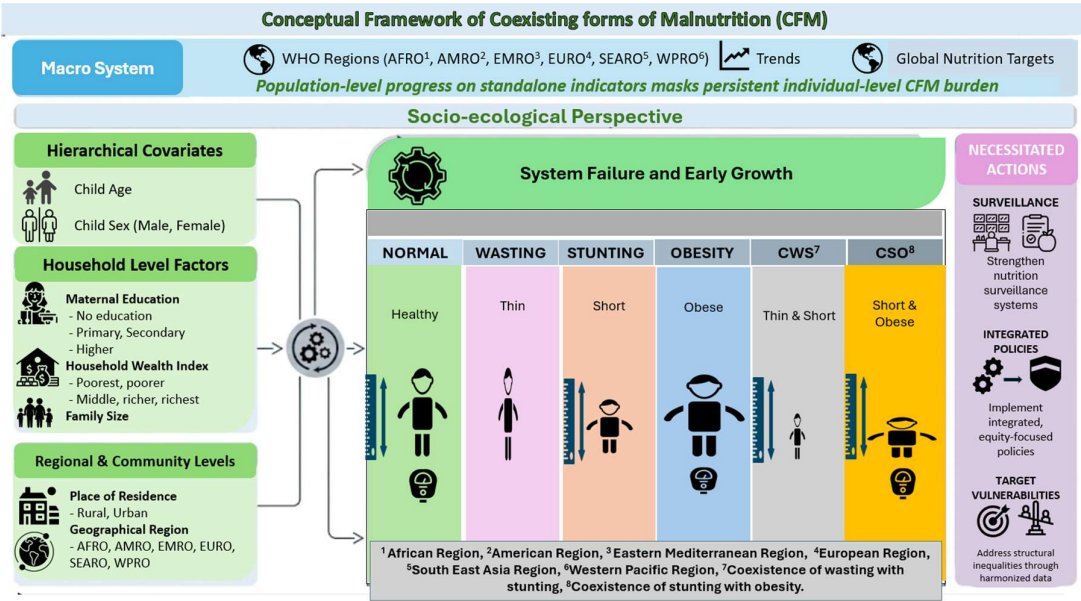


Figure 1. Conceptual framework of Coexisting forms of malnutrition.

2.4. Study Outcomes

In this study, tracking and forecasting of nutrition profile of young children below five years was carried out by measuring their anthropometric variables such as stunting, wasting and obesity. According to the WHO, a child is considered as stunted and wasted, if the z-score value for height-for-age (HAZ) and weight-for-height (WHZ) is ≤ -2.00 S.D., respectively [20]. However, children with WHZ value ≥ 2.00 S.D. are considered as obese [21]. Children experiencing more than one type of nutritional disorder would be considered to have coexisting forms of malnutrition (CFM) [22,23]. The Global Nutritional Report (GNR) proposed two major types of CFM in children aged below five years, such as Coexistence of Stunting with Obesity (CSO) and Coexistence of Wasting with Stunting (CWS) [22]. Further information about different types of nutritional status in children assessed in this study is presented below in Figure 2.

	Normal	Wasting	Stunting	Obesity	CWS	CSO
Nutritional profile						
HAZ	> -1.99 S.D.	> -1.99 S.D.	≤ -2.00 S.D.	> -1.99 S.D.	≤ -2.00 S.D.	≤ -2.00 S.D.
WHZ	-1.99 to $+1.99$ S.D.	≤ -2.00 S.D.	-1.99 to $+1.99$ S.D.	≥ 2.00 S.D.	≤ -2.00 S.D.	≥ 2.00 S.D.

Figure 2. Nutritional outcome and their types assessed in this study.

Where, CWS = Coexistence of wasting with stunting, CSO= Coexistence of stunting with obesity, HAZ = Height for age z-score, WHZ = Weight for height z-score, $>$ = Greater than, $\geq$ = Greater than equals to, $\leq$ = Less than equals to, and S.D. = Standard deviation.

2.5. Study Covariates

A wide range of biological, social, cultural, economic, ecological, and geographical factors may influence the prevalence and trends of malnutrition, including CFM. Based on data availability and

completeness within the selected datasets, relevant covariates were identified and organized into a hierarchical framework comprising individual, household, and regional/community level factors.

At the individual level, covariates included the child’s age and sex (male, female). Household-level factors comprised maternal education (no education, primary, secondary, higher) and household wealth index (poorest, poorer, middle, richer, richest). Regional and community-level factors included place of residence (rural, urban) and geographical region (AFRO, AMRO, EMRO, EURO, SEARO, WPRO).

2.6. Data Handling and Management

After data retrieval, data screening was carried, in which a team of researchers (AK, BA, MR, MK) reviewed all the variables and identified variables of interest: HAZ, WHZ, and basic variables such as age, sex, education, wealth index and region. Datasheet, which contain all the variable of interest were included, while those devoid of variables of interest were excluded. Following data screening, standardization of each dataset was performed. The dataset standardization is characterized by homogenization of each variable and its categories, i.e., heterogeneous categories or differing categories of each variable were converted to homogeneous categories. Some of the variables, such as education and wealth index have non-standardized categories, and these heterogeneous categories were transformed into homogeneous categories. For example, in DHS, the wealth index has five categories: poorest, poorer, middle, richer and richest, and MICS data also has five wealth index categories: poorest, second, middle, fourth and richest. The wealth index coding and the coding order were similar in both datasets ranged from 1 to 5. Regarding the education, the DHS datasets have four categories: no education, primary education, secondary education, and higher education, while the MICS datasets showed six education categories: none, pre-primary, primary, secondary, higher and tertiary. The six education categories of MICS datasets were converted into four categories according to the DHS education categories. However, some of the variables, such as sex and region have homogenous categories and homogenous coding in all the datasets. Certain variables, such as child age and their z-score values were converted from continuous variable to categorical variable. Additional variables were created in each dataset, of which some were created from the existing variables, i.e., a new variable called ‘nutritional status’ was created from the HAZ and WAZ variable, and this new variable consists of six different types of nutritional status: normal, wasting, stunting, obesity, CWS, and CSO. However, some variables, such as survey year, dataset type (DHS and MICS), and geographical region (AFRO, AMRO, EURO, EMRO, SEARO, and WPRO) were added in each dataset for identification purposes. Finally, data merging was carried out for each country, followed by each region as defined by the WHO and finally the globe. Different steps performed for data handling and their management are summarized in Figure 3.

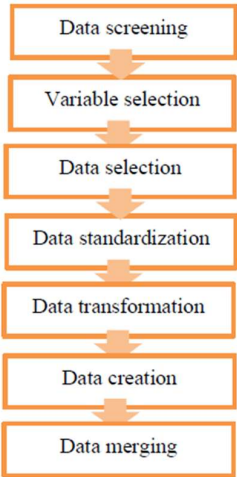


Figure 3. Steps for handling and managing the Demographic Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) dataset.

2.7. Statistical Analysis

The analyses of this study were conducted using pooled, nationally representative survey datasets from baseline and current rounds across 48 LMICs. Sampling weights, clustering, and stratification variables were incorporated throughout to ensure nationally representative estimates for the complex survey design.

Initially, data was analysed descriptively using Statistical Package for the Social Sciences-Version 29 (SPSS-29). The prevalence of each nutrition indicator: Stunting, wasting and obesity (Table 1) and various forms of malnutrition such as stunting, wasting, obesity, CWS, and CSO (Table 2) was calculated separately for baseline and current survey rounds. Annual Rate of Change (ARR) was calculated for each nutritional indicator and malnutrition type using Microsoft Excel-365. This assessed the temporal change between two survey rounds and is widely used global in nutrition monitoring frameworks. The UNICEF, WHO, and the World Bank JME used this technical approach ensuring methodological comparability with GNTs. ARR was derived using following formula:

$$ARR = \ln (P_2 / P_1) / t$$

Where:

P_1 = Prevalence at baseline survey

P_2 = Prevalence at current survey

t = Time interval (years) between surveys

$\ln$ = Natural logarithm

Based on ARR value, the projected prevalence of each nutrition indicators and each form of malnutrition was estimated using following formula:

$$\text{Projected Prevalence} = P_2 \times e(ARR \times t)$$

Where:

t = Time interval (years) from the most recent survey to 2030.

The inferential analyses were performed using a Generalised Linear Model (GzLM) framework with binomial logistic regression. Six mutually exclusive nutritional states were modelled separately: Normal nutritional status (reference category), stunting, wasting, obesity, CWS and CSO. The logit link function was specified for categorical outcomes. GzLM was selected due to its flexibility in link functions, robustness for large datasets and suitability for binary and multinomial outcomes. Robust standard errors were estimated to account for clustering and heteroskedasticity. Furthermore, model assumptions of logistic regression were assessed and satisfied for independence of observations, correct model specification, absence of multicollinearity (VIF observed <5), linearity of continuous predictors, and large sample size. The model diagnostics indicated good fit and no violation of key assumptions.

To examine temporal shifts in disparities, interaction terms between each covariate and survey year (covariate $\times$ year) were incorporated. These interactions assessed whether socioeconomic, demographic, and regional gradients across two survey period for each region. Additionally, interaction terms between survey year and malnutrition type were evaluated to determine whether temporal trends differed across nutritional states. The GzLM framework enabled straightforward inclusion of these interaction terms while maintaining computational efficiency and valid inference under complex survey design.

Table 1. Scenario-based projections of GNTs to 2030 among children under five across LMICs.

	Survey period	Stunting		Wasting		Obesity	
		Prevalence	Status	Prevalence	Status	Prevalence	Status
African Region (AFRO)							
Benin	2012	44.6	↓	26.1	↓	9	↓
	2018	32.7		5.3		3.8	
	2030	17.6		0.2		0.7	
Burundi	2010	55.7	↑	5.3	↓	5.4	↑

	2016	55.2		3.4		5.4	
	2030	54.1		1.2		5.4	
Burkina Faso	2014	35.2	↓	12.9	↓	6.4	↓
	2021	22.4		9.3		3.8	
	2030	13.3		6.1		1.9	
Cameron	2011	32.7	↓	7.1	↑	6.6	↑
	2022	29.2		7.9		8.3	
	2030	27.8		8.5		9.8	
Chad	2010	40.1	↓	9.8	↓	6.3	↑
	2019	31.9		12.4		7.7	
	2030	25.9		16.4		9.8	
Comoros	2012	28.6	↓	15.4	↓	6.8	↓
	2022	16.9		4		0.8	
	2030	12.9		1.4		0.1	
Congo	2012	31.1	↓	7.8	↓	4.3	↓
	2015	21		6		2.2	
	2030	4.7		1.6		0.1	
Cote de Ivoire	2012	44.9	↓	9	↑	6.3	↑
	2021	37.5		10.2		5.8	
	2030	30.5		11.6		5.3	
DRC	2010	27.1	↓	11.7	↓	4.6	↓
	2018	19.7		5.6		3.3	
	2030	12.4		1.9		2	
Eswatini	2010	28.4	↓	11.1	↓	4.9	↓
	2022	19.9		5.7		3.8	
	2030	14.6		3.7		3.2	
Ethiopia	2011	32.2	↓	10.2	↑	5.3	↓
	2016	32		11.2		4.8	
	2030	31.5		14.6		3.6	
Gambia	2013	26.7	↓	3.7	↓	2.1	↓
	2020	26.9		3.1		1.8	
	2030	27.4		2.4		1.4	
Ghana	2014	34.8	↓	9.6	↓	5.3	↓
	2022	18.4		7.4		4.4	
	2030	10.6		5.7		3.7	
Guinea	2012	40.5	↓	7.7	↓	5.8	↑
	2018	38.4		4.4		5.9	
	2030	34.9		1.4		6.1	
Guinea-Bissau	2014	32.1	↑	7.7	↓	4.1	↑
	2019	33.1		5.8		5	
	2030	35.7		3.1		7.7	
Kenya	2014	48.9	↓	8	↑	8.1	↓
	2022	39.6		6.4		4.6	

	2030	33.5		5.1		2.6	
Lesotho	2014	47.2	↓	9	↓	5.1	↓
	2024	36.1		5.3		4.1	
	2030	30.9		3.9		3.6	
Liberia	2013	38.7	↓	11	↓	5.5	↓
	2020	27.9		9		4.6	
	2030	17.5		6.8		3.6	
Madagascar	2009	27	↓	9.3	↑	4.1	↑
	2021	25.8		10.5		4.3	
	2030	25		11.5		4.5	
Malawi	2010	40.3	↓	9.4	↓	5.6	↓
	2016	33.9		4.5		4.2	
	2030	29.2		0.8		2.1	
Mali	2013	43.2	↓	16.9	↓	8.1	↓
	2018	37.2		5.6		5.1	
	2030	35		0.4		1.7	
Mauritania	2011	41	↑	5.4	↓	2.7	↓
	2015	43.2		4.3		2.8	
	2030	49.4		1.8		3.2	
Mozambique	2011	28.1	↓	6.9	↑	3.8	↓
	2023	25.6		6.1		2	
	2030	24.9		5.7		1.4	
Nigeria	2013	44.5	↓	6.3	↓	5.4	↓
	2018	34.7		4		4.8	
	2030	21.9		1.3		3.6	
Rwanda	2013	17	↓	2.9	↑	1.2	↓
	2020	13.2		3.5		0.7	
	2030	9.42		4.6		0.3	
Sao Tome & Principe	2014	21.5	↓	8.9	↑	4.2	↑
	2019	20.5		9.5		4.2	
	2030	19		11.1		4.2	
Senegal	2011	35.2	↓	14.8	↓	7.1	↓
	2023	31.6		6.8		5.4	
	2030	30.3		4.3		4.6	
Sierra Leone	2013	30.2	↓	0.5	↑	0.3	↑
	2019	20.2		1.4		0.4	
	2030	11.38		4.5		0.7	
Togo	2010	33.7	↓	2.6	↑	3	↓
	2017	24.6		3.8		2	
	2030	17.34		5.7		0.9	
Uganda	2011	33.5	↓	6.6	↓	4.8	↓
	2019	29.5		5.2		4.1	
	2030	25.3		3.8		3.3	

Zambia	2013	40.4	↓	9.1	↓	4.6	↓
	2018	35.5		7		4.2	
	2030	29		4.4		3.4	
Zimbabwe	2011	32.6	↑	6.2	↑	4.6	↑
	2015	36.6		6.7		5.2	
	2030	56.6		8.8		8.2	
American Region (AMRO)							
Haiti	2012	23.7	↓	6.2	↓	4.2	↓
	2017	22.9		5.4		3.7	
	2030	21.3		3.77		2.7	
Honduras	2012	27	↓	3.1	↓	5.4	↓
	2019	19.8		1.3		0.5	
	2030	12.9		0.5		0.1	
Eastern Mediterranean Region (EMRO)							
Egypt	2008	29.4	↓	17.7	↑	9	↓
	2014	21		17.2		7.3	
	2030	9.3		30.5		4.2	
Jordan	2012	8.8	↓	3	↑	4.3	↑
	2023	9.3		4.6		7	
	2030	10.66		6.6		9.5	
Pakistan	2012	45.2	↓	11.1	↓	6.3	↓
	2017	38.5		6.9		4.2	
	2030	30.9		3.6		1.5	
Palestine	2010	11	↓	4.4	↓	4.2	↑
	2020	8.8		3		8.2	
	2030	7.23		2.4		16.1	
Sudan	2010	35.8	↑	9.9	↓	6.3	↑
	2014	39.8		8.7		6.7	
	2030	61.3		5.2		8.6	
Tunisia	2011	10.5	↑	2.3	↑	0.2	↑
	2023	12.6		2.9		0.2	
	2030	14		3.3		0.2	
Yemen	2013	46.8	↑	12.1	↓	7.7	↑
	2023	48.8		9.5		8.9	
	2030	51.4		8.7		9.8	
European Region (EURO)							
Kyrgyzstan	2014	13.2	↓	2	↑	0.2	↓
	2018	10.8		2		0	
	2030	6.2		2		0	
Tajikistan	2012	26.2	↓	12.9	↓	4.3	↓
	2017	19.6		8.6		3.4	
	2030	9.4		3		1.8	

Southeast Asian Region (SEARO)							
Bangladesh	2011	41.5	↓	10.2	↑	8.6	↓
	2022	24.5		9.5		5.2	
	2030	16.7		9.1		3.6	
India	2015	39.4	↓	16.2	↑	8	↓
	2021	36.8		16.7		6.8	
	2030	34.7		18.4		5.3	
Nepal	2011	42.9	↓	7.8	↓	5.6	↓
	2022	28.4		5.8		4.5	
	2030	21		4.7		3.8	
Timor-Leste	2010	57.9	↓	16.3	↑	8.9	↑
	2016	47.4		20.4		10.1	
	2030	32.2		35.2		13.6	
Western Pacific Region (WPRO)							
Laos	2012	46.2	↓	3.6	↑	3	↑
	2017	33.3		7.4		3.1	
	2030	19.5		48.6		3.4	

Where, ↓ = projected malnutrition prevalence will likely reach GNT by 2030, ↓ = projected malnutrition prevalence will be trending down but will likely be above the defined GNTs, ↑ = projected malnutrition prevalence will likely be above the defined GNTs, and ↑ = projected malnutrition prevalence will likely increase but would remain under the defined GNTs.

Table 2. Scenario-based projections of standalone and coexisting forms of malnutrition to 2030 among children under five across LMICs.

	Survey period	Malnutrition	Stunting	Wasting	Obesity	CSO	CWS
		Prevalence	Prevalence	Prevalence	Prevalence	Prevalence	Prevalence
Benin	2012	62.7	27.6	13.3	4.8	4.2	12.8
	2018	38.5	29.4	4.6	1.2	2.6	0.7
	2030	35.4	33.4	0.6	0.4	1	0
Burundi	2010	59.9	49.2	3.3	0.9	4.5	2
	2016	58.6	49.8	2.6	0.8	4.6	0.8
	2030	58.3	51.0	1.8	0.6	4.8	0.1
Burkina Faso	2014	47.8	28.5	11.5	1.1	5.3	1.4
	2021	31.7	18.6	8.5	0.8	3	0.8
	2030	19.6	11.5	5.8	0.5	1.4	0.4
Cameron	2011	41.1	27.4	4.5	3.9	2.7	2.6
	2022	39.6	23.4	3.7	6.7	1.6	4.2
	2030	41	20.8	3.2	10	1.1	5.9
Chad	2010	49.9	33.8	9.8	0	6.3	0
	2019	44.3	24.2	12.4	0	7.7	0
	2030	33.5	16.1	7.6	0	9.8	0
Comoros	2012	43.6	21.4	10.8	4.2	2.6	4.6

	2022	20.9	16.1	4	0.0	0.8	0
	2030	14.5	12.6	1.6	0	0.3	0
Congo	2012	39.1	27	6.4	1.6	2.7	1.4
	2015	27	18.8	6	0	2.2	0
	2030	9.3	3.9	4.6	0	0.8	0
Cote de Ivoire	2012	53.9	38.6	8.1	0.9	S	0.9
	2021	47.9	31.9	9.2	1.2	4.6	1
	2030	43.2	25.5	11.1	1.6	3.9	1.1
DRC	2010	38.2	21.9	10	1.1	3.5	1.7
	2018	26.5	17.6	5.3	1.5	1.8	0.3
	2030	17.2	11.8	2.4	2.4	0.6	0
Eswatini	2010	39.8	23.8	8.8	2.6	2.3	2.3
	2022	26.7	17.2	5.3	1.5	2.3	0.4
	2030	18.9	12.2	3.3	1	2.3	0.1
Ethiopia	2011	42.6	27.1	8.5	1.9	3.4	1.7
	2016	42.1	26.1	7.9	2.2	2.6	3.3
	2030	55	23.5	6.7	3.3	1.2	20.3
Gambia	2013	30.4	24.6	3.7	0	2.1	0
	2020	30	25.1	3.1	0	1.8	0
	2030	29.9	26.0	2.5	0	1.4	0
Ghana	2014	44.2	29.3	6.9	2.5	2.8	2.7
	2022	27.3	15.5	6.8	2.1	2.3	0.6
	2030	19	8.6	6.7	1.7	1.9	0.1
Guinea	2012	49	35.5	4.4	4.1	1.7	3.3
	2018	44.5	34.2	1.9	4.2	1.7	2.5
	2030	40	31.8	0.7	4.4	1.7	1.4
Guinea-Bissau	2014	40	28.2	6.3	1.6	2.5	1.4
	2019	39.8	29	4.1	2.6	2.4	1.7
	2030	46	30.9	2.9	7.4	2.2	2.6
Kenya	2014	53.9	37.8	3.9	1.1	7	4.1
	2022	45.9	34.9	5.4	0.9	3.7	1
	2030	41.7	31.4	7.5	0.7	1.9	0.2
Lesotho	2014	54	39.9	3.9	2.9	2.2	5.1
	2024	41.8	32.4	3.3	2.4	1.7	2
	2030	35.9	28.4	2.9	2.1	1.4	1.1
Liberia	2013	49.1	32.6	9.6	0.8	4.7	1.4
	2020	36.7	23.1	7.8	1	3.6	1.2
	2030	25	14.2	6.1	1.4	2.4	0.9
Madagascar	2009	36.3	22.9	9.3	0	4.1	0
	2021	36.3	21.5	10.5	0	4.3	0
	2030	37.1	20.5	12.1	0	4.5	0

Malawi	2010	48.6	33.6	4.9	3.4	2.2	4.5
	2016	39.2	30.5	3.1	2.2	2	1.4
	2030	31.8	27.5	1.9	0.7	1.6	0.1
Mali	2013	57.4	32.4	11	3.2	4.9	5.9
	2018	43.2	32.5	4.8	1.2	3.9	0.8
	2030	36.8	32.8	1.7	0.1	2.2	0
Mauritania	2011	46.4	38.3	5.4	0	2.7	0
	2015	47.5	40.4	4.3	0	2.8	0
	2030	55.4	49.3	2.9	0	3.2	0
Mozambique	2011	35.4	24.7	5.4	1.9	1.9	1.5
	2023	31.7	23.6	6.1	0	2	0.0
	2030	31.5	22.9	6.6	0	2	0
Nigeria	2013	50.6	38.9	2.7	3.4	2	3.6
	2018	40.4	31.6	2	3.7	1.1	2.0
	2030	27.7	21.2	1.3	4.5	0.2	0.5
Rwanda	2013	19.9	15.8	2.9	0	1.2	0
	2020	16.7	12.5	3.5	0	0.7	0
	2030	14.02	9.1	4.6	0	0.32	0
Sao Tome & Principe	2014	31.2	18.1	8.6	1.1	3.1	0.3
	2019	30.6	16.9	9.3	0.8	3.4	0.2
	2030	30.4	14.8	11.0	0.4	4.1	0.1
Senegal	2011	49	27.1	9.6	4.2	2.9	5.2
	2023	38.9	26.7	4.7	2.6	2.8	2.1
	2030	34.8	26.4	2.6	1.9	2.7	1.2
Sierra Leone	2013	30.7	29.9	0.5	0	0.3	0
	2019	21.6	19.8	1.4	0	0.4	0
	2030	15.88	10.8	4.5	0	0.58	0
Togo	2010	36.3	30.7	2.6	0	3	0
	2017	28.4	22.6	3.8	0	2	0
	2030	23.04	16.4	5.7	0	0.94	0
Uganda	2011	40.5	29.1	4.8	2.2	2.6	1.8
	2019	36	26.7	3.9	2.6	1.5	1.3
	2030	31.5	23.8	3	3.2	0.7	0.8
Zambia	2013	48.7	35	5.8	2.5	2.1	3.3
	2018	42.5	31.3	4.4	2.6	1.6	2.6
	2030	34.8	26.8	3	2.8	0.8	1.4
Zimbabwe	2011	39.6	28.8	3.8	3.2	1.4	2.4
	2015	44.8	32.9	4.3	3.9	1.3	2.4
	2030	68.3	50.3	6.4	8.2	1.0	2.4
Haiti	2012	30.9	20.5	4.9	2.3	1.9	1.3
	2017	29.4	20.3	4.2	2.3	1.4	1.2

	2030	26.4	19.7	2.8	2.3	0.63	0.97
Honduras	2012	33.5	25.0	2.3	4.2	1.2	0.8
	2019	21.1	19.3	1.3	0	0.5	0
	2030	13.4	12.8	0.5	0	0.1	0
Egypt	2008	45	18.3	7.5	8.1	0.9	10.2
	2014	38.1	13.6	10.8	6.3	1	6.4
	2030	41.2	6.2	28.7	3.2	1.3	1.8
Jordan	2012	15	7.7	2.1	4.1	0.2	0.9
	2023	18.5	6.9	2.3	6.9	0.1	2.3
	2030	22.66	6.4	2.4	9.6	0.06	4.2
Pakistan	2012	52.8	35.4	5.9	1.7	4.6	5.2
	2017	44.9	33.8	5.1	1.3	2.9	1.8
	2030	35	29.9	3.5	0.6	0.9	0.1
Palestine	2010	17.8	9.2	2.9	3.9	0.3	1.5
	2020	18.3	7.1	1.4	8.1	0.1	1.6
	2030	25.53	5.5	0.7	17.6	0.03	1.7
Sudan	2010	45.7	29.5	9.9	0	6.3	0
	2014	48.5	33.1	8.7	0	6.7	0
	2030	66.5	52.7	5.2	0	8.6	0
Tunisia	2011	12.8	10.3	2.3	0	0.2	0
	2023	15.5	12.4	2.9	0	0.2	0
	2030	17.3	13.8	3.3	0	0.2	0
Yemen	2013	58.2	38.4	10.7	0.7	7	1.4
	2023	58.3	39.9	9.5	0	8.9	0
	2030	60.1	40.9	8.7	0	10.5	0
Kyrgyzstan	2014	15.2	13	2	0	0.2	0
	2018	12.8	10.8	2	0	0	0
	2030	8.2	6.2	2	0	0	0
Tajikistan	2012	38.6	21.4	10.0	2.4	1.9	2.9
	2017	28.7	16.7	6.9	2.2	1.2	1.7
	2030	13.7	8.7	2.6	1.7	0.3	0.4
Bangladesh	2011	51.9	33.1	9.5	0.9	7.7	0.7
	2022	34.7	20.0	9.1	1.1	4.1	0.4
	2030	26.9	13.9	8.9	1.3	2.6	0.2
India	2015	55	30.8	14.7	0.9	7.1	1.5
	2021	52.5	29	14.4	1.3	5.5	2.3
	2030	50.8	26.5	13.9	2.2	3.7	4.5
Nepal	2011	50.7	37.3	7.2	0.6	5.0	0.6
	2022	35	24.7	5.6	1	3.5	0.2
	2030	27	18.2	4.6	1.4	2.7	0.1
Timor-Leste	2010	71.7	46.5	12.9	0.9	8	3.4

	2016	65.6	35.1	16.8	1.4	8.7	3.6
	2030	67.6	18.1	31.2	4.2	10.1	4.0
Laos	2012	49.8	43.2	3.4	0.2	2.8	0.2
	2017	40.7	30.2	6.9	0.5	2.6	0.5
	2030	68.1	11.9	43.1	5.5	2.1	5.5

2.8. Ethical Considerations

This study utilised published and anonymous data from the MICS and DHS databases. Hence, the ethical approval was not required for this study according to the international standards.

3. Results

3.1. Scenario-Based Projections of GNTs to 2030 Among Children Under Five Across LMICs

Table 1 described the GNT of each form of paediatric malnutrition (stunting, wasting and obesity) across two survey periods, i.e., baseline and current. Additionally, it presents the ARR of projected prevalence for each nutritional indicator to the year 2030. Of the 48 LMICs included, 15 countries (Bangladesh, Guinea, Benin, Burundi, Chad, Cote d’Ivoire, Kenya, Lesotho, Mali, Malawi, Nepal, Nigeria, Pakistan, Timor-Leste, and Yemen) did not meet any of the GNT cut-offs in the current and baseline survey. Specifically, only Timor-Leste and Yemen still show unacceptably high levels across all three key forms of child malnutrition. In Timor-Leste, the prevalence of stunting is projected to decline by 32.2% from 47.4% in the current survey by 2030. Though, the prevalence of wasting and obesity in Timor-Leste is expected to remain above the 5% threshold. By 2030, Zimbabwe and Yemen are projected to have prevalence levels of all three forms of malnutrition above the GNT cut-offs. The analysis of nutritional indicators revealed that initially thirteen countries mostly from AFRO region demonstrated compliance with the cut-off thresholds for two distinct nutritional indicators Congo, the Democratic Republic of Congo (DRC), Eswatini, Guinea-Bissau, Madagascar, Mozambique, Sao Tome & Principe, Uganda, and Zimbabwe. Haiti, Honduras from the AMRO region. Tajikistan from the EURO region. Laos from the WPRO region. Concurrently, twelve other countries met the criteria for a single nutritional indicator. These were Burkina Faso, Cameroon, Comoros, Egypt, Ghana, India, Ethiopia, Liberia, Mauritania, Zambia, Senegal, and Sudan. However, a more recent survey indicates a shift in these patterns. This subsequent assessment identified twelve countries meeting the cut-off for one nutritional indicator. Bangladesh, Burundi, Guinea-Bissau, for wasting and Cameroon, Cote d’Ivoire, Egypt, Chad, India, Mali, Senegal, Sudan, and Zimbabwe for stunting. Furthermore, a larger cohort of twenty-four countries met the threshold of two indicators in current surveys. Stunting and obesity by Benin, Burkina Faso, Congo, DRC, Eswatini, Ghana, Kenya, Lesotho, Liberia, Tajikistan, Ethiopia, Laos, Jordan, Madagascar, Mauritania, Nepal, Pakistan, Sao Tome & Principe, Mozambique, Uganda, Zambia. Stunting and wasting by Guinea and Palestine. Projections for 2030 indicate that 22 countries stand to successfully meet all the three GNT for critical indicators of child malnutrition. These were mostly from AFRO region Benin, Comoros, Congo, DRC, Eswatini, Gambia, Lesotho, Malawi, Mali, Nigeria, Rwanda, Senegal, Sierra Leone, Tunisia, Uganda, and Zambia. Haiti and Honduras specified AMRO region. One country Nepal from SEARO region. Pakistan and Tunisia from EMRO region. Kyrgyzstan and Tajikistan from EURO region. Moreover by 2030 it is expected that 14 countries will be expected to meet two cut-offs for nutritional thresholds. Bangladesh, Burkina Faso, Egypt, Ethiopia, Ghana, Kenya, Liberia, Madagascar, Mauritania, Mozambique, Sao Tome & Principe, and Togo fulfilling stunting and obesity. Guinea and Palestine fulfilling stunting and wasting targets. Ten countries (Burundi, Cameroon, Chad, Côte d’Ivoire, Guinea-Bissau, India, Laos, Sudan, and Timor-Leste, Jordan) will be expected to meet threshold of one GNT mainly stunting. At baseline around eight countries (Gambia, Jordan, Kyrgyzstan, Palestine, Sierra Leone, Togo, and Tunisia, Rwanda.) met the GNT cut-offs for all three malnutrition (stunting, wasting, and obesity) indicators. An improvement observed in the current survey where

ten countries (Comoros, Gambia, Haiti, Honduras, Kyrgyzstan, Malawi, Nigeria, Rwanda, Sierra Leone, and Togo) achieved these targets. However, by 2030, Togo, which currently meets the GNT cut-offs for all forms of malnutrition is projected to no longer meet these targets due to an expected increase in wasting prevalence beyond the 5% threshold from its current prevalence of 3.8%.

From the baseline surveys around 18 countries reported a high prevalence of stunting exceeding 40%. Mostly were from AFRO region Benin, Chad, Côte d'Ivoire, Burundi, Guinea, Kenya, Lesotho, Malawi, Mali, Mauritania, Nigeria, and Zambia. Three from SEARO region Bangladesh, Nepal, Timor-Leste. Pakistan and Yemen from EMRO and Laos from WPRO. Projections to 2030 offered a substantial improvement in stunting prevalence encouragingly Pakistan (30.9%) and Timor-Leste (32.2%) putting them on a path consistent with the GNT. In stark contrast, stunting is expected to remain stubbornly above 40% in Burundi, Mauritania, and Yemen. Additionally, projections indicate that stunting prevalence may exceed 40% in Sudan and Zimbabwe by 2030. The number of countries classified in the red zone for stunting declined markedly from 18 at baseline to five in the current period. These were (Burundi (55.2%), Timor-Leste (47.4%), Mauritania (43.2%), Pakistan (38.5%) and Yemen 48.8%).

Wasting remains a major public health challenge across LMICs. At baseline wasting prevalence above the global cut-off (>5%) was observed in 38 countries. Majority were from AFRO region Benin, Burundi, Comoros, Burkina Faso, Cameroon, Chad, Congo, Côte d'Ivoire, DRC, Eswatini, Ethiopia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Nigeria, São Tomé and Príncipe, Senegal, Sudan, Uganda, Zambia and Zimbabwe. Four represented the SEARO region Bangladesh, Nepal, India, Timor-Leste. Egypt, Pakistan and Yemen represented the EMRO region. Haiti from AMRO and Tajikistan from EURO. However, wasting prevalence remained above the global threshold in 33 countries during the current period. Projections indicate that by 2030, more than half of LMICs (approximately 28 countries) are expected to meet the GNT for wasting. In subsequent rounds of surveys, notable advancements emerged in the fight against acute malnutrition. Six low- and middle-income countries Burundi, Comoros, Guinea, Malawi, Mauritania, and Nigeria succeeded in achieving the GNT for wasting. However, projection 2030 reveal that several countries mostly from AFRO region projected to continue experiencing a high burden of wasting beyond 2030. These were Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Ethiopia, Ghana, Guinea-Bissau, Kenya, Liberia, Madagascar, Mozambique, São Tomé and Príncipe, Sudan, Togo, and Zimbabwe. Bangladesh, India and Timor-Leste from the SEARO region. Egypt, Jordan and Yemen from EMRO. Laos from WPRO. Children living in LMICs also experience obesity. Currently, 17 LMICs report obesity prevalence exceeding the global threshold of 5%. Certain LMICs had high obesity threshold at baseline now meet the GNT of <5% obesity. These included Benin, Burkina Faso, Comoros, Ethiopia, Ghana, Kenya, Lesotho, Liberia, Malawi, Nigeria from AFRO region. Nepal from SEARO and Pakistan from EMRO had high obesity threshold at baseline now meet the GNT of <5% obesity. By 2030, forward-looking projections offer some cautious optimism for curbing childhood overweight and obesity in LMICs. Projections indicate that a significant majority of LMICs specifically over 30 nations are positioned to achieve the GNT for childhood obesity. Despite this positive trajectory, a subset of 14 countries is expected to maintain an obesity prevalence exceeding the 5% threshold. This group includes AFRO countries mostly Guinea-Bissau, Sudan, Burundi, Cameroon, Chad, Côte d'Ivoire, Guinea and Zimbabwe. SEARO represented by India and Timor Leste. Jordan, Palestine and Yemen from EMRO region. Laos from WPRO. These findings highlight a persistent public health challenge in these specific regions contrasting with the broader progress observed across other LMICs.

3.2. Baseline, Current and Scenario-Based Projections of Various Forms of Malnutrition Including CFM Among Children Under Five Across LMICs

Table 2 presented prevalence of malnutrition and its various types including coexisting forms of malnutrition (CFM): coexistence of wasting with stunting (CWS) and coexistence of stunting with obesity (CSO) among under five years children of 48 LMICs at an individual level.

At baseline more than half of children under five were malnourished in 13 countries. Majority were from AFRO region Benin, Burundi, Côte d'Ivoire, Kenya, Lesotho, Mali, Nigeria. Bangladesh, Nepal, India, Timor Leste were from SEARO region. EMRO region included Pakistan and Yemen. Paediatric malnutrition exceeded 50% in four countries such as Burundi, India, Timor-Leste, and Yemen in the current surveys. Projections for 2030 suggest that nine countries are expected to have a paediatric malnutrition prevalence exceeding 50%. These were Burundi, Ethiopia, India, Laos, Mauritania, Sudan, Timor-Leste, Yemen, and Zimbabwe.

Stunting was the most prevalent form of malnutrition in 42 LMICs as found in all surveys except in Congo, Egypt, Laos, Jordan, Palestine, and Timor-Leste. In these six countries, projections to 2030 indicate that stunting prevalence will be lower than other forms of malnutrition. Specifically, the projected prevalence of wasting in Egypt, Congo, Laos, and Timor-Leste is expected to exceed that of stunting. However, in Jordan and Palestine, childhood obesity is projected to be more prevalent than other forms of malnutrition.

By 2030, most of the LMICs would be expected to control the raising prevalence of stunting despite of its high burden. However, the prevalence of stunting would be expected to rise from their current stunting level in 10 countries. These are mostly from AFRO region Benin, Burundi, Gambia, Guinea-Bissau, Mali, Mauritania, Sudan and Zimbabwe. Two countries Tunisia and Yemen from the EMRO region. The projected prevalence of wasting would be expected to increase in 15 countries. These are mostly from AFRO region Cote de I'vore, Kenya, Madagascar, Mozambique, Rwanda, Sao Tome & Principe, Sierra Leone, Togo, and Zimbabwe. SEARO region included Nepal, Timor Leste. Eygpt, Jordan and Tunisia from EMRO region. Laos from WPRO region. Similarly, the projected prevalence of obesity would be expected to rise in 2030 in 17 countries. These are mostly from AFRO region Cameroon, DRC, Ethiopia, Guinea, Guinea-Bissau, Liberia, Nigeria, Uganda, Zambia and Zimbabwe. Bangladesh, India, Nepal, Timor-Leste from SEARO. EMRO included Jordan and Palestine. WPRO included Laos.

Alongside with standalone forms of malnutrition, CFM specifically the CWS and CSO were observed in 47 countries, with Kyrgyzstan as the only exception. The prevalence of CSO would be expected to rise in 12 countries by 2030. Notably observed in Burundi, Chad, Egypt, Madagascar, Mauritania, Mozambique, Nepal, Sao Tome & Principe, Sierra Leone, Sudan, Timor-Leste and Yemen. While the prevalence of CWS would be expected to rise in 2030 in 9 countries. These were Cameroon, Cote de I'vore, Ethiopia, Guinea-Bissau, India, Jordan, Laos, Palestine, and Timor-Leste.

3.3. Determinants of Standalone and Coexisting Forms of Malnutrition Among Children Under Five Across LMICs

We found significantly higher odds of stunting by 15% (14 % to 15%) with each increasing month in age among children between the ranges of 0 to 59 months age. On the other hand, the odds of wasting and obesity decrease by 14% (13% to 14%) and 16% (15% to 17%) with each increasing month in age among children between the ranges of 0 to 59 months age. The odd of coexistence of wasting with stunting increased by 1.03 (1.02 to 1.03) and the coexistence of stunting with obesity decreased with 0.83 (0.82 to 0.84) with each increasing month in age among children between the ranges of 0 to 59 months age. Compared to female children, the male children are at significantly increased odds of acquiring stunting, wasting and obesity to the 1.14 (1.13 to 1.15), 1.10 (1.08 to 1.11), 1.13 (1.09 to 1.16), respectively. Similarly, the coexistence of wasting with stunting is associated with an increased odds of 1.46 (1.43 to 1.48) and the coexistence of stunting with obesity is significantly associated with an increased odds of 1.12 (1.08 to 1.15) among male children between the ranges of 0 to 59 months age.

Compared to parents who have acquired higher education, the odds of stunting and wasting were increased by approximately 1 to 2 folds among parents who have acquired less education or no education. Lower level of parents' education was significantly associated with the lower odds of having child with obesity, ranging from 21% to 29%. The odds of coexistence of wasting with stunting increased by approximately 1.5 to 3-fold among parents who have acquired less education or no education compared to parents who have acquired higher education. The coexistence of stunting

with obesity increased the odds to the 1.41 (1.33 to 1.50) among parents who have no education. On contrary, the odds of the coexistence of stunting with obesity decreased to the 0.89 (0.84 to 0.94) among parents who have acquired secondary education. However, no association was observed with the coexistence of stunting with obesity among parents who have acquired primary education when compared with parents having higher education. Overall, the level of parental educational level is significantly associated with increased odds of malnutrition among children under five across LMICs.

When compared with the richest wealth index, the odd of developing stunting and wasting increased by approximately 1-2-fold among children belonging to Richer to Poorest wealth index. The odds of obesity with each of the wealth index, namely, from poor to richer significantly decreased by 18% to 38% when compared with the children belonging to richest wealth index. The coexistence of wasting with stunting is 1 to 2-fold higher among children belonging to Richer to Poorest wealth index as compared to richest wealth index. The coexistence of stunting with obesity is associated with decreased odd to the 27% to 41% when compared with the children belonging to richest wealth index.

We found significantly higher odds of stunting and wasting to the 1.19 (1.17 to 1.21) and 1.04 (1.02 to 1.06), respectively among the children’s residents of rural areas as compared to the children’s residents of rural area. On the other hand, the odds of obesity decreased to the 0.99 (0.95 to 1.03) among the children’s residents of rural areas. The odd of coexistence of wasting with stunting increased by 1.14 (1.11 to 1.17) and the coexistence of stunting with obesity increased to the 1.13 (1.08 to 1.17) among the children’s residents of rural areas. When compared with WPRO the odds of stunting decreased to the 0.85 (0.83 to 0.87), 0.52 (0.50 to 0.54), 0.83 (0.81 to 0.86), 0.49 (0.47 to 0.51) in children belonging to the regions of AFRO, AMRO, EMRO and EURO. However, the odds of stunting increased to the 30% (27% to 34%) in children belonging to the region of SEARO. There were approximately 1-3-fold higher odds of wasting in the regions of AFRO, EMRO, EURO and SEARO when compared with WPRO. On, contrary, there were lower odds of wasting in the regions of AMRO to the 0.59 (0.46 to 0.75). Compared with WPRO, across all five LMICs the increasing odds of obesity were approximately 3 to 4.5 folds. The coexistence of wasting with stunting was associated with the increased odds to approximately 1 to 3 folds in the regions of AFRO, EMRO, and SEARO. The coexistence of wasting with stunting was significantly lower to the 0.32 (0.28 to 0.36) and 0.36 (0.30 to 0.43) in the regions of AMRO and EURO. The coexistence of stunting with obesity is associated with the increased odds of approximately 2 to 5 fold in the regions of AFRO, EMRO, EURO and SEARO. However, the coexistence of stunting with obesity is associated with the lower odds to the 0.49 (0.24 to 1.04).

The odds of stunting, wasting and obesity decreased to the approximately 3% with an increased passing year. Similarly, the odd of coexistence of wasting with stunting decreased to the 0.97 (0.97 to 0.97) and the coexistence of stunting with obesity decreased to the 0.94 (0.94 to 0.94) with an increased passing year among children under five across LMICs (Table 3).

Table 3. Cross survey temporal assessment of standalone and coexisting forms of malnutrition among children under five across LMICs.

Variables	Stunting	Wasting	Obesity	CWS	CSO
Individual factors					
Age of child (in year)	1.15 (1.14 to 1.15) *	0.86 (0.86 to 0.87) *	0.84 (0.83 to 0.85) *	1.03 (1.02 to 1.03) *	0.83 (0.82 to 0.84) *
Child sex:					
Female (reference)	Ref	Ref	Ref	Ref	Ref

Male	1.14 (1.13 to 1.15) *	1.10 (1.08 to 1.11) *	1.13 (1.09 to 1.16) *	1.46 (1.43 to 1.48) *	1.12 (1.08 to 1.15) *
Household factors					
Education:					
None	2.19 (2.14 to 2.23) *	1.54 (1.50 to 1.59) *	0.79 (0.74 to 0.84) *	2.94 (2.79 to 3.09) *	1.41 (1.33 to 1.50) *
Primary	1.99 (1.94 to 2.03) *	1.19 (1.15 to 1.22) *	0.74 (0.69 to 0.78) *	2.21 (2.10 to 2.33) *	1.03 (0.96 to 1.09)
Secondary	1.41 (1.39 to 1.44) *	1.10 (1.07 to 1.12) *	0.71 (0.68 to 0.75) *	1.51 (1.44 to 1.59) *	0.89 (0.84 to 0.94) *
Higher (reference)	Ref	Ref	Ref	Ref	Ref
Wealth index					
Poorest	2.00 (1.96 to 2.04) *	1.48 (1.26 to 1.73) *	0.62 (0.59 to 0.69) *	2.59 (2.48 to 2.70) *	0.73 (0.44 to 1.21)
Poorer	1.73 (1.71 to 1.77) *	1.24 (1.05 to 1.47) *	0.68 (0.64 to 0.72) *	1.95 (1.87 to 2.04) *	0.64 (0.37 to 1.11)
Middle	1.51 (1.48 to 1.54) *	1.30 (1.10 to 1.54) *	0.79 (0.75 to 0.83) *	1.58 (1.51 to 1.65) *	0.59 (0.33 to 1.05)
Richer	1.27 (1.25 to 1.30) *	1.20 (1.01 to 1.42) *	0.82 (0.78 to 0.86) *	1.29 (1.23 to 1.34) *	0.69 (0.40 to 1.18)
Richest (reference)	Ref	Ref	Ref	Ref	Ref
Regional & Community factors					
Place of residence					
Rural	1.19 (1.17 to 1.21) *	1.04 (1.02 to 1.06) *	0.99 (0.95 to 1.03)	1.14 (1.11 to 1.17) *	1.13 (1.08 to 1.17) *
Urban (reference)	Ref	Ref	Ref	Ref	Ref
Geographical regions					
AFRO	0.85 (0.83 to 0.87) *	1.24 (1.08 to 1.40) *	4.82 (3.99 to 5.84) *	1.05 (0.98 to 1.13)	2.70 (1.89 to 3.86) *
AMRO	0.52 (0.50 to 0.54) *	0.59 (0.46 to 0.75) *	6.00 (4.95 to 7.45) *	0.32 (0.28 to 0.36) *	0.49 (0.24 to 1.04)
EMRO	0.83 (0.81 to 0.86) *	1.73 (1.50 to 1.98) *	6.65 (5.49 to 8.06) *	1.64 (1.51 to 1.76) *	5.13 (3.58 to 7.36) *
EURO	0.49 (0.47 to 0.51) *	1.65 (1.39 to 1.97) *	3.00 (2.39 to 3.78) *	0.36 (0.30 to 0.43) *	3.90 (2.58 to 5.92) *
SEARO	1.30 (1.27 to 1.34) *	3.65 (3.21 to 4.15) *	4.56 (3.76 to 5.51) *	3.27 (3.05 to 3.51) *	5.10 (3.59 to 7.28) *
WPRO (reference)	Ref	Ref	Ref	Ref	Ref
Temporal factor					
Year	0.97 (0.97 to 0.98) *	0.98 (0.98 to 0.98) *	0.98 (0.97 to 0.98) *	0.97 (0.97 to 0.97) *	0.94 (0.94 to 0.94) *

Table 4: Interaction effects between survey year and selected covariates on SFM and CFM among children under five in LMICs

Across the two survey periods, with each increasing month in age there was 1% reduction in the odds of stunting among children under five in LMICs. Conversely, each additional month of children age was associated with 1% increase in the odds of wasting. There was no significant difference observed in the odds of child’s obesity trend over time. With each increasing month in age, there was slight but significant reduction in the odds of coexistence of wasting with stunting (OR = 0.99; CI: 0.99–0.99) and the coexistence of stunting with obesity (OR = 0.98; CI: 0.97–0.98).

The yearly change in stunting, wasting and obesity was not associated with children’s sex. The coexistence of stunting with obesity was increased in the odds of 1.01 (1.00 to 1.02) among male children as compared to female counterparts.

The odds of stunting and wasting showed a small but statistically significant reduction approximately 1% among children whose parents had lower levels of education. The odds of obesity were reduced by approximately 8% (7% to 10%) among children of parents had no formal education. There was significant reduction in the odds of coexistence of wasting with stunting approximately 2% to 7 % among children whose parents had lower levels of education. And the coexistence of stunting with obesity was reduced approximately 2% to 8% among children whose parents had primary level of education and no formal education. Conversely, the odds of coexistence of stunting with obesity were increased to approximately 2% (1% to 4%) among children whose parents had secondary level of education.

The yearly change in stunting showed a small but statistically significant reduction of approximately 2%–3% among children belonging to the richer, middle, poorer, and poorest wealth indices compared with those in the richest wealth index. Across the two survey periods, the odds of wasting increased slightly among children in the poorest wealth index (OR = 1.01; 95% CI: 1.00–1.02). No statistically significant association was observed between wealth status and wasting among children in the middle and richest wealth indices (OR = 1.00; 95% CI: 0.99–1.01). In contrast, the odds of obesity were reduced by approximately 2% (CI: 1%–3%) among children belonging to the poorest wealth index. The risk of stunting, wasting and obesity was not associated with place of residence across the two survey periods. The odds of coexistence of stunting with obesity were increased to approximately 1% to 2% among children belonging to the poorest to middle wealth index.

Children in the AFRO and EURO regions had a 2%–3% lower risk of stunting compared with WPRO region. Children of AMRO and EMRO are at increased risk of stunting approximately 2% and 7%, respectively. The risk of wasting in the Children in the AFRO and AMRO is statistically reduced by 0.95 (0.94 to 0.97) and 0.97 (0.95 to 0.99), respectively. The odds of wasting were reduced by approximately 11% (CI: 8%–12%) among children of EURO across the two survey periods. Compared with WPRO, across all four regions namely, AFRO, EMRO, EURO and SERO LMICs the odds of obesity were increasing odds of obesity were ranging from 6% to 13%, while no significant association was observed for AMRO 1.00 (0.98 to 1.02). The odds of coexistence of wasting with stunting were reduced in the region of AFRO 0.98 (0.96 to 0.98) and SEARO 0.98 (0.96 to 0.99) as compared to the region of WPRO. The odds of coexistence of wasting with stunting were significantly increased in the region of AMRO 1.02 (1.00 to 1.05) and EMRO 1.08 (1.06 to 1.09). The coexistence of stunting with obesity among children was significantly reduced to 14% to 36% across all five LMIC’s as compared to region of WPRO.

Table 4. Interaction effects between survey year and selected covariates on standalone and coexisting forms of malnutrition among children under five in low- and middle-income countries (LMICs).

Variables	Stunting	Wasting	Obesity	CWS	CSO
Individual factors					
Year * Age of child (in year)	0.99 (0.99 to 0.99) *	1.01 (1.01 to 1.01) *	1.00 (0.99 to 1.00)	0.99 (0.99 to 0.99) *	0.98 (0.97 to 0.98) *
Child sex * Year					
Female (reference)	Ref	Ref	Ref	Ref	Ref
Male	0.99 (0.99 to 1.01)	1.01 (0.99 to 1.01)	1.00 (0.99 to 1.01)	0.99 (0.99 to 1.00)	1.01 (1.00 to 1.02) *
Household factors					
Education * Year					
None	0.99 (0.99 to 1.00)	0.99 (0.98 to 0.99) *	0.92 (0.90 to 0.93)	0.95 (0.93 to 0.96) *	0.92 (0.91 to 0.94) *
Primary	0.99 (0.98 to 0.99)	0.99 (0.98 to 0.99) *	*	0.93 (0.92 to 0.95) *	0.98 (0.96 to 0.99) *
Secondary	*	1.00 (0.99 to 1.01)	0.99 (0.97 to 1.00)	0.98 (0.96 to 0.99) *	1.02 (1.01 to 1.04) *
Higher (reference)	0.99 (0.98 to 0.99) *	Ref	1.00 (0.99 to 1.01) Ref	Ref	Ref
Wealth index * Year					
Poorest	0.98 (0.97 to 0.98)	1.01 (1.00 to 1.02) *	0.98 (0.97 to 0.99)	1.01 (0.99 to 1.05)	1.02 (1.01 to 1.04) *
Poorer	*	1.01 (0.99 to 1.01)	*	0.99 (0.99 to 1.00)	1.01 (1.00 to 1.03) *
Middle	0.98 (0.97 to 0.98)	1.00 (0.99 to 1.01) *	0.99 (0.98 to 1.01)	0.99 (0.99 to 1.00)	1.02 (1.00 to 1.03) *
Richer	*	1.00 (0.99 to 1.01)	1.00 (0.99 to 1.01)	0.99 (0.99 to 1.00)	1.00 (0.98 to 1.02)
Richest (reference)	0.98 (0.97 to 0.99) *	Ref	0.99 (0.98 to 1.00) Ref	Ref	Ref
Regional & Community factors					
Place of residence * Year					
Rural	0.99 (0.99 to 1.00)	0.99 (0.99 to 1.00)	0.99 (0.99 to 1.00)	1.88 (1.88 to 1.89) *	1.01 (0.99 to 1.01)
Urban (reference)	Ref	Ref	Ref	Ref	Ref
Geographical regions *					
Year	0.98 (0.97 to 0.99)	0.95 (0.94 to 0.97) *	1.10 (1.08 to 1.11)	0.98 (0.96 to 0.98) *	0.72 (0.67 to 0.76) *
AFRO	*	0.97 (0.95 to 0.99) *	*	1.02 (1.00 to 1.05) *	0.69 (0.64 to 0.75) *
AMRO	1.02 (1.01 to 1.03)	1.01 (0.99 to 1.02)	1.00 (0.98 to 1.02)	1.08 (1.06 to 1.09) *	0.71 (0.66 to 0.76) *
EMRO	*	0.89 (0.88 to 0.92) *	*	0.99 (0.96 to 1.02)	0.64 (0.59 to 0.71) *
EURO	1.07 (1.06 to 1.08)	0.99 (0.98 to 1.01)	1.07 (1.06 to 1.09)	0.98 (0.96 to 0.99) *	0.86 (0.81 to 0.92) *
SEARO	*	Ref	*	Ref	Ref
WPRO (reference)	0.97 (0.96 to 0.99) *		1.06 (1.03 to 1.10) *		
	1.00 (0.99 to 1.01) Ref		1.13 (1.11 to 1.14) *		
			Ref		

4. Discussion

This study measured the projected trajectories of stunting, wasting, obesity, and CFM among children under five across 48 LMICs to 2030. The findings revealed uneven malnutrition reduction across different regions and countries, although child mortality attributable to malnutrition has declined globally due to improvements in healthcare delivery [24,25]. The study reported that majority of the countries are projected to meet one or more GNTs by 2030, while most remain off-track to fully achieve the nutrition commitments under the SDGs [26]. The dominant pattern across indicators is widening divergence between countries with stable systems and those affected by conflict, climate shocks, or weak governance [27,28].

Among various forms of paediatric malnutrition, stunting which is also known as chronic undernutrition is responsive to long-term, multisectoral strategies. Sustained investments in maternal health, sanitation, education, and primary care have remarkably reduced the rising burden of stunting in most of on-track countries [29,30]. However, projections reveal important fragility, because the inequality gaps between the on-tracks and off-track LMICS narrowed temporarily between baseline and current surveys but are projected to widen again by 2030, i.e., stunting is expected to remain above 40% in Burundi, Mauritania, and Yemen, with Sudan and Zimbabwe at risk of joining this group (Table 1). These trajectories suggest that stunting reduction requires sustained structural transformation [31,32]. Unlike stunting, wasting responds rapidly to acute shocks, such as conflict, drought, displacement, food price volatility, and infectious disease outbreaks [27,28]. By the year 2030, more than half of LMICs are projected to meet $\leq 5\%$ threshold GNT for wasting. Furthermore, the on-track countries will show gradual improvements for wasting reduction, while the off-track countries are expected to experience rising prevalence. This divergence mirrors patterns described by the Lancet Commission on the Future of Health, where improvements in stable systems coexist with deterioration in fragile states [33]. Countries such as Sudan, Yemen, Zimbabwe, Chad, and Timor-Leste demonstrate particularly concerning trajectories (Table 1). Even small absolute reductions in wasting among on-track countries represent meaningful system-level strengthening in acute malnutrition management. In contrast, minimal change or rising prevalence in fragile settings reflects structural vulnerability and repeated humanitarian shocks [27,28]. By 2030, wasting inequality between country groups is projected not merely to return to baseline levels but to surpass them.

Obesity in children under five year is an emerging nutritional problem, which presents a structurally different but equally concerning trajectory. The prevalence of obesity in more than half of the LMICs remains below the 5% threshold. By 2030, certain countries from Asia, Africa, and Middle East projected to show rising obesity trend specifically in those countries still burdened by undernutrition (Table-1 and Table-2). This reveals bidirectional movement between the on-track and off-track countries by 2030. The on-track countries show modest but consistent declines due to policy interventions targeting obesogenic environments [34]. Conversely, the off-track countries are projected to experience further increases driven by rapid dietary transitions, ultra-processed food penetration, urbanisation, and weak regulatory frameworks [35,36]. This reflects systemic food changes rather than short-term crises. The rising prevalence of obesity coexists in certain countries such as Jordan, Palestine, Sudan, Timor-Leste, and Zimbabwe coexists with undernutrition (stunting or wasting or both) (Table 1), thereby indicating the double burden of malnutrition, a phenomenon in which ultra-processed food penetration drives over nutrition even within populations still struggling with acute undernutrition [37].

CFM (CWS and CSO) was identified in nearly all LMICs, underscoring the complexity of current nutrition landscapes. Despite its global prevalence, still the targets for the reduction of CFM and its various forms are not yet defined by any local and international body. By 2030, the prevalence of both CWS and CSO is projected to rise. Countries like Ethiopia, India, Laos, and Timor-Leste indicate rising projection of CWS by 2030 (Table 2), and this depicts a complex relation between chronic deprivation and acute shocks [27,28]. However, an escalated projection of CSO in several conflict-affected countries including Yemen and Sudan (Table 2) reflects calorie-dense but micronutrient-poor

diets, humanitarian food assistance dependency, and rapid market shifts toward processed foods [35,37].

Countries with deteriorating trajectories represent critical regional hotspots. Five countries are projected to have stunting prevalence persist above 40% by 2030: Burundi (54.1%), Mauritania (49.4%), Sudan (61.3%), Yemen (51.4%), and Zimbabwe (56.6%). Wasting remains the most challenging indicator across LMICs, with 33 countries currently exceeding the 5% GNT threshold and 22 projected to continue exceeding this threshold by 2030. Childhood obesity is rising globally, with 14 countries expected to exceed the 2030 threshold. We observed concerning levels of CSW, exceeding 4% in Ethiopia (20.3%), Cameroon (5.9%), Laos (5.5%), and India (4.5%). CSW represents the most lethal form of malnutrition, with mortality risk twelve times higher than well-nourished children. Moreover, the escalated project of CSO to over 5% in Timor-Leste (10.1%), Chad (9.8%), and other conflict-affected settings, highlighting the emerging double burden in fragile and transitioning contexts [27,28,37]. (Table 2).

Across regions, high-risk countries share common drivers: conflict, climate shocks, weak health systems, and structural poverty. The AFRO region remains the epicentre of global malnutrition crisis with several countries classified either as the danger zone or critical hotspots requiring emergency response. In AFRO region, Burundi, Mali, Mauritania, and Zimbabwe continue to experience stunting likely due to, suboptimal exclusive breastfeeding limited dietary diversity, infectious disease burden and limited community-based nutrition programs including poor antenatal care [24,29,38,39]. Ethiopia demonstrated unexpected CWS crisis (Projected 20.3%) secondary to the compounded effects of Tigray conflict, severe drought, locust attacks and COVID-19 pandemic. Benin presents an unusual trajectory: rising projected stunting (33.4%) despite a marked decline in wasting (from 13.3% to 0.6%), suggesting improvement in acute malnutrition management but persistent chronic determinants. In EMRO, Sudan and Yemen showed protracted humanitarian catastrophes with persistently high stunting and CSO, likely linked to prolonged nutritionally inadequate food assistance in the conflict-affected countries [40]. while Jordan and Palestine illustrate emerging childhood obesity secondary to nutrition transition and profound dietary shifts [41]. In SEARO, India and Timor-Leste showed slow progress to reach the GNTs due to poor feeding practices, lack of sanitary measures, and fragile infrastructure [42]. Similarly, in the WPRO region, Laos presents catastrophic projection of wasting (Table 2). Collectively, these countries represent danger zones where chronic deprivation intersects with acute shocks, producing persistent and, in some settings, worsening malnutrition.

In contrast, certain countries from each region achieve the GNTs and have successfully reduced the rising burden of various forms of malnutrition, including CFM. In AFRO region, Chad, Congo Ghana and Rwanda achieved substantial stunting reduction through coordinated national nutrition mechanisms [24,43]. Despite tremendous reduction in stunting, still Chad illustrates a complex pattern of stunting alongside with wasting (CWS) and obesity (CSO). Thereby, reflecting the humanitarian-induced obesity among stunting children of Chad [44]. In SEARO, Bangladesh is projected to improve paediatric nutritional status by incorporating multisectoral improvements: sanitation, dietary diversity, women's empowerment, and health service expansion [45]. In AMRO, Honduras approaches near-elimination thresholds, whereas Haiti showed persistent challenge due to political instability and natural disaster. Within EURO, Tajikistan and Kyrgyzstan combatted the rising malnutrition prevalence by improving the health infrastructure and social protection systems (Table 2).

Child age and sex emerged as fundamental biological determinants of malnutrition. Each additional year increased in child age increase the stunting odds by 15% while decreasing wasting (14%) and obesity (16%). Different studies demonstrated that acute malnutrition peaks between 6-18 months when complementary feeding is introduced and infectious disease exposure intensifies, while the chronic growth faltering accumulates thereafter [38,46]. Between male and female children, higher odds of undernutrition particularly for CWS were observed in male children and this is in line with recent systematic review evidence [47].

Maternal education was the strongest and most consistent predictor across all forms of malnutrition. Children of mothers with no education had 2.19-fold higher odds of stunting compared with those whose mothers had higher education, and similar gradients were observed for wasting, obesity, and CFM. These findings are consistent with a 2024 meta-analysis across 35 studies demonstrating a robust inverse association between maternal education and child undernutrition [48]. Moreover, maternal education also improve the knowledge and practices for appropriate feeding practices and thereby help to reduced malnutrition [49]. Similarly, children from poorest wealth quintile exhibiting 2.00-fold higher odds of stunting compared to the richest quintile. Analysis of DHS data from 24 LMICs (2017–2022) confirms that child undernutrition remains statistically significant with wealth-related inequality across country income categories [50]. Children of rural residence have high risks of nutritional adversities (malnutrition), highlighting structural disadvantages in healthcare access, WASH infrastructure, and food systems [51].

Interaction analyses revealed that structural inequalities are narrowing too slowly to meet 2030 targets. With time, the poverty gap in stunting is closing by only 2% annually, implying that parity between poorest and richest quintiles would take approximately five decades without major policy shifts. Similarly, the rural–urban differential narrowed by just 1% per year, indicating persistent geographic disadvantage. Over time, the difference in stunting between younger and older children has reduced by about 1% each year. A similar small improvement was seen for CWS. This suggests that nutrition and child health programs may be gradually improving conditions in early childhood, although the progress is modest.

In contrast, the difference between boys and girls has remained mostly unchanged for most forms of malnutrition. However, for CSO, the gap has slowly widened, with boys becoming slightly more affected over time. This trend may reflect changing diets and broader nutrition transition patterns [52]. Regionally, EMRO demonstrated worsening trends, with stunting and obesity increasing by approximately 7% annually relative to other regions, whereas AFRO exhibited faster stunting reduction ($\approx 2\%$ annual acceleration). Overall, the year interaction terms capture the cumulative impact of nutrition-specific and nutrition-sensitive interventions between 2012–2023, indicating modest progress but persistent inequities unlikely to resolve under business-as-usual trajectories [3].

4.2. Strengths and Limitation

This study draws on a very large, multi-country sample of more than a million children under 5 years from 48 LMICs, using DHS and MICS surveys that employ multistage stratified cluster sampling, standardised questionnaires, experienced field workers, and validated anthropometric protocols [37,53]. Uniform procedures for data screening, cleaning, coding, and categorisation, along with sample-weight adjustments and harmonisation of key variables, enhanced the validity, precision and comparability of estimates across countries over time. By triangulating DHS and MICS datasets and standardising variable definitions, the analysis achieves broader geographical coverage and more consistent measures than studies restricted to a single survey platform. The use of regression models that include interaction terms between survey period and key covariates allows assessment of how social and regional gradients in malnutrition have evolved over time, rather than relying solely on crude prevalence differences. Despite the large sample size and inclusion of many LMICs, the findings cannot be considered fully representative of all regions because of under-representation of WPRO, EURO, and AMRO region and some parts of EMRO and SEARO region. Several countries that are no longer classified as LMICs were retained because they received development assistance or were LMICs at the time of data collection, which may complicate strict alignment with current World Bank income groupings [23,54]. The pooled data estimates and projections may not reflect the effects of recent conflicts, climate-related disasters, economic crises, or pandemics. Exclusion of around 10-15% of children due to incomplete anthropometry or outliers, while undoubtedly necessary for data quality, may lead to underestimations of malnutrition in settings with poorer measurement. Furthermore, the survey sampling frames primarily target

women of reproductive age, with children under 5 nested within these samples, which can distort the representativeness of the paediatric population. Finally, the malnutrition projections measured in this study were relied on the past trajectories, therefore, they must be interpreted as indicative rather than exact forecast.

4.3. Policy Implications

Addressing paediatric malnutrition through the GNTs remains a critical global priority. However, progress in many LMICs continues to lag behind these targets, partly because current benchmarks are defined by individual anthropometric indicators rather than by the nutritional status of the child as a whole. The presence of one form of malnutrition does not preclude the coexistence of others, highlighting a key limitation of standalone indicator-based approaches. There is a clear need to expand national and regional nutrition surveillance beyond single indicators to systematically capture CFM. This would enable earlier identification and timely management of children affected by multiple nutritional deficits. In addition, redefining the GNTs to include individual-level benchmarks alongside national-level goals could help to reduce the rising burden of malnutrition, including CFM. Such an approach would also support policymakers and programme managers in designing integrated strategies that simultaneously address undernutrition and overnutrition at the individual, community, and national levels.

4.5. Future Directions

Survey frequency across LMICs remains uneven, limiting the ability to comprehensively track nutritional trends over time. More regular and systematically scheduled surveys would allow a clearer understanding of evolving nutrition profiles. DHS and MICS implementing agencies should prioritise greater inclusion of underrepresented regions particularly AMRO, EURO, and WPRO region to ensure more equitable geographic coverage. Integrating nutrition survey data with climatic, environmental, and humanitarian indicators would yield deeper insights into external determinants influencing the national nutrition targets and prevalence of each form of malnutrition including CFM. Furthermore, the adoption of longitudinal study designs including interventional studies would strengthen the identification of context-specific, underlying, and currently underexplored factors contributing to meet the national nutrition targets by combatting malnutrition including CFM in children.

4.6. Conclusion

This study demonstrates that when CFM are considered alongside traditional indicators, many LMICs are not on track to meet the 2030 child growth targets. While some countries show progress, the overall pace of improvement is slow and marked by persistent socioeconomic and regional inequalities. Without accelerated and targeted action, the burden of both standalone and CFM will remain substantial. Governments and global health partners should strengthen nutrition surveillance systems to routinely monitor CFM and implement integrated, equity-focused strategies that simultaneously prevent and manage undernutrition and overnutrition at both national and individual levels.

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Informed Consent Statement: In this study, the research team received data from DHS and UNICEF repository which was de-identified, i.e., it does not contain information in which a participant can either be identified or traced by any means. Due to this reason, this study does not involve a statement for informed consent.

Data Availability Statement: The data from this study can be retrieved from the DHS program (www.dhsprogram.com) and UNICEF (www.mics.unicef.org/surveys).

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Conflicts of Interest: The authors declare no conflict of interest.

List of Abbreviations

AFRO	African Region
AMRO/PAHO	Region of the Americas / Pan American Health Organization
ARR	Annual Rate of Change
CFM	Coexisting Forms of Malnutrition
COVID-19	Coronavirus Disease 2019
CSO	Coexistence of Stunting with Obesity
CSW / CWS	Coexistence of Stunting with Wasting / Coexistence of Wasting with Stunting
DHS	Demographic and Health Surveys
DRC	Democratic Republic of Congo
EMRO	Eastern Mediterranean Region
EURO	European Region
GBD	Global Burden of Disease
GLM/ GzLM	Generalised Linear Model
GNR	Global Nutritional Report
GNT	Global Nutrition Target
HAZ	Height-for-Age Z-score
JME	Joint Malnutrition Estimates
LICs	Low-Income Countries
LMICs	Low- and Middle-Income Countries
MDGs	Millennium Development Goals
MICS	Multiple Indicator Cluster Surveys

OR	Odds Ratio
PDHS	Pakistan Demographic and Health Surveys
SDGs	Sustainable Development Goals
SEARO	South-East Asia Region
SFM	Standalone Forms of Malnutrition
UHC	Universal Health Coverage
UICs	Upper Income Countries
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WAZ	Weight-for-Age Z-score
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WHZ	Weight-for-Height Z-score
WPRO	Western Pacific Region

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