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Maternal experiences of multiple forms of intimate partner violence and associations with undernutrition among children under 5: evidence from 36 low- and middle-income countries based on demographic and health surveys

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ABSTRACT

Background Intimate partner violence (IPV) is a global issue and has various negative impacts on women and their children's physical and psychological health. Although the co-occurrence of multiple forms of IPV (ie, physical, psychological and sexual IPV) against women is prevailing, its negative effects on their children's nutrition remain neglected. This study aimed to explore such effects among children under 5.

Methods We used a sample of 104 740 mother–child pairs from 36 low- and middle-income countries based on the Demographic and Health Surveys between 2005 and 2022. Pooled and income level-specific survey logistic regressions were performed to assess the associations between maternal experience of any form of IPV, multiple forms of any IPV, co-occurrence of different forms of IPV and number of IPV forms within the past 12 months, with child undernutrition.

Findings Maternal exposure to multiple forms of IPV was significantly associated with an increased risk of child wasting (OR: 1·2, 95% CI: 1·0 to 1·4) and underweight (OR: 1·2, 95% CI: 1·1 to 1·4), while no significant association was found for stunting. Significant dose-response effects of the number of IPV forms were found for child wasting ($p<0·05$) and underweight ($p<0·05$). The co-occurrence of psychological and sexual IPV showed the most significant impact on child wasting (OR: 1·4, 95% CI: 1·2 to 1·8) across subtypes of co-occurrence. Most significant results were detected in lower- and middle-income countries. Children whose mothers were shorter than average, underweight, lived in rural areas and poorer families were more vulnerable to undernutrition.

Interpretation This study highlighted the negative effect of multiple forms of maternal IPV on child wasting and underweight with a focus on the number of IPV experienced. Our findings called for enhanced policy-based efforts to end gender-based violence to protect the health and rights of both women and children.

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WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Intimate partner violence (IPV) is a global issue and has negative impacts on women and their children's nutrition.

WHAT THIS STUDY ADDS

⇒ Filling the research gap on multiple forms of IPV, we found that maternal experience of multiple forms of IPV was significantly associated with higher risks of child wasting and underweight, as well as a significant dose-response association between the number of maternal IPV forms for child wasting and underweight.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study calls for more evidence-based policies and interventions to end gender-based violence to protect the health and rights of women and their children.

INTRODUCTION

Intimate partner violence (IPV), defined as physical, sexual and psychological harm caused by an intimate partner or ex-partner, remains a pervasive global health issue.[1] The latest data from the WHO reported that over a quarter (27%) of women still experience physical and/or sexual violence from an intimate partner.[1] In addition, women from low- and middle-income countries (LMICs) are found to be particularly vulnerable to IPV.[2] A recent study in the *Lancet* reported that 37% of women aged 15 to 49 years had experienced at least one form of IPV within the past 12 months, and the prevalence of psychological IPV has risen by 2·3% per year across eight countries.[2]

IPV, especially maternal IPV, has well-documented negative effects on child health, including malnutrition.[3] Evidence from Rwanda, India and Tanzania demonstrates that IPV significantly increases the risk of child stunting,[4 5] underweight and wasting.[6] These associations are grounded in established theoretical pathways linking IPV to maternal mental and physical health impairments and risk behaviours, which subsequently affect child nutrition.[3 7] IPV experience was found to be associated with maternal mental health,[8 9] poor nutrition[10 11] and substance use.[8 12] These maternal health challenges can disrupt prenatal development, increasing the risk of preterm births and low-birth-weight infants,[13] who are more prone to undernutrition during infancy and childhood.[14] Postnatally, such impairments might also induce child maltreatment[15] and inadequate childcare,[16] leading to child nutrition problems.

Most studies only examined the influence of a single form of IPV on child nutrition,[4 5 17] neglecting the high co-occurrence of different forms of IPV and its potential negative effects.[18–20] Co-occurrence of multiple forms of violence was prevalent among women.[18] For example, the co-occurrence of physical, sexual and psychological IPV was 23% among Irish university students,[18] and the co-occurrence of physical and psychological IPV also remained high.[20 21] Moreover, experiencing multiple forms of IPV was demonstrated to be more harmful to women's psychological health and lead to more trauma symptoms.[21 22] Women exposed to two or three types of IPV were nearly twice as likely to have depression and over 40% more likely to have suicidal ideation compared with those experiencing a single form, which may increase risks of child malnutrition through maternal health impacts.[22] Furthermore, the mechanisms through which physical, sexual and psychological IPV affect child undernutrition suggest that different combinations may exert cumulative and distinct effects. These findings underscore the need to examine how co-occurring IPV forms and the number of IPV forms experienced within the past year relate to child undernutrition.

In addition, socio-demographic characteristics at different levels could also act as potential precision variables in the association between maternal IPV and child undernutrition. For instance, child's age, child's gender, maternal age and maternal nutritional status height were found to be related to child's nutritional status.[23–25] Meanwhile, maternal age was negatively associated with IPV experience.[23] In terms of household characteristics, children from richer families and urban areas were more vulnerable to stunting when their mothers experienced IPV.[17]

Therefore, this study used the latest data from the Demographic and Health Survey (DHS) from 36 LMICs to estimate the association between multiple forms of maternal IPV, the number of forms of maternal IPV and child stunting, wasting and underweight by pooled analysis and analysis across low-, lower-middle- and upper-middle-income countries. We further explored this association in different subgroups divided by socio-demographic factors including child's age, child's sex, maternal age, type of residence and household wealth level, with the adjustment of maternal height and body mass index (BMI) to figure out factors that amplify the potential consequences of multiple forms of maternal IPV on child undernutrition.

METHODS

Data source and study participants

This study used the publicly available data from the DHS between 2005 and 2022. The DHS programme has been conducting comprehensive surveys that are cross-sectional and nationally representative, aimed at collecting a wide array of information including demographic, socio-economic and health-related data of women and their children through a stratified and multistage procedure. The programme uses a two-stage cluster sampling technique. First, each participating country is segmented into various geographic zones, which are further stratified by urban and rural areas. Clusters within each stratum are then selected independently, with the selection probability aligned with the cluster's relative population size. Subsequently, within each chosen cluster, households are exhaustively listed, from which a predetermined number of households are systematically selected with equal probability.[26] We selected countries with available data on the domestic violence module, which was frequently administered in a sub-sample of households where no interviews with men were conducted. Within each selected household, only one woman was eligible to be interviewed about domestic violence.

The eligibility criteria for mothers and their children in our study were as follows: (1) lived children aged 0–59 months, (2) valid measures of weight and height for the child (height between 65 and 120 cm), (3) ever-in-union women aged 15–49 years and (4) women who agreed to participate in the domestic violence module. A total of 133 375 mother–child pairs were included as the original sample. We further excluded records with currently pregnant mothers (n=11 410) and children who were not singleton (n=3334). Another 13 888 records of children whose heights were shorter than 65 cm or taller than 120 cm were excluded based on WHO's recommendation for wasting calculation.[27] Three women were excluded due to missing values of particular types of IPV within the last 12 months. We then confined our study to a sample of 104 740 mother–child pairs from 36 countries (online supplemental appendix table 1). The flowchart of sample inclusion and exclusion is presented in online supplemental appendix figure 1.

Written informed consent was obtained from all subjects conducted by the DHS team. The data used in the study consisted of a publicly available de-identified dataset, which was retrieved from the DHS website with permission.

Patient and public involvement

Patients or the public were not involved in this research.

Exposure

The primary exposure of our study is multiple forms of maternal IPV within the past 12 months, defined as the co-occurrence of two or three forms of IPV against mothers from their intimate partner. IPV has been categorised into three types based on WHO's definition,[1] including physical IPV, psychological IPV and sexual IPV, all included in the DHS domestic violence module. Details on the domestic violence data collection procedures are described elsewhere.[28] In the module, physical IPV is measured by seven questions asking women if they have ever (1) been pushed, shaken or had something thrown at them; (2) been slapped; (3) been punched with a fist or hit by something harmful; (4) been kicked or dragged; (5) been strangled or burnt; (6) been threatened with knife, gun or other weapons; and (7) had arm twisted or hair pulled, by their husband or partner within the past 12 months before the survey. Psychological IPV is defined by three questions asking women if their husbands had ever (1) humiliated her, (2) threatened her with harm and (3) insulted her or made her feel bad within the past 12 months before the survey. Sexual IPV is measured by asking women if they had ever been (1) physically forced into unwanted sex, (2) forced into any other unwanted sexual acts and (3) physically forced to perform sexual acts they didn't want to do, by husbands or partners within the past 12 months before the survey.[29]

We also defined four subtypes of multiple forms of maternal IPV, including the co-occurrence of physical and sexual IPV, co-occurrence of physical and psychological IPV, co-occurrence of sexual and psychological IPV and co-occurrence of all three forms of IPV. In addition, ever experiencing any form of IPV within the past 12 months and the number of IPV forms (0–3) experienced within the past 12 months were included in this study as well. Details of the seven exposures are presented in online supplemental appendix table 2.

Outcome

The main outcome of our study was child undernutrition, including stunting, wasting and underweight. Stunting was defined as height-for-age z score below <-2 SD, wasting was defined as weight-for-height z score below −2 SD and underweight was defined as weight-for-age z score below −2 SD. All three outcomes were constructed based on the 2006 WHO child growth standards, which were developed based on a multi-country study that collected data from diverse under-5 children across the globe, ensuring they reflect optimal growth conditions.[30]

Covariates

Based on previous studies,[25 31] we included the following demographic and socioeconomic variables as our covariates: child's age (0–11, 12–23, 24–47, 48–59 months), child sex (male, female), maternal age (15–19, 20–34, 35–49 years), maternal height (0–144·9, 145–149·9, 150–154·9, 155–159·9, ≥160 cm), maternal body mass index (BMI) (<18·5, 18·5–24·9, ≥25), type of residence (urban, rural) and household wealth level (low, high).

Statistical analysis

We assessed the association of ever experiencing maternal IPV, multiple forms of maternal IPV and subtypes, and the number of IPV forms with child undernutrition by pooling data from all selected countries. We included sampling weight, clustering and strata variables from the DHS.[26] The national sampling weight was from the original sampling weights of each country provided by the DHS; the overall and subgroups' weights were calculated using sampling weights rescaled by the population size of each country in the survey year to ensure that the estimates were representative. We clustered the sample by primary sampling units to accommodate error term interdependence within clusters and households. We accounted for intra-cluster correlation by clustering the mothers' identification variables. We first estimated the proportion of all covariates among mother–child pairs with 95% CIs among all participants and three subgroups, namely, mothers who ever experienced any type of IPV within the past 12 months before the survey, experienced multiple types of IPV within the past 12 months before the survey and with no experience of IPV within the past 12 months before the survey.

For the main analysis, we developed two sets of logistic regression to assess the associations between each of the seven exposures and each of the three outcomes. We used country income groups specific to the survey year based on World Bank classification for income-level analyses. First, crude logistic regression models were performed to assess the associations at pooled and income-specific levels. Second, adjusted logistic regressions were performed controlling all the seven covariates to estimate the association at pooled and income-specific levels. The *Cochran–Armitage* test for trend was conducted to estimate the dose-response association between the number of maternal IPV forms and child undernutrition as post-estimation for crude and adjusted regression models. The ORs, 95% CIs and p value for trends were calculated for each regression model.

Finally, we performed stratified analysis by child's age and sex, maternal age, type of residence and household wealth level to figure out the factors that amplify the association between multiple forms of maternal IPV, the number of forms of maternal IPV and child undernutrition. The 'svy' command was used in all analyses to account for the sample design of the surveys. Statistical significance was set at p<0·05. We dropped the samples with missing values of covariates. Only maternal BMI and height had missing values, and the percentages were less than 0·5%. All the statistical analysis was conducted in Stata 18.

RESULTS

A total of 104 740 mother–child pairs from 36 countries were included in our final analysis. Table 1 shows the characteristics of the weighted sample and the prevalence of IPV experience in demographic subgroups. All included children comprised 52·5% males and 47·5% females. The overall prevalence among children was 32·2% for stunting (95% CI: 31·0 to 33·2), 21·0% for wasting (95% CI: 20·2 to 22·0) and 28·9% for underweight (95% CI: 27·8 to 29·9). 30·0% of women reported that they have experienced at least one form of IPV in the past 12 months and 14·2% experienced multiple forms of maternal IPV. 73·2% of the mother–child pairs lived in rural areas, and 32·3% of them were from high household wealth level. The prevalence of experiencing any or multiple types of IPV was higher among women in rural areas or from low-wealth level households.

Figure 1 shows the Associations between maternal experience of any form of IPV, multiple forms of IPV and subtypes and the number of IPV forms, and child undernutrition in fully adjusted models. Overall, maternal exposure to any form of IPV increased the odds of child underweight by 13·3% (95% CI: 1·0 to 1·3), while multiple forms of maternal IPV significantly increased the odds of child underweight by 21·4% (95% CI: 1·1 to 1·4). Co-occurrence of physical and sexual IPV and physical and psychological IPV were significantly associated with a higher risk of child underweight by 21·5% (95% CI: 1·0–1·5) and 19·6% (95% CI: 1·0 to 1·4), respectively. Compared with mother–child pairs with no IPV experience, the experience of three forms of IPV (OR: 1·3, 95% CI: 1·0 to 1·6) and of two forms of IPV (OR: 1·2, 95% CI: 1·0 to 1·4) both significantly increased the risk of child underweight, while no significant impact was found for experiencing one form of IPV. There was a significant trend in the number of maternal IPV for underweight, as maternal experience of more forms of IPV significantly increased the risk of child underweight ($p<0·05$). As for wasting, multiple forms of maternal IPV increased the odds of child wasting by 19·0% (95% CI: 1·0 to 1·4). Co-occurrence of psychological and sexual IPV also showed a significant impact on child wasting (OR: 1·4, 95% CI: 1·2 to 1·8), while no significant associations were found for the other two subtypes. Compared with mother–child pairs with no IPV experience, maternal experience of three forms of IPV (OR: 1·3, 95% CI: 1·0 to 1·6) significantly increased the possibility of child wasting, while no significant association was found for one or two forms of IPV experience. A significant trend was also found in the number of maternal IPV forms for wasting ($p<0·05$). For stunting, no associations were found between any or multiple forms of IPV or co-occurrence of any two or three forms of IPV and child stunting. In contrast, the crude analysis found significant associations between multiple forms of maternal IPV and child stunting (OR: 1·2, 95% CI: 1·1 to 1·4), wasting (OR: 1·2, 95% CI: 1·0 to 1·4), and underweight (OR: 1·3, 95% CI: 1·2 to 1·5). The results of crude models remain consistent with the adjusted ones (online supplemental appendix figure 2).

Figure 2 presents the Associations between multiple forms of maternal IPV and subtypes, any form of maternal IPV and number of maternal IPV forms with child undernutrition across income levels in fully adjusted models. No significant associations were found between maternal IPV and child underweight in low-income countries (LICs) and upper-middle-income countries (UMICs). However, in lower-middle-income countries (LMICs), significant associations were observed, with co-occurrence of physical and sexual IPV, physical and psychological IPV and sexual and psychological IPV significantly increasing the possibility of child underweight. More forms of maternal IPV significantly predicted increased risks of child underweight in LMICs ($p<0·05$). For child wasting in LMICs, the co-occurrence of psychological and sexual IPV was the only significant associated factor across subtypes, increasing the odds by 47·9% (95% CI: 1·2 to 1·8). No significant associations were found between maternal IPV and child wasting in LICs and UMICs, except that experiencing one type of IPV increased the odds of wasting by 70·6% (95% CI: 1.1 to 2.6) in UMICs. Regarding the number of maternal IPV, only in LMICs was there a significant trend in the number of IPV for wasting ($p<0·05$). In comparison, multiple forms of maternal IPV were found to increase the odds of child stunting by 31·0% (95% CI: 1·2 to 1·5) in LICs, along with a significant trend in the number of IPV experienced ($p<0·05$). Significant crude associations between multiple forms of maternal IPV and child stunting were found in LICs and LMICs, while such associations between multiple forms of maternal IPV and child wasting and underweight were only found in LMICs (online supplemental appendix figure 3).

Figure 3 shows the Associations between multiple forms of maternal IPV and child undernutrition stratified by child's age, child's sex, maternal age, maternal height, maternal body mass index, type of residence and household wealth level. We found that when the mother suffered from multiple forms of IPV, children aged 36–47 months (OR: 1·5, 95% CI: 1·1 to 2·0), male children (OR: 1·3, 95% CI: 1·0 to 1·5), those living in low-wealth households (OR: 1·2, 95% CI: 1·1 to 1·4) and children from rural areas (OR: 1·2, 95% CI: 1·0 to 1.4), were more likely to be underweight. Additionally, children whose mothers were aged 20–34 years (OR: 1·2, 95% CI: 1·1 to 1·5), were 150–155 cm tall (OR: 1·3, 95% CI: 1·0 to 1·8) and were underweight themselves (OR: 1·5, 95% CI: 1·1 to 2·0) were also more likely to be underweight when their mother experienced multiple forms of IPV. Significant associations were also observed between child wasting and multiple forms of maternal IPV in similar subgroups. Notably, children aged 36–47 months (OR: 1·8, 95% CI: 1·3 to 2·5), male children (OR: 1·3, 95% CI: 1·1 to 1·6) and children of mothers aged 20–34 years (OR: 1·2, 95% CI: 1·0 to 1·4), shorter than 145 cm (OR: 1·5, 95% CI: 1·0 to 2·3) or were 150–155 cm tall (OR: 1·4, 95% CI: 1·0 to 1·8), and of normal weight (OR: 1·5, 95% CI: 1·0 to

Table 1 Weighted prevalence of any, multiple and no intimate partner violence experience within the past 12 months among ever-in-union women and their children under 5, based on the most recent Demographic and Health Survey across 36 lower-middle-income countries

	Prevalence (95% CI)			
Characteristics	**Total mother–child pair observed ***	**Ever experienced IPV within 12 months †**	**Experienced two or more IPV types within 12 months †**	**Never experienced IPV within 12 months †**
Total sample for pooled analysis across 36 countries, no. (%)	104 740 (100)	38 943 (30.0)	17 592 (14.2)	65 797 (70.0)
Children's characteristics				
Age in months				
0–11	11.7 (10.9, 12.5)	26.2 (23.5, 29.0)	12.3 (10.4, 14.5)	73.9 (71.0, 76.6)
12–23	21.5 (20.5, 22.5)	29.5 (26.9, 32.3)	13.3 (11.7, 15.1)	70.5 (67.7, 73.1)
24–35	21.5 (20.6, 22.4)	29.3 (27.3, 31.5)	13.7 (12.2, 15.3)	70.7 (68.5, 72.8)
36–47	22.7 (21.7, 23.7)	32.0 (29.5, 34.7)	15.6 (14.0, 17.3)	68.0 (65.3, 70.5)
48–59	22.7 (21.8, 23.7)	31.1 (29.1, 33.2)	15.2 (13.6, 16.9)	68.9 (66.8, 70.9)
Sex				
Male	52.5 (51.3, 53.7)	30.3 (28.9, 31.9)	14.7 (13.7, 15.8)	70.0 (68.1, 71.2)
Female	47.5 (46.3, 48.7)	29.7 (28.1, 31.3)	13.7 (12.7, 14.8)	70.4 (68.7, 71.9)
Nutritional status				
Stunting	32.2 (31.1, 33.3)	32.9 (31.2, 34.7)	15.7 (14.4, 17.1)	67.1 (65.3, 68.8)
Wasting	21.0 (20.1, 22.0)	30.4 (28.3, 32.7)	16.1 (14.3, 18.1)	69.6 (67.3, 71.7)
Underweight	28.9 (27.9, 30.0)	33.2 (31.3, 35.2)	16.8 (15.3, 18.4)	66.8 (64.8, 68.7)
Women's characteristics				
Maternal age in years				
15–19	2.3 (1.9, 2.9)	22.1 (15.6, 30.4)	7.2 (4.3, 11.7)	77.9 (69.6, 84.4)
20–34	86.2 (85.4, 87.0)	30.1 (28.9, 31.3)	14.4 (13.6, 15.3)	69.9 (68.7, 71.1)
35–49	11.5 (10.8, 12.1)	31.1 (28.6, 33.7)	14.2 (12.3, 16.3)	68.9 (66.3, 71.4)
Maternal height, cm				
<145	11.3 (10.4, 12.2)	28.3 (25.3, 31.5)	14.0 (12.0, 16.3)	71.7 (68.5, 74.7)
145–149.9	23.2 (22.3, 24.2)	32.6 (30.5, 34.8)	16.0 (14.4, 17.8)	67.4 (65.2, 69.5)
150–154.9	32.7 (31.6, 33.8)	30.0 (28.2, 32.0)	14.6 (13.2, 16.1)	70.0 (68.1, 71.8)
155–159.9	20.8 (20.0, 21.7)	26.3 (24.5, 28.2)	12.6 (11.3, 14.1)	73.7 (71.8, 75.5)
≥160	11.8 (11.0, 12.6)	33.6 (29.2, 38.3)	13.0 (11.0, 15.2)	66.4 (61.7, 70.8)
Missing	0.3 (0.2, 0.4)	–	–	–
Maternal BMI				
<18.5	19.8 (18.9, 20.7)	31.3 (29.0, 33.7)	14.8 (13.2, 16.6)	68.7 (66.3, 71.0)
18.5–24.9	58.6 (57.4, 59.7)	31.4 (30.0, 33.0)	14.7 (13.8, 15.8)	68.6 (67.0, 70.1)
≥25	21.3 (20.3, 22.2)	25.1 (23.1, 27.1)	12.3 (10.8, 13.9)	75.0 (72.9, 76.9)
Missing	0.4 (0.3, 0.5)	–	–	–
Household's characteristic				
Type of residence				
Urban	26.9 (25.7, 28.1)	26.7 (24.1, 29.6)	11.3 (10.0, 12.9)	73.3 (70.4, 75.9)
Rural	73.2 (71.9, 74.3)	31.2 (30.1, 32.4)	15.3 (14.4, 16.2)	68.8 (67.7, 70.0)
Household wealth level				
Low	67.7 (66.5, 68.8)	33.9 (32.6, 35.3)	16.5 (15.5, 17.5)	66.1 (64.7, 67.5)

Continued

Table 1 Continued

Characteristics	Prevalence (95% CI) Total mother–child pair observed *	Ever experienced IPV within 12 months †	Experienced two or more IPV types within 12 months †	Never experienced IPV within 12 months †
High	32.3 (31.2, 33.5)	21.8 (20.2, 23.5)	9.5 (8.4, 10.8)	78.2 (76.5, 79.8)

All IPV refers to IPV experiences within the past 12 months.
*Proportion of the total sample.
†Prevalence of mothers who ever experienced IPV, experienced two or more types of IPV, never experienced IPV within the past 12 months, among mother–child subgroups divided by key socio-demographic variables.
BMI, body mass index; IPV, intimate partner violence.

1·5) showed increased risks of wasting. Although children in urban areas and from richer families appeared to face higher risks of wasting from multiple forms of maternal IPV compared with those in rural settings and from poor or middle-income families, the stratification results were not significant. Unadjusted analysis showed similar results (online supplemental appendix figure 4). In addition, adjusted stratification analysis on the association between the number of forms of maternal IPV and child undernutrition also presented similar vulnerable groups (online supplemental appendix figure 5)

DISCUSSION

Our study explored the association between multiple forms of maternal IPV, the number of forms of maternal IPV and child undernutrition in LMICs and had three salient findings. First, we found that multiple forms of maternal IPV were associated with a higher risk of child wasting and underweight. Second, we revealed a significant dose-response association between the number of maternal IPV for child wasting and underweight, indicating cumulative effects of experiencing more forms of IPV on the increased risks of child undernutrition. Third, we identified key socio-demographic factors that influenced the association between multiple forms of maternal IPV and child undernutrition.

Overall, we found significant positive associations between multiple forms of maternal IPV and child wasting and underweight. A possible explanation is that multiple forms of IPV had profound effects on mothers' mental and physical health, which in turn impacts their children's health.[3 7] For example, women who experience IPV are more likely to have low-birth-weight newborns, who are at a higher risk of remaining underweight and developing wasting during childhood.[32] In addition, IPV was also considered to impair a mother's ability to provide adequate care for her children, such as ensuring full vaccination, further contributing to undernutrition.[33 34]

We noticed a significant dose-response association between the number of maternal IPV forms for child wasting and underweight, which means that if a mother experienced more forms of IPV, her children would have higher risks of wasting and underweight. This finding aligns with previous studies that found a cumulative negative effect of experiencing more than one type of IPV on women's psychological well-being, highlighting the importance of investigating co-occurrence of various types of IPV against women.[22] The underlying mechanism for the cumulative effect could be explained from two aspects. First, since the three forms of IPV share similar general effects on maternal mental health, physical health and risk behaviours,[3 7] experiences of multiple forms of IPV might cause cumulative detriments in these areas, leading to increased risks of child undernutrition. Second, different forms of IPV were also found to cause different types of health problems. As a result, experiencing more forms of IPV might lead to a broader range of health risks, thereby increasing the possibility of child undernutrition. For instance, experience of sexual IPV could result in maternal sexual health issues such as chronic pelvic pain, genital irritation, fibroids, sexually transmitted diseases and pregnancy complications,[35 36] increasing the risk of child anthropometric failures.[37]

We identified women's anthropometric status, household residence and wealth level as factors that influenced the associations between multiple forms of maternal IPV and child undernutrition. Specifically, underweight mothers who experienced multiple forms of IPV were more likely to have an undernourished child compared with their normal-weight counterparts. This may be because underweight mothers are at a higher risk of adverse birth outcomes, which could subsequently lead to poorer nutritional status in their children.[38] Moreover, the negative impact of maternal IPV on child underweight was more pronounced in rural areas and lower-income families. Evidence suggests that women from rural areas and poorer households are more vulnerable to IPV and often have limited decision-making power and reduced empowerment.[39] This lack of empowerment may constrain mothers' ability to make optimal food choices and provide adequate care for their children, thereby increasing the risk of child undernutrition.

There were several limitations in our study. First, we used the cross-sectional data based on the DHS dataset, so the causal relationships were not able to be inferred. Second, the sample of this study mainly covered countries

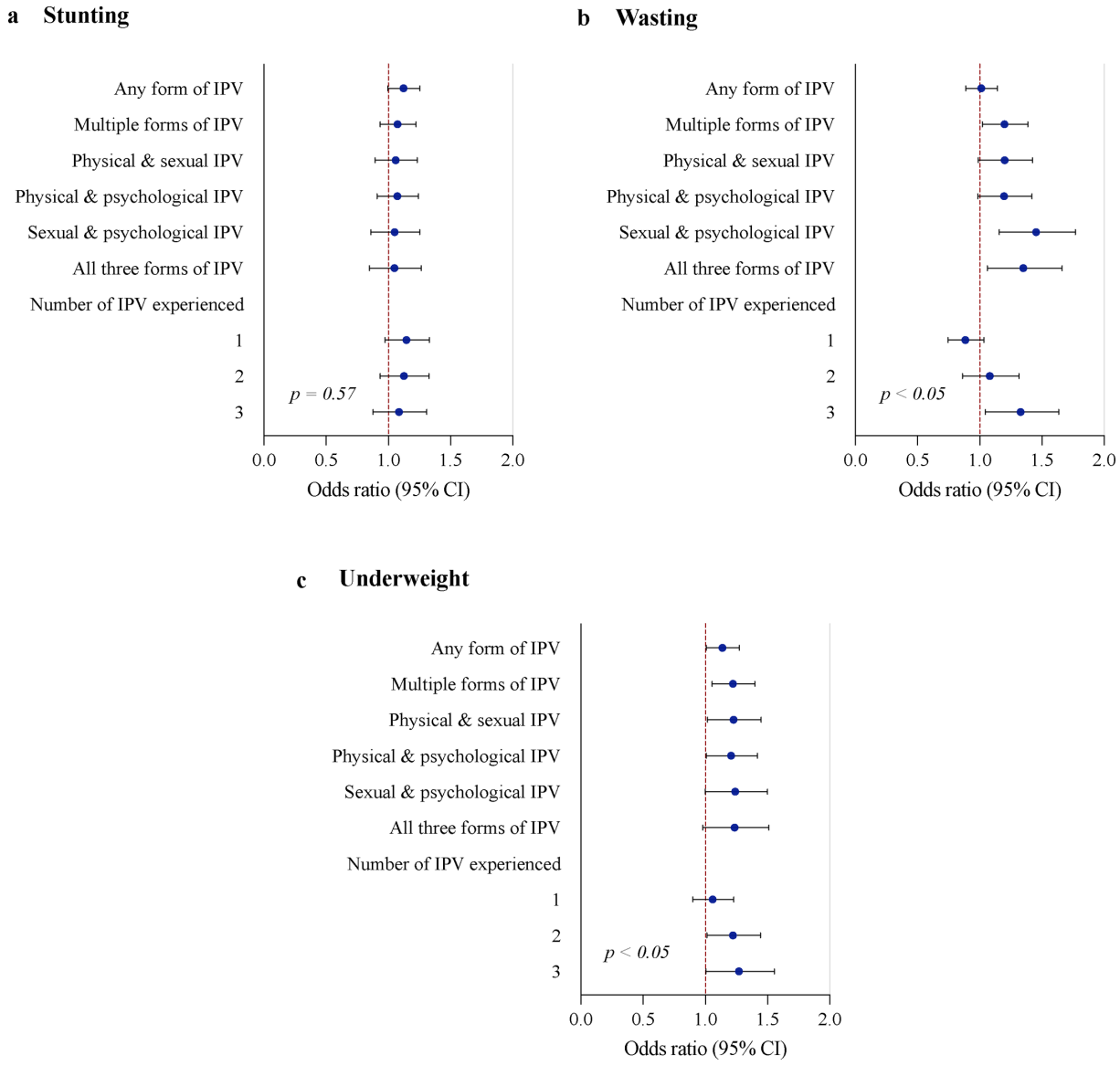

Figure 1 Odds ratios and 95% CIs were estimated using survey logistic regression adjusting for child's age in months, child's sex, maternal age, maternal height, maternal body mass index, type of residence, and household wealth level. CI, confidence interval; IPV, intimate partner violence; LMIC, Low- and middle-income countries; Physical & Sexual IPV: co-occurrence of physical and sexual intimate partner violence; Physical & Psychological IPV: co-occurrence of physical and psychological intimate partner violence; Psychological & Sexual IPV: co-occurrence of psychological and sexual intimate partner violence.

in the sub-Saharan African region, which hindered the representativeness and generalisation of the findings in a broader context. More large-scale mediation analyses in diverse cultural contexts on multiple forms of IPV are needed for future research. Third, self-reported IPV data might be subject to underreporting due to stigma, fear or cultural norms, potentially leading to measurement bias. Lastly, while our study analysed multiple forms of IPV, the dataset lacked detailed information on the severity, frequency and duration of IPV incidents, which may have differential effects on child nutrition outcomes.

Based on 104 740 mother–child pairs from 36 LMICs, this study found significant associations between multiple forms of maternal IPV and child wasting and underweight. We demonstrated the trend in the number of IPV forms experienced by mothers for child wasting and undernutrition. We also identified women's health status, type of residence and household wealth as important factors that affected this association. These results underscore the urgent need for integrated programme responses that address both IPV against mother and child undernutrition with a particular focus on multiple forms. Additionally, it is necessary to provide economic and emotional support for mother–child pairs from low sources. Our findings also indicated that more efforts need to be made on multiple forms of IPV, to reach the

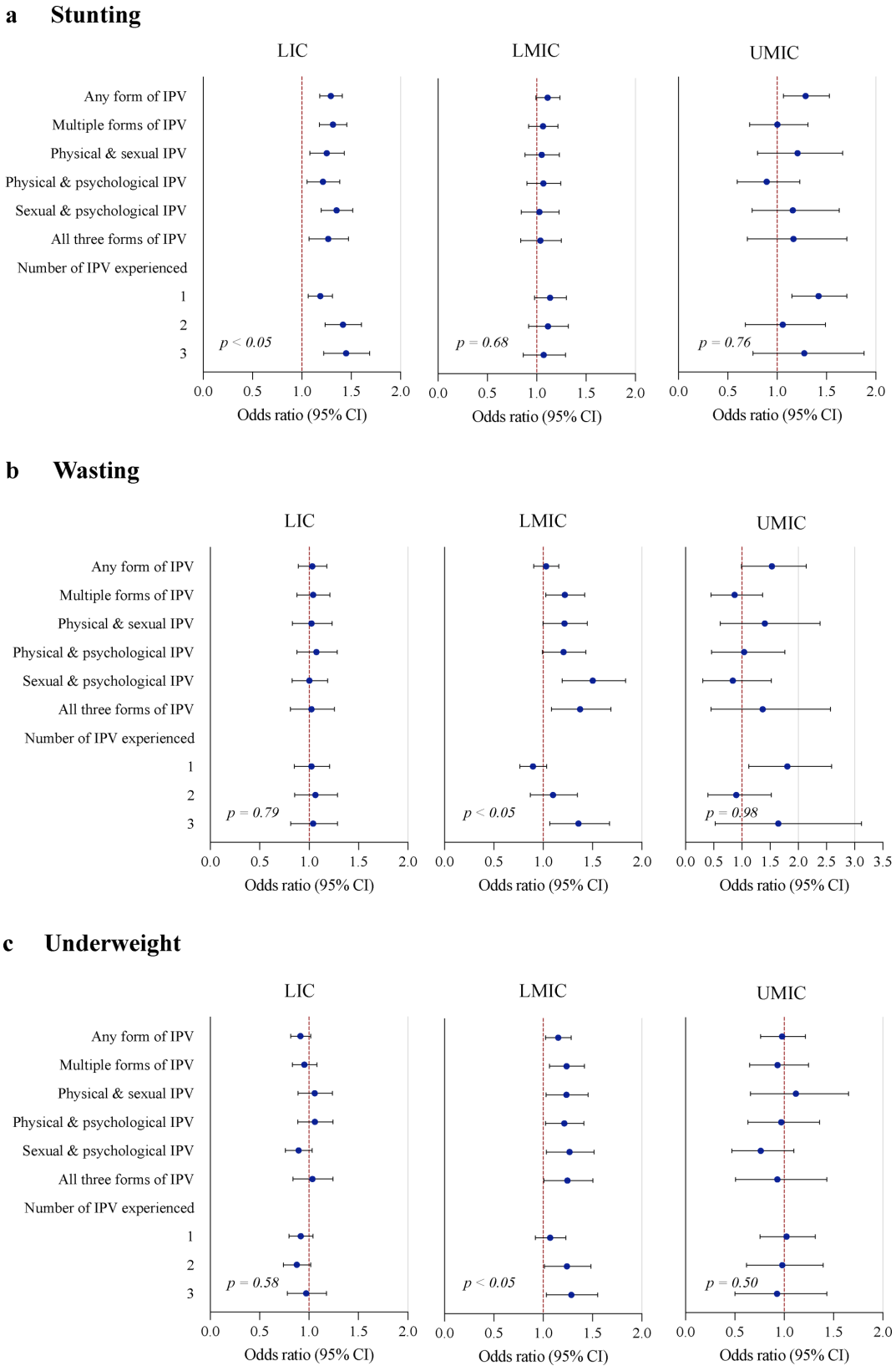

Figure 2 All IPV refers to IPV experiences within the past 12 months. CI, confidence interval; IPV, intimate partner violence; LIC, low-income country; LMIC, lower middle-income country; UMIC, upper middle-income country; Physical & Sexual IPV: co-occurrence of physical and sexual intimate partner violence; Physical & Psychological IPV: co-occurrence of physical and psychological intimate partner violence; Psychological & Sexual IPV: co-occurrence of psychological and sexual intimate partner violence; All three forms of IPV: co-occurrence of all three forms of intimate partner violence.

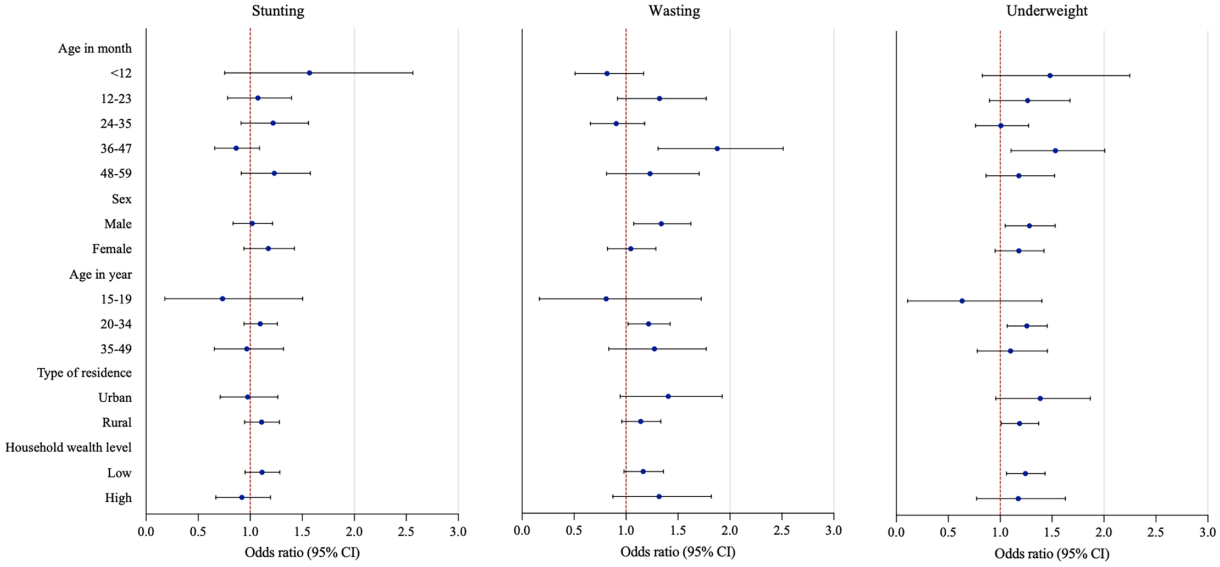

Figure 3 All p values refer to p values of trend of the associations between the number of IPV forms and child undernutrition. CI, confidence interval; IPV, intimate partner violence; Age in month: Child's age in months; Sex: Child's sex; Age in year: Maternal age in years.

Sustainable Development Goals 5.2 that called for elimination of all forms of violence toward women and girls, thus protecting health and rights of both women and their children.

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Patient consent for publication Not applicable.

Ethics approval The data used in the analyses is publicly available upon request from the Demographic and Health Survey (DHS). Standard DHS surveys have been reviewed and approved by informed consent form (ICF) Institutional Review Board (IRB), and country-specific DHS survey protocols are reviewed by the ICF IRB and typically by an IRB in the host country. ICF IRB ensures that the survey complies with the US Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46), while the host country IRB ensures that the survey complies with laws and norms of the nation. More information of the ethical declarations of the DHS can be found at https://dhsprogram.com/methodology/protecting-the-privacy-of-dhs-survey-respondents.cfm

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REFERENCES

1 World Health Organization. Violence against women. World Health Organ; 2024. Available: https://www.who.int/news-room/fact-sheets/detail/violence-against-women
2 Ma N, Chen S, Kong Y, *et al*. Prevalence and changes of intimate partner violence against women aged 15 to 49 years in 53 low-income and middle-income countries from 2000 to 2021: a secondary analysis of population-based surveys. *Lancet Glob Health* 2023;11:e1863–73.
3 Bailey BA. Partner violence during pregnancy: prevalence, effects, screening, and management. *Int J Womens Health* 2010;2:183–97.
4 Neamah HH, Sudfeld C, McCoy DC, *et al*. Intimate Partner Violence, Depression, and Child Growth and Development. *Pediatrics* 2018;142:e20173457.
5 Utumatwishima JN, Mogren I, Elfving K, *et al*. Women's exposure to intimate partner violence and its association with child stunting:

findings from a population-based study in rural Rwanda. *Glob Health Action* 2024;17:2414527.
6 Mondal D, Paul P. Association between intimate partner violence and child nutrition in India: Findings from recent National Family Health Survey. *Child Youth Serv Rev* 2020;119:105493.
7 Yount KM, DiGirolamo AM, Ramakrishnan U. Impacts of domestic violence on child growth and nutrition: a conceptual review of the pathways of influence. *Soc Sci Med* 2011;72:1534–54.
8 Bosch J, Weaver TL, Arnold LD, *et al*. The Impact of Intimate Partner Violence on Women's Physical Health: Findings From the Missouri Behavioral Risk Factor Surveillance System. *J Interpers Violence* 2017;32:3402–19.
9 Velonis AJ, O'Campo P, Kaufman-Shriqui V, *et al*. The Impact of Prenatal and Postpartum Partner Violence on Maternal Mental Health: Results from the Community Child Health Network Multisite Study. *J Womens Health (Larchmt)* 2017;26:1053–61.
10 Hussain Sana S, Makhdoom S, Husain S, *et al*. Frequency of domestic violence in pregnancy and its adverse maternal outcomes among Pakistani women. *Afr H Sci* 2023;23:406–14.
11 Chaudhary A, Nakarmi J, Goodman A. Association between intimate partner violence and nutritional status of married Nepalese women. *Glob Health Res Policy* 2022;7:14.
12 Ogden SN, Dichter ME, Bazzi AR. Intimate partner violence as a predictor of substance use outcomes among women: A systematic review. *Addict Behav* 2022;127:107214.
13 Lin C-H, Lin W-S, Chang H-Y, *et al*. Domestic violence against pregnant women is a potential risk factor for low birthweight in full-term neonates: A population-based retrospective cohort study. *PLoS ONE* 2022;17:e0279469.
14 Hollanders JJ, van der Pal SM, van Dommelen P, *et al*. Growth pattern and final height of very preterm vs. very low birth weight infants. *Pediatr Res* 2017;82:317–23.
15 Antai D, Braithwaite P, Clerk G. Social determinants of child abuse: evidence of factors associated with maternal abuse from the Egypt demographic and health survey. *J Inj Violence Res* 2016;8:25–34.
16 Pakrashi D, Saha S. Intergenerational consequences of spousal violence: effect on nutritional status of children. *Rev Econ Household* 2024;22:67–94.
17 Chai J, Fink G, Kaaya S, *et al*. Association between intimate partner violence and poor child growth: results from 42 demographic and health surveys. *Bull World Health Organ* 2016;94:331–9.
18 Armour C, Sleath E. Assessing the co-occurrence of intimate partner violence domains across the life-course: relating typologies to mental health. *Eur J Psychotraumatol* 2014;5:24620.
19 Miranda JK, Crockett MA, Vera-Pavez JI. The co-occurrence of intimate partner violence exposure with other victimizations: A nationally representative survey of Chilean adolescents. *Child Abuse Negl* 2021;117:105046.
20 Valério ID, Soares ALG, Moraes CL de, *et al*. Prevalence, co-occurrence, and associated factors of intimate partner violence among Brazilian university students. *Ciênc Saúde Coletiva* 2024;29:29.
21 Hacıaliefendioğlu A, Yılmaz S, Koyutürk M, *et al*. Co-occurrence patterns of intimate partner violence. In: *Pacific symposium on biocomputing 2021*. Kohala Coast, Hawaii, USA, 2020: 79–90. Available: https://www.worldscientific.com/worldscibooks/10.1142/12171
22 de Baumont AC, Oliveira GS, de Figueiredo JB, *et al*. Intimate partner violence and women's mental health during the COVID-19 pandemic in Brazil. *Trends Psychiatry Psychother* 2024;46:e20220594.
23 Alhusen JL, Ray E, Sharps P, *et al*. Intimate Partner Violence During Pregnancy: Maternal and Neonatal Outcomes. *J Womens Health (Larchmt)* 2015;24:100–6.
24 Lin K, Zhou P, Liu M, *et al*. The relationship between intimate partner violence and child malnutrition: a retrospective study in 29 sub-Saharan African countries. *Front Public Health* 2023;11:1231913.
25 Wali N, E Agho K, Renzaho AMN. Wasting and Associated Factors among Children under 5 Years in Five South Asian Countries (2014-2018): Analysis of Demographic Health Surveys. *Int J Environ Res Public Health* 2021;18:4578.
26 ICF. demographic and health surveys (various). Funded by USAID; 2005.
27 De Onis M, WHO MULTICENTRE GROWTH REFERENCE STUDY GROUP. 2006 WHO Child Growth Standards based on length/height, weight and age. *Acta Paediatr*95:76–85.
28 HeiseL, Ellsberg M, CHANGE, WHO MultiCountry Study of Women's Health and Domestic Violence. Recommendations for enhancing the quality and safety of research on domestic 445 violence.
29 Croft TN, Aileen MJM, Courtney KA. Guide to dhs statistics. In: *Rockville*. Maryland, USA: ICF, 2018.
30 Nutrition and Food Safety (NFS). WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. 2006. Available: https://www.who.int/publications/i/item/924154693X
31 Li Z, Kim R, Vollmer S, *et al*. Factors Associated With Child Stunting, Wasting, and Underweight in 35 Low- and Middle-Income Countries. *JAMA Netw Open* 2020;3:e203386.
32 Abbas F, Kumar R, Mahmood T, *et al*. Impact of children born with low birth weight on stunting and wasting in Sindh province of Pakistan: a propensity score matching approach. *Sci Rep* 2021;11:19932.
33 Daramola T, Szatkowski L. Association between women's experience of domestic violence and childhood vaccination in West Africa: Cross-sectional analysis of Demographic and Health Survey data. *PLoS ONE* 2023;18:e0293900.
34 Shinsugi C, Mizumoto A. Associations of Nutritional Status with Full Immunization Coverage and Safe Hygiene Practices among Thai Children Aged 12–59 Months. *Nutrients* 2022;14:34.
35 Reza A, Breiding MJ, Gulaid J, *et al*. Sexual violence and its health consequences for female children in Swaziland: a cluster survey study. *The Lancet* 2009;373:1966–72.
36 Jina R, Thomas LS. Health consequences of sexual violence against women. *Best Pract Res Clin Obstet Gynaecol* 2013;27:15–26.
37 Kamal SMM. Child Marriage and Its Association with Reproductive Health Status of Women and Their Child Well-being In Bangladesh. *JMTI* 2022;9:40–59.
38 Khan MN, Rahman MM, Shariff AA, *et al*. Maternal undernutrition and excessive body weight and risk of birth and health outcomes. *Arch Public Health* 2017;75:12.
39 Wado YD, Mutua MK, Mohiddin A, *et al*. Intimate partner violence against adolescents and young women in sub-Saharan Africa: who is most vulnerable? *Reprod Health* 2021;18:119.