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Triple burden of malnutrition among mother–child pairs in low-income and middle-income countries: a cross-sectional study

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ABSTRACT

Objective This study aimed to assess the prevalence and determinants of the triple burden of malnutrition among mother–child pairs in low-income and middle-income countries.

Design Cross-sectional study.

Setting Low-income and middle-income countries.

Participants Women and children.

Primary outcome Triple burden of malnutrition (overweight/obese mother with undernourished and anaemic under 5 years child).

Methods Data for this study were drawn from recent 22 low-income and middle-income countries Demographic and Health Surveys. A total weighted sample of 116 795 mother–child pairs was included in the study. STATA V.14.2 was used to clean, code and analyse the data. Multilevel logistic regression was employed to identify factors associated with the problem. Adjusted OR (AOR) with 95% CI and a p<0.05 was reported to indicate statistical association. Model fitness and comparison were done using intraclass correlation coefficient, median OR, proportional change in variance and deviance.

Result The pooled prevalence of the triple burden of malnutrition among mother–child pairs was 11.39%. It showed statistically significant positive associations with mothers aged ≥35 years (AOR 2.25, 95% CI 2.08 to 2.44), family size >10 (AOR 1.17, 95% CI 1.08 to 1.26), delivery by caesarean section (AOR 1.93, 95% CI 1.83 to 2.03), the richest household (AOR 1.72, 95% CI 1.56 to 1.88), grand multiparous (AOR 1.62, 95% CI 1.46 to 1.81), age of child 36–47 months (AOR 1.77, 95% CI 1.64 to 1.90), at a p<0.05. Whereas breast feeding (AOR 0.94, 95% CI 0.89 to 0.99), married mothers (AOR 0.87, 95% CI 0.78 to 0.96), female children (AOR 0.88, 95% CI 0.84 to 0.92), improved toilet (AOR 0.23, 95% CI 0.17 to 0.29), improved source of drinking water (AOR 0.28, 95% CI 0.21 to 0.35), rural residents (AOR 0.66, 95% CI 0.62 to 0.69) had a contrasting relationship with the triple burden of malnutrition.

Conclusion About 1 out of 10 households suffer from the triple burden of malnutrition in low-income and middle-income countries. This study revealed that several maternal, child, household and community-level factors have a significant impact on the triple burden of malnutrition among mother–child pairs.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The findings were supported by large datasets covering 22 low-income and middle-income countries.
⇒ We employed multilevel analysis which is an appropriate methodology for such data.
⇒ The data were collected using a common internationally acceptable methodological procedure.
⇒ Demographic and Health Survey (DHS) used a cross-sectional survey design, and the causal relationship between the triple burden of malnutrition and the independent variables cannot be established.
⇒ We did not include important covariates such as dietary intake, physical activity level or comorbidities as the DHS did not collect information on these variables.

BACKGROUND

The triple burden of malnutrition, which is the coexistence of overnutrition, undernutrition and micronutrient deficiencies, is increasing in low-income and middle-income countries (LMICs).[1] The WHO characterised overnutrition (obesity and overweight) as a pandemic of a major public health concern due to the increased frequency of the problem in many countries.[2] It is ranked as the sixth-leading cause of disability-adjusted life-years and accounts for approximately 4 million people dying each year worldwide.[3–5] Several previous studies have shown that following marked dietary change, obesity/overweight is increasing more rapidly in LMICs compared with higher-income countries.[6 7]

Similarly, undernutrition continues to be a major public health concern throughout the developing world.[8 9] Nearly half of all deaths in children under 5 are attributable to undernutrition and it encompasses wasting, stunting, underweight and micronutrient deficiencies (anaemia).[10 11] Despite stunting having declined steadily, faster progress is

needed to reach the 2030 target.[12 13] Wasting and underweight persisting at alarming rates require a reversal in trajectory if the 2030 target is to be achieved.[14] Since 2000, a significant reduction in the prevalence of anaemia in children under 5 has been observed in many LMICs.[15] Children are more vulnerable to inadequate prenatal, infant and young child nutrition, particularly in resource-constrained settings.[16 17] Endorsing early childhood feeding best practices is crucial to improve the health of children.[18]

Malnutrition has a tremendous negative impact on the normal functioning of every organ system.[19] It can cause permanent, widespread damage to a child's growth, development and well-being.[20] Scientific evidence has shown that malnutrition in children is associated with poorer school performance, increased susceptibility to infections and slow recovery from illness.[21 22] Maternal malnutrition increases the risk of poor pregnancy outcomes including obstructed labour, premature or low birthweight babies and postpartum haemorrhage.[23 24] To reduce the problem the United Nations adopted the Sustainable Development Goals (SDGs), targeted to end poverty in all its forms everywhere (SDG 1), end hunger, achieve food security, improve nutrition, promote sustainable agriculture (SDG 2), ensure healthy lives and promote well-being for all at all ages (SDG 3).[25 26]

Previous literature recognised the basic and underlying causes of malnutrition including the environmental, economic and sociopolitical contextual factors, with poverty having a central role.[11 27–29] The triple burden of malnutrition among mother–child pairs is a relatively new issue and only a few country-based studies explored the problem which could not give a panoramic view of the problem in LMICs.[30–32] Given the persistent and high levels of the problem in these countries, there is a strong need for action. To design and deliver effective interventions adequate understanding of the socioeconomic, environmental and cultural factors is highly important. Besides if the SDG targets are to be met, coordinated action is required towards not only sustaining current rates of decline but also accelerating progress. Therefore, the objective of this study was to assess the prevalence of the triple burden of malnutrition among mothers and children and the potential factors associated with it in LMICs.

MATERIALS AND METHODS

Study design, setting and period

This study is based on 22 LMICs that have had Demographic and Health Surveys (DHS) from 2016 to 2020. The DHS used a cross-sectional survey study design to collect data and provide population and health indicators at the national level. The list of those countries and the respective year of surveys is provided in table 1.

Table 1 Study setting and year of surveys

Country	Year of survey	Region
Albania	2017/2018	Southeastern Europe
Benin	2017/2018	West Africa
Burundi	2016/2017	East-central Africa
Cameroon	2018	West-central Africa
Ethiopia	2016	East Africa
Gambia	2019/2020	West Africa
Guinea	2018	West Africa
Haiti	2016/2017	Caribbean
India	2019/2021	South Asia
Liberia	2019/2020	West Africa
Madagascar	2021	East Africa
Mali	2018	West Africa
Mauritania	2019/2021	Northwest Africa
Maldives	2016/2017	South Asia
Nigeria	2018	West Africa
Nepal	2016	South Asia
Rwanda	2019/2020	East Africa
Sierra Leone	2019	West Africa
Tajikistan	2017	Central Asia
Timor-Leste	2016	South Asia
Uganda	2016	East Africa
South Africa	2016	South Africa

Data source and sampling procedure

The current analysis was based on pooled data from DHSs in 22 LMICs. These are nationally representative surveys that collect data on reproductive, maternal, neonatal, child health and nutrition in LMIC. The surveys are similarly designed that used standardised questionnaires and data collection procedures, allowing therefore comparability of results. The survey employed a two-stage cluster sampling technique. In the first stage, the selection of proportional clusters/enumeration areas was performed using each country's most recent population and housing census as a sampling frame. In the second stage, a systematic selection of households from the newly created cluster was performed. A detailed description of the DHS sampling design and data collection procedures has been found in each country's DHS report. The study population for this study was mother–child pairs. Weighting was done using the complex sample design weighting and the 'svyset' Stata command was applied. Variables v005 (sampling weight), v021 (primary sampling unit) and v023 (stratification used in sample design) were used, and as the result, a total weighted sample of 116 795 mother–child pairs was included in the analysis.

DEFINITION OF VARIABLES

Outcome variable

The triple burden of malnutrition was the outcome variable of this study where the mother was overweight/obese and children under 5 years of age were undernourished

and anaemic.[30 31] At the same household level, first, we created four different categories of malnutrition such as overweight/obese mother and stunted child, overweight/obese mother and wasted child, overweight/obese mother and underweight child, and overweight/obese mother and anaemic child. Then we further combined overweight/obese mothers, undernourished children and anaemic children to generate the triple burden of malnutrition. Categorisation was made based on height-for-age z-score (HAZ), SDs, weight-for-height z-score (WHZ), weight-for-age z-score (WAZ), haemoglobin level and body mass index (BMI).

Stunting dichotomised and coded into 0=not stunted (HA −2SD and above) and 1=stunted (HAZ<−2 SD).

Wasting dichotomised and coded into 0=not wasted (WHZ −2 SD to +2 SD) and 1=wasted (WHZ<−2SD).

Underweight dichotomised and coded into 0=not underweight (WHZ −2 SD and above) and 1=underweight (WAZ<−2SD).

Child anaemia dichotomised and coded into 0=not anaemic (haemoglobin level>11 g/dL) and 1=anaemic (haemoglobin level<11 g/dL).

Mother's BMI dichotomised and coded into 0=normal (18.5–24.9 kg/m^2) and 1=overweight/obese (≥25 kg/m^2).

The triple burden of malnutrition was dichotomised and coded into 0=no (not overweight/obese mother and not undernourished child plus not anaemic child, and 1=yes (overweight/obese mother and undernourished child plus anaemic child).

An undernourished child is a child who is stunted or wasted or underweight.

Independent variables

Based on previous works of literature and the likelihood of influencing the outcome of interest, several explanatory variables including the age of mothers, mother's education, marital status, current breast feeding, delivery by caesarean section, family size, wealth index, media access, parity, age of the child, sex of the child, type of toilet facility, source of drinking water, residence and distance to health facility were considered.

STATISTICAL ANALYSES

We append the dataset of each country to generate pooled data. The data extraction, coding and analysis were carried out using STATA software V.14.2. We weighted the sample to restore the representativeness of the sample so that the total sample looks like the country's actual population. Due to the hierarchical nature of the DHS, the multilevel analysis was fitted to identify significantly associated factors. Four models were fitted; the null model (with no predictors), model I (adjusted for individual-level variables only), model II (adjusted for community-level variables only) and model III (model adjustment for both individual and community-level variables simultaneously). Adjusted OR (AOR) with 95% CI and p<0.05 was used to determine significant predictors. Model fitness and comparison were done using intraclass correlation coefficient (ICC), proportional change in variance, median OR (MOR), the likelihood ratio test and deviance computed.

Patient and public involvement statement

As our study used secondary analysis of DHS data, participants and the public were not involved in the study design or planning of the study. The study participants were not consulted to interpret the results and write or editing of this document for readability or accuracy.

RESULTS

Demographics and socioeconomic characteristics

A total of 116 795 mother–child pairs were included in the study. Over half (56.48%) of mothers were in the age category of 25–34 years. About 22.98% of mothers were illiterate and the majority (46.39%) had attended secondary education. Approximately 95.73% of mothers were married and 62.89% were currently breast feeding. About 20.33% and 21.21% of the households were in the low wealth quintile of poorest and poorer, respectively. Over a quarter (27.62%) of the families had never been exposed to any type of media. The majority of the children (32.59%) were aged ≤12 months. A large proportion (83.60%) of the households had improved sources of drinking water and almost two-thirds (67.02%) of the households had improved toilet facilities. Almost three-fourth (71.03%) of participants lived in rural areas and for over a quarter (27.42%) of those participants, the distance to access health facilities was a big problem (table 2).

Prevalence of triple burden of malnutrition

In 22 LMICs, the pooled prevalence of the triple burden of malnutrition among mother–child pairs was found at 11.39% (95% CI 9.56% to 13.23%). Ethiopia has the lowest (3.54%) prevalence of triple burden while Mauritania (31.66%) bears the highest (figure 1).

MULTILEVEL ANALYSES

Random parameter estimation and model selection

Based on the result of random effect analysis, the ICC of the null model was 0.30, indicating that 30% of the total variability in triple burden prevalence was attributable to between-cluster variability, while about 70% was due to individual differences. The null model MOR was 3.04, which indicates that a mother/child from a cluster with a high triple burden prevalence has a 3.04 times higher probability of being malnourished than a mother/child from a cluster with a lower prevalence. Model III was the best-fitted model since it has the highest log likelihood (−91 665) and the lowest deviance (183 330) value (table 3).

Table 2 Sociodemographic characteristics of the study participants

Variables	Categories	Unweighted frequency (%)	Weighted frequency (%)
Age of mothers	15–24	34 983 (29.05)	35 918 (30.75)
	25–34	68 386 (56.78)	65 971 (56.48)
	≥35	17 073 (14.18)	14 906 (12.76)
Mothers education	No education	27 995 (23.24)	26 845 (22.98)
	Primary education	19 684 (16.34)	18 633 (15.95)
	Secondary	57 008 (47.33)	54 185 (46.39)
	Higher	15 755 (13.08)	17 131 (14.67)
Mothers marital status	Not in union	5583 (4.64)	4987 (4.27)
	Married	114 859 (95.36)	111 807 (95.73)
Currently breast feeding	No	44 160 (36.66)	43 338 (37.11)
	Yes	76 282 (63.34)	73 457 (62.89)
Delivery by caesarean section	No	99 291 (82.49)	93 974 (80.51)
	Yes	21 077 (17.51)	22 748 (19.49)
Family size	≤5	56 365 (46.80)	53 677 (45.96)
	6–10	54 605 (45.34)	53 258 (45.60)
	>10	9472 (7.86)	9859 (8.44)
Wealth index	Poorest	28 097 (23.33)	23 749 (20.33)
	Poorer	27 352 (22.71)	24 774 (21.21)
	Middle	24 741 (20.54)	24 330 (20.83)
	Richer	22 180 (18.42)	23 880 (20.45)
	Richest	18 072 (15.00)	20 061 (17.18)
Media access	No	33 942 (28.18)	32 256 (27.62)
	Yes	86 500 (71.82)	84 539 (72.38)
Parity	Primiparous	36 241 (30.09)	35 333 (30.25)
	Multiparous	76 092 (63.18)	73 823 (63.21)
	Grand multiparous	8109 (6.73)	7639 (6.54)
Age of child	≤12	38 959 (32.35)	38 059 (32.59)
	13–23	25 382 (21.07)	24 819 (21.25)
	24–35	22 208 (18.44)	21 478 (18.39)
	36–47	17 948 (14.90)	17 204 (14.73)
	48–59	15 945 (13.24)	15 234 (13.04)
Sex of child	Male	63 660 (52.86)	62 008 (53.09)
	Female	56 782 (47.14)	54 787 (46.91)
Type of toilet facility	Unimproved	37 519 (31.15)	38 518 (32.98)
	Improved	82 923 (68.85)	78 277 (67.02)
Source of drinking water	Unimproved	20 959 (17.40)	19 159 (16.40)
	Improved	99 483 (82.60)	97 636 (83.60)
Residence	Urban	28 722 (23.85)	33 838 (28.97)
	Rural	91 720 (76.15)	82 957 (71.03)
Distance to a health facility	No problem	84 605 (70.25)	84 776 (72.58)
	Big problem	35 837 (29.75)	32 019 (27.42)

Factors associated with the triple burden of malnutrition (fixed effects)

The triple burden of malnutrition was statistically significant with mothers aged 25–34 years (AOR 1.54, 95% CI 1.45 to 1.63), ≥35 years (AOR 2.25, 95% CI 2.08 to 2.44), mothers attended secondary education (AOR 1.08, 95% CI 1.02 to 1.15), family size >10 (AOR 1.17, 95% CI 1.08 to 1.26), delivery by CS (AOR 1.93, 95% CI 1.83 to

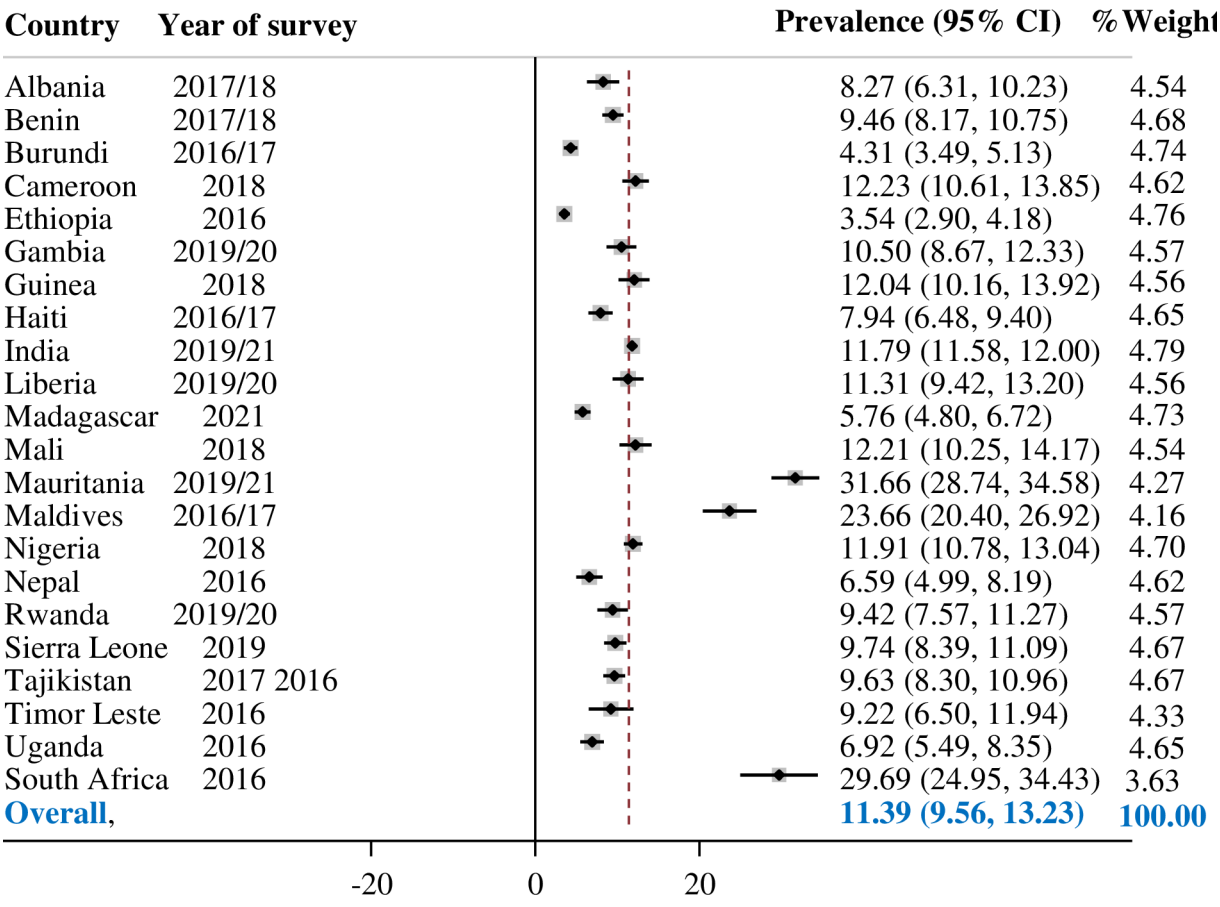

Figure 1 The pooled prevalence of the triple burden of malnutrition.

2.03), the richer household (AOR 1.63, 95% CI 1.49 to 1.76), the richest household (AOR 1.72, 95% CI 1.56 to 1.88), multiparous (AOR 1.42, 95% CI 1.34 to 1.49), grand multiparous (AOR 1.62, 95% CI 1.46 to 1.81), age of child 36–47 months (AOR 1.77, 95% CI 1.64 to 1.90), age of child 48–59 (AOR 1.51, 95% CI 1.39 to 1.64), breast feeding (AOR 0.94, 95% CI 0.89 to 0.99), married mothers (AOR 0.87, 95% CI 0.78 to 0.96), female children (AOR 0.88, 95% CI 0.84 to 0.92), improved toilet facility (AOR 0.23, 95% CI 0.17 to 0.29), improved source of drinking water (AOR 0.28, 95% CI 0.21 to 0.35), rural residents (AOR 0.66, 95% CI 0.62 to 0.69) at a $p<0.05$ (table 3).

DISCUSSION

LMICs are increasingly facing the triple burden of malnutrition where women and children are among the hardest hit by the problem.[33 34] This study assessed the triple burden of malnutrition (co-occurrence of undernutrition, overweight/obesity and anaemia among mother–child pairs) in the same household, using nationally representative data in LMICs. The result showed that the pooled prevalence of triple burden was 11.39% (95% CI 9.56% to 13.23%); Ethiopia had the lowest (3.54 %) prevalence while Mauritania (31.66%) had the highest. The variation among countries could be attributed to differences in socioeconomic status, food environment, physical activity, genetic factors, healthcare system strength, national policy and political commitments.

The study revealed that several maternal, child, household and community-level factors have a significant impact on the triple burden of malnutrition among mother–child pairs. It has found a parallel correlation between the triple burden of malnutrition and maternal age. The odds of being malnourished increase as the age of the mother increases. This is in agreement with previous studies where older mothers bear the highest risk compared with younger ones.[31 35] The possible explanation could be because of reduced physical activity, less energy requirement and hormonal changes among older mothers. Similarly, mothers who have attended secondary education were more likely to be malnourished.[31] A plausible explanation for this could be the shifts from manual labour to more sedentary occupations and the related decline in physical activity.

Being married reduced the risk of the triple burden of malnutrition. Partners together could generate more money, reduce food insecurity and tend to take better care of themselves and their children. It has been reported that children in single-parent households suffered from undernutrition significantly more than children brought up by both parents.[36 37] Likewise, this study revealed breast feeding reduced the triple burden of malnutrition. Breast feeding plays a vital role in the prevention of different

Table 3 Multivariable multilevel logistic regression analysis of the triple burden of malnutrition

Variables	Categories	Null model	Model I AOR 95% CI	Model II AOR 95% CI	Model III AOR 95% CI
Age of mothers	15–24		1.00		1.00
	25–34		1.54 (1.46 to 1.63)†	—	1.54 (1.45 to 1.63)†
	≥35		2.28 (2.11 to 2.47)†	—	2.25 (2.08 to 2.44)†
Mothers education	No education		1.00		1.00
	Primary education		1.04 (0.97 to 1.12)	—	1.04 (0.97 to 1.12)
	Secondary		1.08 (1.01 to 1.15)*	—	1.08 (1.02 top 1.15)*
	Higher		0.94 (0.86 to 1.02)	—	0.94 (0.86 to 1.02)
Mothers marital status	Not in union		1.00		1.00
	Married		0.83 (0.75 to 0.93)*	—	0.87 (0.78 to 0.96)†
Currently breastfeeding	No		1.00		1.00
	Yes		0.92 (0.87 to 0.97)*	—	0.94 (0.89 to 0.99)*
Delivery by CS	No		1.00		1.00
	Yes		1.94 (1.84 to 2.04)†	—	1.93 (1.83 to 2.03)†
Family size	≤5		1.00		1.00
	6–10		1.00 (0.97 to 1.08)	—	1.01 (0.98 to 1.08)
	>10		1.14 (1.06 to 1.24)†	—	1.17 (1.08 to 1.26)†
Wealth index	Poorest		1.00		1.00
	Poorer		1.41 (1.31 to 1.52)†	—	1.38 (1.28 to 1.49)†
	Middle		1.60 (1.48 to 1.73)†	—	1.49 (1.38 to 1.62)†
	Richer		1.86 (1.72 to 2.02)†	—	1.63 (1.49 to 1.76)†
	Richest		2.15 (1.97 to 2.35)†	—	1.72 (1.56 to 1.88)†
Media access	No		1.00		1.00
	Yes		1.01 (0.98 to 1.08)	—	1.02 (0.99 to 1.11)
Parity	Primiparous		1.00		1.00
	Multiparous		1.42 (1.34 to 1.50)†	—	1.42 (1.34 to 1.49)†
	Grand multiparous		1.61 (1.44 to 1.79)†	—	1.62 (1.46 to 1.81)†
Age of child	≤12		1.00		1.00
	13–23		1.41 (1.32 to 1.50)†	—	1.41 (1.32 to 1.50)†
	24–35		1.62 (1.52 to 1.73)†	—	1.63 (1.53 to 1.74)†
	36–47		1.75 (1.62 to 1.89)†	—	1.77 (1.64 to 1.90)†
	48–59		1.50 (1.38 to 1.62)†	—	1.51 (1.39 to 1.64)†
Sex of child	Male		1.00		1.00
	Female		0.88 (0.84 to 0.92)†	—	0.88 (0.84 to 0.92)†
Type of toilet facility	Unimproved		1.00		1.00
	Improved		0.24 (0.18 to 1.31)	—	0.23 (0.17 to 0.29)†
Source of drinking water	Unimproved		1.00		1.00
	Improved		0.21 (0.16 to 0.28)	—	0.28 (0.21 to 0.35)†
Community-level variables					
Residence	Urban			1.00	1.00
	Rural		—	0.49 (0.46 to 0.52)†	0.66 (0.62 to 0.69)†
Distance to a health facility	No problem			1.00	1.00
	Big problem		—	0.87 (0.82 to 0.91)†	0.94 (0.89 to 0.98)†
Random effect					

Continued

Table 3 Continued

Variables	Categories	Null model	Model I AOR 95% CI	Model II AOR 95% CI	Model III AOR 95% CI
	Variance	1.40	1.24	1.31	1.23
	ICC	0.30	0.27	0.28	0.27
	MOR	3.04	2.88	2.96	2.85
	PCV	Reff	11.42	6.43	12.14
Model comparison					
	Log likelihood ratio	−100 585	−92 108	−97 815	−91 665
	Deviance	201 170	184 216	195 630	183 330

*p<0.05.
†p<0.01.
AOR, adjusted OR; CS, caesarean section; ICC, intraclass correlation coefficient; MOR, median OR; PCV, proportional change in variance.

forms of childhood malnutrition.[38] However, delivery by caesarean section (C-section) delays the timely initiation of breastfeeding and prelacteal feeding.[39] Previous studies have reported that C-section increases maternal obesity and negatively affects the breast feeding of children, which results in malnutrition.[40 41] Moreover, malnutrition in children is related to gut microbiota alteration and C-section contributes to microbial alterations in the small intestine.[42]

Our study revealed a parallel relationship between the household wealth quintiles and the triple burden of malnutrition. As household income increases, the odds of malnutrition increase.[30 43] High income could increase the purchasing power for food, influencing the type of foods consumed and the intake of prepared or processed food.[33] Economic growth and the food industry's rapid penetration into the market have resulted to depend on energy-dense and nutrient-poor foods.[44] In recent years, the dietary preference in LMICs has changed as the food environment is dominated by media advertising, and relatively cheap, energy-dense foods.[45]

The odds of the triple burden of malnutrition were higher in a household with a family size >10. A plausible explanation is that in a household with a large family, providing optimum nutritious food to all the family members and children could be difficult.[46 47] Moreover giving proper care and time to children and the family could be unlikely and this could lead to malnutrition. Likewise, parity was found to be a determinant of the triple burden of malnutrition. Higher parity increased the odds of malnutrition. The possible explanation could be that women could gain weight during pregnancy, and weight loss might not occur in the post-partum period which could lead to child malnutrition.[48]

This study revealed that child age and sex were significant factors for malnutrition. Older under 5 children were more likely to be malnourished compared with younger ones.[49] A previous study[50] revealed that there was an increased frequency of parasite infection in older children leading to a higher prevalence of malnutrition compared with the younger ones. In addition, gender was found a significant determinant of malnutrition where a female child was less likely to be malnourished.[51] The cause of the gender gap in malnutrition is unknown, however, some studies argued that male children are known to be more vulnerable than females to diseases including lower respiratory infections, diarrhoeal diseases, malaria and preterm birth. Those diseases have been reported as factors for undernutrition among young male children.[52 53] Others also claimed that boys are more vulnerable to environmental problems while playing, such as exposure to toxins and air pollution than girls.[54]

Being rural residents was associated with lower odds of the triple burden of malnutrition. The urban–rural difference could be attributable to factors including access to different food types, overcrowding, concurrent disease and sedentary lifestyles. Previous studies depicted that urbanisation affects the way of life, access to processed and junk foods could exacerbate malnutrition among women and children.[30 55]

Our study has some strengths and limitations. It used large nationally representative samples with appropriate statistical modelling. The use of large nationally representative data and multilevel analysis helps to provide more robust estimates of observed associations as well as enhance the generalisability of the results. Despite the strengths, this study used cross-sectional data, which did not indicate a temporal relationship between the factors and triple burden. No important covariates, such as dietary intake, physical activity level, comorbidities and nutrition status during pregnancy, were incorporated into the study as the DHS did not provide a complete record of these variables.

CONCLUSIONS AND RECOMMENDATIONS

About 1 out of 10 households suffer from the triple burden of malnutrition in LMICs. This study revealed that several maternal, child, household and community-level factors have a significant impact on the triple

burden of malnutrition among mother–child pairs. The triple burden requires the governments, the scientific and medical communities and the industry's efforts in changing dietary and lifestyle habits to address all forms of malnutrition and should focus on women's nutrition to break the intergenerational triple burden of malnutrition.

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