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The Impact of Parental Migration on Child Nutrition: A Comparative Study of Indonesia and the Philippines

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Abstract

Background

Parental migration is increasingly recognized as an important social determinant of child health in low- and middle-income countries, yet existing evidence remains mixed and is largely derived from cross-sectional studies. This study examined the longitudinal relationship between parental migration and child nutritional outcomes in two major migration-sending countries in Southeast Asia, Indonesia and the Philippines, with particular attention to the gender of the migrant parent and the timing of children's exposure to migration.

Methods

We analyzed longitudinal data from the Child Health and Migrant Parents in South-East Asia (CHAMPSEA) project collected in 2008–2009 and 2016–2017. The analytic sample comprised children aged 3–5 years at baseline and 10–14 years at follow-up. Anthropometric data were converted into z-scores for height-for-age (HAZ), weight-for-age (WAZ), and body mass index-for-age (BAZ). Fixed-effects models were used to estimate the impact of parental migration type on changes in nutritional status, while multivariable logistic regression models assessed whether early exposure to paternal or maternal migration was associated with child nutrition outcomes in later life.

Results

In Indonesia, mother-involved migration was associated with higher BAZ over time but not with HAZ, whereas no significant average effects of parental migration on either BAZ or HAZ were observed in the Philippines. Among Indonesian children, early exposure to paternal migration was linked to a lower risk of undernutrition but a higher risk of overweight in early adolescence. Among Filipino children, paternal migration before age 3 was associated with an increased risk of children's stunting at ages 3 to 5. Household structural characteristics, including the number of older and younger siblings and the presence of co-resident grandparents, were also significantly associated with child nutritional outcomes.

Conclusions

Exposure to parental migration during early life influences children's long-term nutritional trajectories, with effects varying by country context, parent gender, and developmental stage. The potential nutritional benefits of parental migration can be leveraged through interventions implemented at critical developmental periods and by incorporating nutrition-literacy support for stay-behind caregivers.

Background

Early-life nutrition plays a critical role in long-term health, influencing not only physical growth but also immune maturation, cognitive function, and the risk of noncommunicable diseases in adult life [1–3]. However, children's malnutrition remains a pervasive challenge in low- and middle-income countries (LMICs) [4, 5], where the burden of malnutrition presents a complex challenge, characterized by the persistent double burden of undernutrition and rising overweight/obesity [4]. According to a joint report from the United Nations Children's Fund, the World Health Organization (WHO), and the World Bank, Southeast Asia had an under-5 stunting prevalence of 22.7%, giving the region the third highest stunting burden (below only Southern Asia and Sub-Saharan Africa), in 2024 [5]. Moreover, within Southeast Asia, countries like the Philippines and Indonesia continue to experience serious child nutrition challenges: among children under 5 years old in the Philippines, 23.6% are stunted and 15.1% are underweight based on the 2023 National Nutrition Survey [6], while Indonesia has a similar stunting rate (21.5%) and underweight rate (15.9%) according to the 2023 Indonesia Health Survey [7].

From the perspective of the social determinants of health (SDoH) framework, structural factors such as poverty and public policy, together with intermediary conditions like caregiving practices and food security, determine children's nutritional outcomes [8, 9]. In Southeast Asia, parental migration is increasingly recognized within the SDoH framework as a key factor shaping children's health outcomes [10, 11]. The region serves as a major source of migrant labor, with an estimated 23.6 million individuals residing outside their countries of origin—over 90% of whom are labor migrants [12]. The present study contributes to the evidence on the impact of parental migration on child nutrition in Southeast Asia by using longitudinal data from two Southeast Asian countries, Indonesia and the Philippines. Both are LMICs and among the largest labor-sending nations in the region, where migration is often viewed as a household poverty-reduction strategy [13]. In the Philippines, about 27% of minors have at least one parent working abroad [14], while in Indonesia, approximately one million children have parents who have migrated internationally—a figure likely to be higher when internal migration is considered [12].

Studies on the impacts of parental or family migration on child nutrition have expanded across diverse geographical contexts and methods. The existing literature focuses on countries with extensive rural-to-urban migration, such as China and India [15–20], while a growing body of work pays attention to the implications of international migration [21–25]. Most research has centered on left-behind children, i.e., those for whom one or both parents have migrated and who remain in care of stay-behind families [11, 17, 18, 20, 21, 26–28]. Comparatively few studies have addressed children who accompany their migrant parents [10, 19, 23, 25, 29]. Most studies have measured child nutrition outcomes using stunting and underweight as primary indicators, while wasting and overweight/obesity are measured less frequently. Additionally, several studies have used proxies such as food/kilocalorie consumption and dietary diversity/quality indicators [22–25, 28, 30, 31]. A few studies have included maternal nutrition outcomes (e.g., pre-pregnancy body mass index, gestational weight gain) [29, 32], breast-feeding duration [28, 31], and low birth weight [28, 32] as extensions of full life-cycle assessments.

Existing evidence suggests that the association between parental migration and child nutrition is nuanced and context-dependent [10, 11, 23, 28]. A systematic review of studies revealed that parental migration was associated with reduced risks of undernutrition and improved child growth, but also with an increased risk of being overweight [10]. Moreover, a meta-analysis reported that parental migration was associated with a 12%–13% increased risk of stunting and wasting among left-behind children [11]. However, the conclusions derived from these reviews primarily relied on evidence from internal migration in China [11]. The influence of parental migration on child nutrition may differ across migration types, with distinct effects observed between internal and international migration. For example, in Mexico, international migration of parents was associated with poorer child height outcomes, while internal migration showed no effects ; conversely, in Indonesia, internal migration positively impacted child height, whereas international migration had no significant positive effects [21]. Heterogeneities have also been observed among samples involving international migration.

Although several studies from the Global South report positive associations between parents' international migration and children's growth [24, 33–35], evidence from other Global South contexts—such as Peru, India, Sri Lanka, Nepal, and Vietnam—has shown mixed or even adverse effects on child nutrition[11, 20, 36, 37]. Thus the results are inconclusive. The implications of parental migration for children's growth vary by children's age and gender. Younger children, especially preschoolers, tend to be more sensitive to the effects of migration, showing either improved [18, 20, 28, 35] or worsened nutrition outcomes [27, 37] depending on critical growth windows. Gender differences have also been observed: several studies have indicated that girls seem to benefit more from parental migration than boys do, possibly because remittances reduce costly risk-coping strategies that disproportionately disadvantage girls, thus allowing greater investment in girls [20, 38, 39]. However, in contexts where gender inequality remains deeply entrenched, left-behind daughters may still face a higher risk of undernutrition or derive fewer benefits from parental migration compared with their male counterparts [36, 40]. Moreover, the gender of the migrant parent plays a role. Paternal migration, especially when accompanied by remittances or increased food expenditure, is often associated with positive nutritional outcomes such as reduced stunting and underweight, and higher birth weights [17, 24, 30, 34, 39]. Conversely, maternal migration is more often associated with negative or null effects, likely caused by reduced maternal caregiving and poorer feeding practices due to stress or heavy workloads for stay-behind caregivers [15, 37, 38, 41].

Despite an expanding body of research on migration and child nutrition, several critical evidence gaps persist. First, longitudinal analyses are limited, as most studies rely on cross-sectional data, constraining causal inference; only a few have used panel datasets to track children's growth trajectories over time [29, 33]. Even fewer longitudinal studies exist in Southeast Asia due to data availability. While several cross-sectional studies have indicated mostly nutritional benefits of parental migration, its long-term effects on children's growth require further evidence. Furthermore, a life-course perspective is critical for understanding the implications of parental migration for child nutrition, as its influences may accumulate across developmental stages. This perspective emphasizes the "timing of events in lives," suggesting that exposures during sensitive early-life periods may have lasting impacts on development [42]. Therefore, the timing of a child's first exposure to parental migration should be considered when examining changes in nutritional outcomes associated with parental migration. However, few studies have examined how the effects of parental migration on child development differ by the timing of exposure across children's life course [43, 44].

Second, although evidence suggests age-specific impacts of parental migration on child development, existing studies have largely focused on children under 5, leaving the longer-term nutrition outcomes during middle childhood and adolescence underexplored [10, 15–17, 24, 29]. Third, the mechanisms linking parental migration and child nutrition remain under-studied. Existing work has emphasized economic pathways like remittance-related improvements in household food expenditure and food security [22–24, 28, 38], whereas broader contextual factors including family structure, home environment, and children's time allocation have received limited consideration [15, 37, 38, 41].

In this study, using data from an eight-year cohort study, children's nutritional status was measured at two key developmental stages: early childhood (ages 3–5) and adolescence (ages 10–14). These longitudinal cross-national datasets provides a valuable opportunity to

assess both country-specific patterns and the broader regional dynamics of parental migration and child nutrition. The evidence from this comparative study can inform theoretically targeted policies and interventions to reduce child undernutrition in the context of parental migration. Specifically, this study addresses the following research questions: 1) What are the average impacts of parental migration on children's nutritional outcomes over time? 2) Do these impacts differ by the gender of the migrant parent ? and 3) How is the timing of children's exposure to parental migration associated with their subsequent nutritional status?

Methods

Data

This study used survey data from the Child Health and Migrant Parents in South-East Asia (CHAMPSEA), a longitudinal mixed-method study of the implications of parental migration for children's well-being in the region. The first wave of data was collected between 2008 and 2009, and the second wave from 2016 to 2017. The CHAMPSEA project employed a three-stage sampling strategy, drawing on public health surveillance methodologies [45, 46]. Although the samples are not nationally representative, replication is feasible by following strict protocols to identify and sample eligible households in two provinces of each country with high rates of international migration. Migrant households were defined as those in which 1) there was at least one child within the target age group (younger child cohort, 3 to 5 years, or older child cohort, 9 to 11 years) at the time of the baseline survey; and 2) one or both parents had migrated abroad for a minimum of six continuous months prior to the survey. A comparison group of non-migrant households was drawn from the same communities. Only one (index) child was selected per eligible household, with random selection applied when more than one child met the inclusion criteria. The analytic sample draws on the younger child cohort, aged 3–5 years at baseline and approximately 10–14 years during follow-up. In Indonesia, 522 households were interviewed at baseline and 481 re-interviewed in the second wave; in the Philippines, 501 households were interviewed initially and 368 successfully followed up. These correspond to retention rates of 92% and 73%, respectively. Only children who strictly fell within the specified age range were included in the analysis. After deleting one household due to the death of both parents and additional cases with missing data or measurement outliers on key variables (e.g., height), the final analytic sample comprised 974 households (Indonesia: 490; The Philippines: 484) at baseline and 792 households at follow-up (Indonesia: 438; The Philippines: 354).

Measures

Nutritional status. Children's weight and height were measured by trained fieldworkers during the household surveys following standard anthropometric procedures. Following international protocols, each measurement was taken three times, and where two of the three readings matched, that value was recorded as the final measure; if all three differed, the average was used. Anthropometric data were collected at both waves and converted into z-scores for height-for-age (HAZ), weight-for-age (WAZ), and body mass index-for-age (BAZ) based on the WHO Child Growth Standards. Different sets of nutritional indicators were used for participants during early childhood (Wave 1) and adolescence (Wave 2) to reflect age-appropriate manifestations of nutritional status. For children under 5, underweight (WAZ < − 2 SD) and stunting (HAZ < − 2 SD) were selected because these indicators capture the main forms of undernutrition prevalent in early childhood. The prevalence of overweight in this age group was extremely low in both countries (< 2%), limiting statistical precision and interpretability; therefore, overweight was not included as an outcome at Wave 1. For participants aged 10–14, stunting (HAZ < − 2 SD) and overweight (BAZ > + 1 SD) were included to reflect the dual burden of malnutrition and overnutrition increasingly observed among Southeast Asian populations [47, 48].

Parental migration status. The household survey included the migrant status of parents and information about non-resident migrant family members. On the basis of the answers, household migrant status at both waves was classified as non-migrant or migrant depending on whether one parent or both parents were migrant workers in the six months preceding the interview date, with non-migrant households as the comparison group. To differentiate gendered impacts of parental migration on children, we further classified migrant households into two types: father-only migration and mother-involved migration, the latter referring to conditions where either the mother migrated alone or she migrated with the father. We classified mother-only migration and both-parent migration as one combined group because the percentage of both-parent migration in the sample was less than 6% at both waves in both countries.

Children's exposure to parental migration. A retrospective life-history approach was used to construct separate migration history files for fathers and mothers. Parental migration trajectories were recorded from the birth of the index child up to the time of interview. Given that the first three years of life represent a critical window for nutritional development, children's exposure to parental migration was classified as either before or after age three. To examine the timing of exposure in relation to child nutrition, children's exposure at Wave 2 was

further categorized by age at first exposure to parental migration: no exposure to paternal or maternal migration (reference group), first exposure to paternal or maternal migration before age three, and first exposure to paternal or maternal migration after age three.

Household demographic characteristics. Drawing on the literature, several household demographic factors that may influence children's nutritional status were included as control variables. These comprised the child's age and gender, the caregiver's educational level, household income, the number of older and younger siblings, and the number of co-resident grandparents.

Home environment. Beyond demographic characteristics, children's nutrition may also be shaped by the quality of the home environment and time-use patterns [50, 51]. Drawing on the construction of the Wealth Index by the Young Lives project, a widely used indicator of long-term socioeconomic status in developing-country contexts [49], three primary indicators were used to assess the home environment: housing quality, consumer durables, and access to services. Housing quality captures housing-related features and is calculated as the average of four components: the quality of walls, roofs, and floors, along with household density. Access to services reflects the household's capacity to meet essential shelter requirements, encompassing the availability of electricity, a safe drinking water source, sanitation facilities, and type of fuel for cooking. The consumer durables sub-index measures household ownership of common items such as televisions, refrigerators, and air conditioners. All three indicators are normalized to a scale ranging from 0 to 1, with higher values denoting better conditions.

Child time use. Children's daily time use included the average number of minutes per day spent sleeping, eating, and helping with domestic work, as reported by the primary caregiver. These variables provided additional contextual information about the child's daily routines and energy expenditure, which may influence nutritional outcomes.

Data analysis

To estimate the average effects of parental migration on children's nutritional status over time, we employed fixed-effects models. This approach minimizes potential bias arising from unobserved, time-invariant household or individual characteristics that may confound the association between migration and nutrition outcomes. The results of the Hausman tests supported the suitability of the fixed-effects model for this analysis. Continuous measures of nutritional status (HAZ and BAZ) were used as outcome variables. These indicators were preferred over categorical classifications because they retain greater variability and sensitivity to within-child changes in nutrition across waves. The association between parental migration status and children's nutritional outcomes was modeled as follows:

$$Y_{it} = \alpha_0 + \alpha_1 PM_{it} + \alpha_2 CHILD_{it} + \alpha_3 HH_{it} + \alpha_4 HOME_{it} + \alpha_5 TIME_{it} + \alpha_i + \epsilon_{it},$$

where Y_{it} is a continuous measure of the nutritional status of child *i* at time *t*; PM_{it} represents the parental migration status; and $CHILD_{it}$ includes children's age and age squared. The vector HH_{it} captures time-varying household characteristics, including the number of older and younger siblings, the number of co-resident grandparents, household wealth, and family structure. The vector $HOME_{it}$ represents time-varying characteristics of the home environment, while $TIME_{it}$ represents children's daily time-use measures. The vector α_i accounts for unobserved, time-invariant factors that may affect both parental migration and children's nutrition. To further examine whether the timing of children's initial exposure to parental migration influenced their nutritional outcomes, a series of multivariate logistic regression models were estimated. For participants at Wave 1, an indicator variable was constructed to capture whether children had been exposed to maternal or paternal migration before age 3, allowing assessment of the short-term effects of early parental absence on children's nutrition. For participants at Wave 2, a categorical predictor was constructed to distinguish whether children had experienced paternal or maternal migration before or after age 3, with children who had no exposure to parental migration serving as the reference group. This classification allowed for the assessment of the long-term effects of parental migration and for comparison between early-life exposure and later exposure during subsequent developmental stages. Demographic variables from each survey wave were entered into the logistic models separately.

Results

In total, 490 Indonesian children (438 at Wave 2) and 484 Filipino children (354 at Wave 2) were included in the analysis. In the Indonesian sample, 52% of the children had one or two parents who were migrants in the baseline survey, and this percentage decreased to 29% in the follow-up survey. In the Philippines, 51% of the sampled children had at least one parent who was a migrant during the first wave, and this percentage decreased to 42% in Wave 2. At the baseline, the exposure of the sampled children to parental migration during the early life stage (before the age of 3) was 29% in Indonesia and 30% in the Philippines, while their exposure to maternal migration was 25% and 7%, respectively.

Table 1 reports the descriptive statistics of the sample and the variables used in the analysis by household migrant status. The overweight prevalence was 19% for Indonesian children and 14% for Filipino children at Wave 2. The overall prevalence of stunting among Indonesian and Filipino children was 29% and 15%, respectively, at

Table 1
Nutritional Status and Socio-Demographic Characteristics of Participants by Household Migration Status

	Wave 1				**Wave 2**			
	Indonesia		**The Philippines**		**Indonesia**		**The Philippines**	
	(n = 490)		**(n = 484)**		**(n = 438)**		**(n = 354)**	
Nutrition indicators	Non-migrant household	Migrant household	Non-migrant household	Migrant household	Non-migrant household	Migrant household	Non-migrant household	Migrant household
BAZ	-0.371,	-0.201,	-0.376,	-0.198,	-0.268,	-0.062,	-0.048,	0.221,
(mean, SD)	1.072	1.062	1.197	1.334	1.316	1.288	1.524	1.408
HAZ	-1.423,	-1.136,	-0.969,	-0.748,	-1.13,	-1.085,	-0.821,	-0.582,
(mean, SD)	1.025	1.133	1.118	1.169*	0.999	1.054	1.237	1.048
Stunting (%)	29.11	27.27	15.48	14.29	20.00	15.63	13.04	12.93
Overweight (%)	1.27	1.98	2.51	1.63	15.48	19.53	24.15	26.53
Underweight (%)	20.25	17.39	15.90	11.43	n.a.	n.a.	n.a.	n.a.
Demographic variables (mean, SD)								
Child gender (% of female)	50.83	49.24	51.45	49.39	48.93	55.3	50.95	53.02
Child age	4.49, 0.82	4.57, 0.88	4.54, 0.89	4.66, 0.86	12.84, 0.82	12.61, 0.89	12.73, 0.88	12.82, 0.88
The number of older sibling(s)	0.65, 0.58	0.42, 0.65	1.1, 1.29	0.99, 1.12	0.37, 0.6	0.3, 0.52	0.9, 1.1	0.88, 1.05
The number of younger sibling(s)	0.19, 0.42	0.11, 0.35*	0.58, 0.67	0.31, 0.52***	0.62, 0.71	0.4, 0.62**	1.08, 1.22	0.6, 0.8***
The number of co-resident grandparent(s)	0.37, 0.67	0.66, 0.83***	0.31, 0.62	0.6, 0.82***	0.21, 0.53	0.48, 0.75***	0.2, 0.6	0.46, 0.69***
Household income	129.94, 196.5	179.99, 221.75**	207.37, 107.65	441.25, 339.63***	196.13, 228.46	247.75, 184.53*	295.79, 215,26	518.89, 445.05***
Home environment (mean, SD)								
House quality	0.72, 0.17	0.76, 0.16*	0.71, 0.16	0.78, 0.12***	0.77, 0.14	0.81, 0.12**	0.74, 0.11	0.79, 0.06***
Consumer durables	0.4, 0.22	0.4, 0.21	0.44, 0.2	0.58, 0.19***	0.49, 0.14	0.5, 0.12	0.43, 0.18	0.56, 0.21***
Access to services	0.53, 0.2	0.55, 0.2	0.79, 0.23	0.91, 0.15***	0.66, 0.2	0.68, 0.21	0.82, 0.2	0.89, 0.15***
Time use – minutes per day (mean, SD)								
Sleep	635,27, 79.81	638.83, 79.44	712.73, 79.64	697.59, 88.6*	488.63, 62.13	482.44, 59.02	525.68, 66.55	508.93, 55.82*

Abbreviations: BAZ, Body mass index-for-age; HAZ, Height-for-age; n.a., not applicable; *p < 0.05. **p < 0.01. ***p < 0.001 for group difference tests

	Wave 1				Wave 2			
	Indonesia (n = 490)		The Philippines (n = 484)		Indonesia (n = 438)		The Philippines (n = 354)	
Eating	48.4, 31.04	49.17, 28.19	48.94, 29.45	57.4, 34.71**	30.75, 14.55	31.04, 15.61	52.85, 25.29	53.09, 25.08
Domestic tasks	6.83, 15.33	8.5, 22.68	9.34, 16.15	6.89, 12.28	31.65, 32.96	31.17, 36.73	56.6, 44.56	49.06, 43.01

Abbreviations: BAZ, Body mass index-for-age; HAZ, Height-for-age; n.a., not applicable; *p < 0.05. **p < 0.01. ***p < 0.001 for group difference tests

Wave 1, and decreased to 19% and 13% at Wave 2. No significant differences were found in nutritional indicators between children with or without migrant parents at either wave, except for Filipino children from migrant households who showed significantly higher HAZ than Filipino children from non-migrant households at Wave 2 ($t = -2.133$, $p < .05$).

[Insert Table 1 here]

The average age and gender ratio of the sampled children were similar in the two countries. In terms of changes in the family structure, index children in migrant households had significantly lower average numbers of younger siblings but more co-resident grandparents. Across both survey waves, migrant households in both countries reported higher household income than non-migrant households. Regarding home environment indicators, migrant households also had better housing quality at both waves. At Wave 2, migrant households in the Filipino sample had significantly greater possession of consumer durables and access to basic services compared with non-migrant households; however, households in the Indonesian sample did not show such differences. Furthermore, Filipino children with migrant parents had shorter average sleep duration at both waves, whereas no significant differences in time use were observed among Indonesian children.

Figure 1 reports the results of fixed-effects models examining the effects of parental migration type on children's BAZ and HAZ after adjusting for child age, home environment, and time-use factors. For Indonesian children, mother-involved migration was associated with a higher BAZ score but not a higher HAZ score. In the Filipino sample, no significant average effect of parental migration on either BAZ or HAZ was found. Detailed results are provided in Table 1 of the Supplementary File.

[Insert Fig. 1 here]

Figure 1. Association Between Parental Migration and Child Nutritional Outcomes (Fixed-effects Model)

Figure 2 presents the results of logistic regressions estimating the association between early-life exposure to parental migration and the nutritional status of children aged 3 to 5 years. For Indonesian children, experiencing paternal migration before age 3 was significantly linked to lower probabilities of being underweight and stunted in early childhood. In contrast, Filipino children in early childhood who were first exposed to paternal migration before the age of 3 had a higher chance of experiencing stunting. Detailed findings are presented in Supplementary Table 2.

[Insert Fig. 2 here]

Figure 2. Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Children Aged 3 to 5 years

Figure 3 displays the results of logistic regression models estimating the association between early-life exposure to parental migration and the nutritional status of children in early adolescence. Among Indonesian children, while exposure to paternal migration in early childhood decreased their risk of stunting it also increased the probability of being overweight in early adolescence. No significant impacts of early-life exposure to parental migration were observed in the Filipino sample. The detailed results can be found in Table 3 of the Supplementary File.

[Insert Fig. 3 here]

Figure 3. Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Adolescents Aged 10 to 14 years

Among the covariates examined, having a greater number of co-resident grandparents in Indonesian families and having more older siblings in Filipino families were associated with an increased risk of underweight and stunting among children aged 3–5 years. Of all home environment factors, only ownership of consumer durables significantly reduced the risk of underweight and stunting for children in both countries. By ages 10–14, the sthe household composition, including the number of older and younger siblings, and co-resident grandparents, were risk factors for stunting among Indonesian children, while higher household income was associated with a greater risk of overweight. Ownership of consumer durables continued to be protective against stunting in both study populations but was also linked to higher odds of being overweight among Filipino children. Time-use patterns were not significantly associated with children's nutritional outcomes in the logistic regression analyses; however, fixed-effects models revealed that increased time spent in domestic tasks had a negative effect on HAZ among Indonesian children across waves.

Discussion

This study contributes to the growing literature on the complex relationship between parental migration and child nutritional outcomes in the Global South by drawing on comparative longitudinal data from Indonesia and the Philippines. We found that parental migration had nuanced impacts on children's nutritional status, varying by which parent (mother and/or father) migrated and the child's developmental stage. The fixed-effects models revealed a positive association between mother-involved migration and Indonesian children's BAZ but not HAZ, suggesting that parental migration may benefit short-term nutritional outcomes without necessarily influencing subsequent linear growth. This finding aligns with a panel study in China reporting that parental migration increased children's weight but not height [17]. In contrast, an earlier analysis using the Indonesian Family Life Survey (IFLS) 2000 and 2007 waves, which sampled children under age 7 at baseline, found that maternal migration more uniformly and negatively affected child HAZ [41]. The IFLS sample excluded children whose parents had both migrated, which may explain the differing results. The absence of both parents differs markedly from having only one migrating parent: while both-parent migration may enhance remittances and allow greater investment in child health, it can also increase the risk of inadequate caregiving and instability in care arrangements for children [52, 53].

The lack of significant associations between parental migration and child nutritional indicators in the fixed-effects models among the Filipino sample suggests that on average, changes in parental migration status are not associated with measurable changes in child nutrition over time. In the Philippines, the lack of significant results implies that much of the observed difference in nutritional outcomes between children with and without migrant parents may reflect other factors rather than the direct causal effect of migration itself. Previous research has shown that maternal migration can negatively affect children's psychological well-being, particularly when the stay-behind caregiver has poor mental health [54]. This may help explain why Filipino households with migrant parents, despite having higher income and better home environments across waves, did not demonstrate corresponding improvements in child nutrition. Moreover, Filipino left-behind children have been reported to experience hygiene issues and nutritional risk (both under- and over-eating) due to reduced parental care [55]. The psychological cost associated with parental absence and the resulting deterioration in caregiving quality may offset potential gains from remittances, thereby constraining or even negating their positive effects on children's health and nutritional outcomes [11, 33].

The findings highlight that children's exposure to paternal migration during the critical first three years of life has lasting effects on their nutritional status in middle childhood and early adolescence, particularly in the Indonesian sample. This supports a broad body of evidence demonstrating that early childhood, especially the first 1,000 days of life, constitutes a sensitive period during which nutritional insults or advantages can have persistent consequences for linear growth, body composition, and later health outcomes [56, 57]. Similarly, a study in Tanzania found the strongest effects of parental migration on child growth among those exposed to migration during early childhood [27]. A study in Nepal also reported that exposure to paternal migration within the first six months of life had lasting negative effects on children's head circumference, which is highly sensitive to early-life malnutrition [36]. Among studies on left-behind children in several Asian countries, early exposure to parental migration within the first three years has also been linked to poorer prosocial behaviors and cognitive development in later life stages [54, 58]. Together, these findings underscore the need for further research on how exposure to parental migration during early life stages shapes children's longer-term health trajectories.

This study found that only paternal migration, and not mother-involved migration, had significant longer-term effects on child nutrition. Paternal migration during early years can reduce Indonesian children's risk of stunting. This finding supports the gender-specific influences of parental migration documented in previous research, partly attributable to the gender income gap among migrant workers [54, 59]. Prior studies have shown that maternal migration, compared with paternal migration, is more often associated with increased

risks of child victimization, poorer psychological adjustment, and reduced dietary quality [60, 61]. However, the present study did not observe significant negative effects of maternal migration. The implications of parental migration likely depend on caregiving norms within broader sociocultural contexts. In both study settings of this study, kinship caregiving is common and may serve as a protective factor that mitigates the potential adverse effects of maternal absence [62, 63]. Moreover, the benefits of remittances from migrant fathers may be maximized when mothers remain at home during early childhood to provide consistent caregiving and make timely health-related decisions, given that the early life years constitute a sensitive developmental window in which gendered caregiving roles and household decision-making are particularly consequential for child nutrition [56, 64, 65]. While research from South Asia has reported stronger benefits of paternal migration for sons' nutrition and education, and a study in China found that the adverse effects of early childhood exposure to parental migration were observed only among boys, this study found no evidence of such a gendered pattern [44, 66, 67]. How parental migration affects children by gender should be examined within specific cultural contexts, with attention to how migration reshapes resource allocation and caregiving dynamics within prevailing gender norms.

While paternal migration during early childhood appeared to reduce Indonesian children's risk of stunting in later life stages, it was also associated with a higher likelihood of being overweight in early adolescence. This pattern echoes findings from studies of children of rural–urban migrants, who similarly showed both greater linear growth and the risk of overweight [10]. Child nutrition research has traditionally focused on undernutrition in LMICs, however, rapid socioeconomic change and shifts in food systems have led to a marked rise in childhood overweight and obesity, producing a growing double burden of malnutrition. The coexistence of undernutrition and excess weight, now widely documented in population-level nutrition research is still rarely examined in migration studies [4, 57, 68]. Our findings highlight some of the complex effects of parental migration on the double burden of malnutrition, especially among Indonesian children. Although remittances can raise household food expenditure, this does not necessarily improve dietary quality [28]. For instance, a study in China found that parental migration resulted in higher calorie intake among children but lower consumption of protein-rich foods [18]. Increased income may also shift dietary patterns toward energy-dense, high-fat foods, including greater intake of meat and processed products, which can contribute to excess weight gain [69]. Therefore, the extent to which remittances support healthy child growth depends also on the nutritional knowledge and dietary behaviors of stay-behind families.

Previous studies have examined the remittance pathways whereby migrant households can afford more nutritious food, enjoy improved household environments (including sanitation and living conditions), and gain enhanced access to healthcare services [23, 24, 28]. Building on this work, our findings highlighted three key household-level factors associated with child nutrition: the number of siblings, co-residence with grandparents, and ownership of consumer durables. The association between a greater number of co-resident grandparents or older siblings and higher risks of underweight and stunting suggested that resource competition within larger households might constrain children's dietary quality and nutritional intake, particularly in low-income settings. Evidence from diverse LMIC contexts indicates that having more siblings is often linked to a higher risk of stunting in resource-constrained settings [70, 71]. In Southeast Asia, grandparents frequently serve as primary or joint caregivers when the middle generation is engaged in labor migration. Previous studies have found that grandparental caregiving can help prevent poor dietary outcomes for children; however, its benefits tend to diminish when grandparents experience chronic illness [72, 73]. The mental health vulnerabilities of stay-behind grandparent caregivers may help explain why co-residence with grandparents is associated with a higher risk of stunting among Indonesian children [74, 75]. Further qualitative research is needed to explore how family-structure factors shape child nutrition through caregiving practices and resource sharing within intergenerational households.

Among household environment indicators, the ownership of consumer durables, which may reflect improved material living standards and long-term socioeconomic stability that support better nutrition, emerged as a key factor associated with a reduced risk of stunting among the sampled households. Such assets can directly benefit childcare by enabling safe food storage and reducing time spent on housework, thereby allowing caregivers to devote more attention to childcare [76]. However, by middle childhood, this advantage appeared accompanied by increased risks of overweight among Filipino children. Moreover, the advantages of migrant households compared with non-migrant households persisted only in terms of housing quality, not consumer durables or access to services. This pattern may suggest that home construction or renovation is prioritized as a key form of household investment following migration over other factors. Notably, the negative within-child association between time spent on domestic work and HAZ among Indonesian children across waves suggested that role burden and reduced time for self-care might cumulatively disadvantage physical growth. Together, these results emphasize the importance of considering household composition and children's daily routines in nutritional interventions.

Implications

The findings carry important policy implications for major labor-sending countries. First, the observation that paternal migration reduces stunting but increases adolescent's risk of being overweight indicates that the nutritional consequences of migration are not uniformly

beneficial. Rather, they may shift from risk of undernutrition in early childhood to overnutrition in later stages as children grow. This non-linear pattern highlights the need for nutrition interventions that address the double burden of malnutrition, rather than focusing solely on underweight or stunting. In the Philippines, proposed amendments to the Universal Health Care Act (Republic Act No. 11223) seek to subsidize 50% of migrant workers' PhilHealth premiums through national government funding and to remove the requirement for payment of unpaid contributions upon their return. Although these provisions have yet to be enacted, such financing mechanisms—if implemented—could be leveraged to expand PhilHealth benefit packages to include nutritional screening and nutrition education for caregivers of left-behind children, ensuring that the health coverage system more directly supports the well-being of families affected by migration [77]. In addition, special attention should be directed toward the nutritional vulnerabilities of children in multi-child households, who may face heightened competition for limited care and resources. The National Nutrition Council's Philippine Plan of Action for Nutrition could further be strengthened by incorporating an SDoH approach, adapting interventions to local family structures and the context characterized by high rates of migration [78].

In Indonesia, *Presidential Regulation No. 72/2021* on stunting reduction targets adolescents, pregnant women, and children under 5 through a multi-sectoral convergence approach [79]. The results of the present study suggest that Indonesia's stunting-reduction framework should more explicitly incorporate children from migrant households, given their distinct caregiving arrangements and risk profiles [80]. Evidence from Indonesia indicates that the nutritional consequences of parental migration differ by which parent migrates, with adverse effects observed for maternal migration but not paternal migration, implying that policy responses should strengthen the capabilities of stay-behind caregivers rather than assuming that remittances alone are sufficient [41]. Because grandparents frequently assume feeding and caregiving responsibilities [81], and because caregiver nutritional knowledge is modifiable through education [82], Indonesia's existing nutrition interventions targeting adolescent girls and pregnant women [79] could be adapted to deliver tailored nutrition-literacy support for older caregivers in migrant households. Without such complementary investments, the economic gains from migration may inadvertently promote energy-dense but nutrient-poor dietary patterns, contributing to risks of overweight without addressing the underlying risks of stunting.

Strengths and limitations

The nuanced findings of this study underscore the need for further research on precisely how migration shapes child nutrition and how best to support migrant families in LMICs. First, more longitudinal and mixed-method studies are needed to strengthen causal inference and explain the underlying mechanisms through which parental migration affects child health outcomes and their potential cumulative effects. Most existing research on migration, alternative care, and nutrition has been cross-sectional, which limits the ability to determine long-term effects. The findings of this study suggest that the impacts of parental migration on child nutrition may not be cumulative, but rather, they may vary according to children's nutritional needs at different developmental stages. While this study drew on panel data spanning eight years, future research with more frequent follow-ups to track children across critical childhood life stages could provide a more nuanced understanding of changes in nutritional status over time.

Second, this study did not account for the potential selection effects of migration. Migration behavior is likely selective, and individuals' decisions to migrate are often influenced by their health conditions. Therefore, mothers who migrate, whether before or after childbirth, are likely to be in better physical health than those who do not migrate. Because this study tracked parental migration trajectories only after the index child's birth, it may have overlooked pre-birth maternal health and migration history, potentially leading to an overestimation of the positive effects of maternal migration after childbirth on child nutrition. Third, the study sample was drawn from communities with high levels of out-migration and therefore is not nationally representative. Moreover, the effects of migration may extend beyond the household level, as national policies and community resources also shape children's nutritional outcomes. For example, the proportion of migrant parents declined more sharply in the Indonesian sample than in the Filipino sample between Waves 1 and 2, likely reflecting changes in local migration policies[1].. Although the fixed-effects approach controls for time-invariant unobserved characteristics, such policy-driven shifts may introduce potential bias if they are correlated with both parental migration decisions and children's nutritional outcomes. Therefore, the country-specific results should be interpreted with caution, acknowledging the potential influence of contextual policy changes.

Despite these limitations, this comparative study offers valuable insights into child nutrition in Southeast Asia, where nationally representative longitudinal data remain scarce. Finally, although fixed-effects models account for stable family characteristics, there may be time-varying factors such as changes in local food prices, or economic shocks that we could not control for and that might influence both migration decisions and child nutrition. Our findings should therefore be interpreted as associations under certain assumptions, rather than definitive causal effects.

Conclusions

Parental migration was associated with children's nutritional outcomes in patterns that varied by country context, the gender of the migrant parent, and the child's developmental stage. In Indonesia, mother-involved migration was linked to higher body mass index-for-age over time, while paternal migration during the first three years of life was associated with a lower likelihood of underweight and stunting in early childhood (ages 3–5) and with reduced stunting but elevated overweight risk in early adolescence (ages 10–14). In contrast, in the Philippines, parental migration showed no consistent longitudinal association with anthropometric outcomes, although early paternal migration was associated with higher odds of stunting among children aged 3–5. These findings indicate that the nutritional consequences of parental migration are not uniformly beneficial and may evolve from risks of undernutrition in early life to risks of overnutrition in later developmental stages. Therefore, policies in major labor-sending countries should strengthen support for stay-behind children and their caregivers—particularly during early childhood—while integrating both undernutrition prevention and overweight management into local nutrition strategies.

Declarations

Ethics approval and consent to participate.

The CHAMPSEA project received ethical approval from the Ethics Committee of universities and research institutions that were involved in the project, including The University of St. Andrews, National University of Singapore, The University of Hong Kong and all local institutions in the study countries. All procedures involving human participants were performed in accordance with the Declaration of Helsinki and its later amendments. The purpose of the project was explained and consent was obtained from all participants. For participants under the age of 16 years, informed consent was obtained from their primary caregivers prior to participation.

Consent for publication.

Not Applicable.

Availability of data and materials

All data and materials necessary to reproduce the results presented in this study will be made openly available upon request.

Competing interests

The authors have no conflicts of interest to disclose.

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Authors' contributions

Yao Fu & Lucy P. Jordan: Conceptualization, methodology, and writing-review and editing; Yao Fu: Data analysis and writing-original draft; Yumeng Du: Writing-original draft; Xiaochen Zhou: Writing-review and editing; Lucy P. Jordan: Funding acquisition and resources, supervision and project administration.

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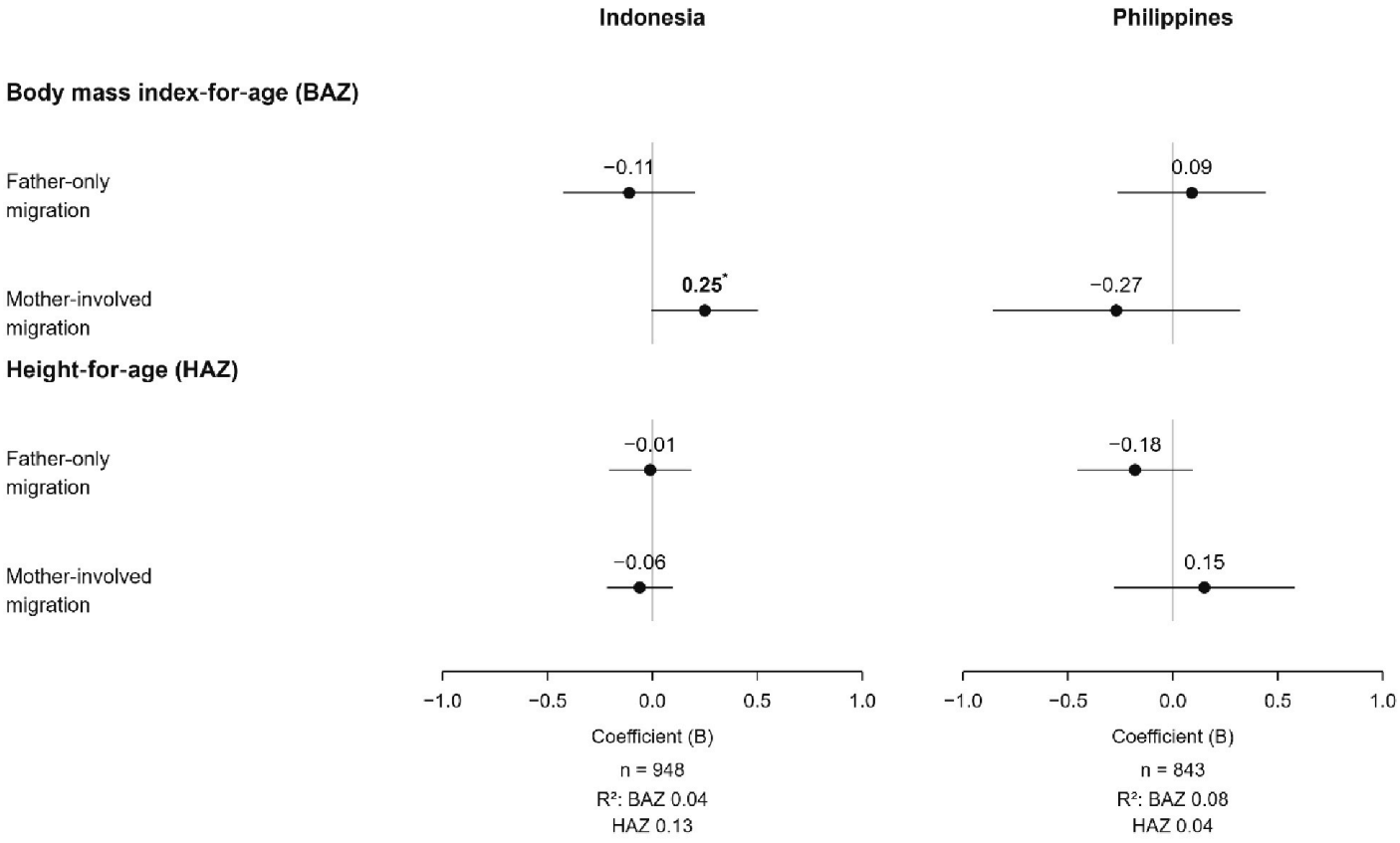
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Footnotes

1. There has been a notable decreasing trend in total documented migrant workers from Indonesia, particularly among women. The Indonesian government implemented several bans on sending female domestic workers to selected Middle Eastern and North African countries since 2010s.

Figures

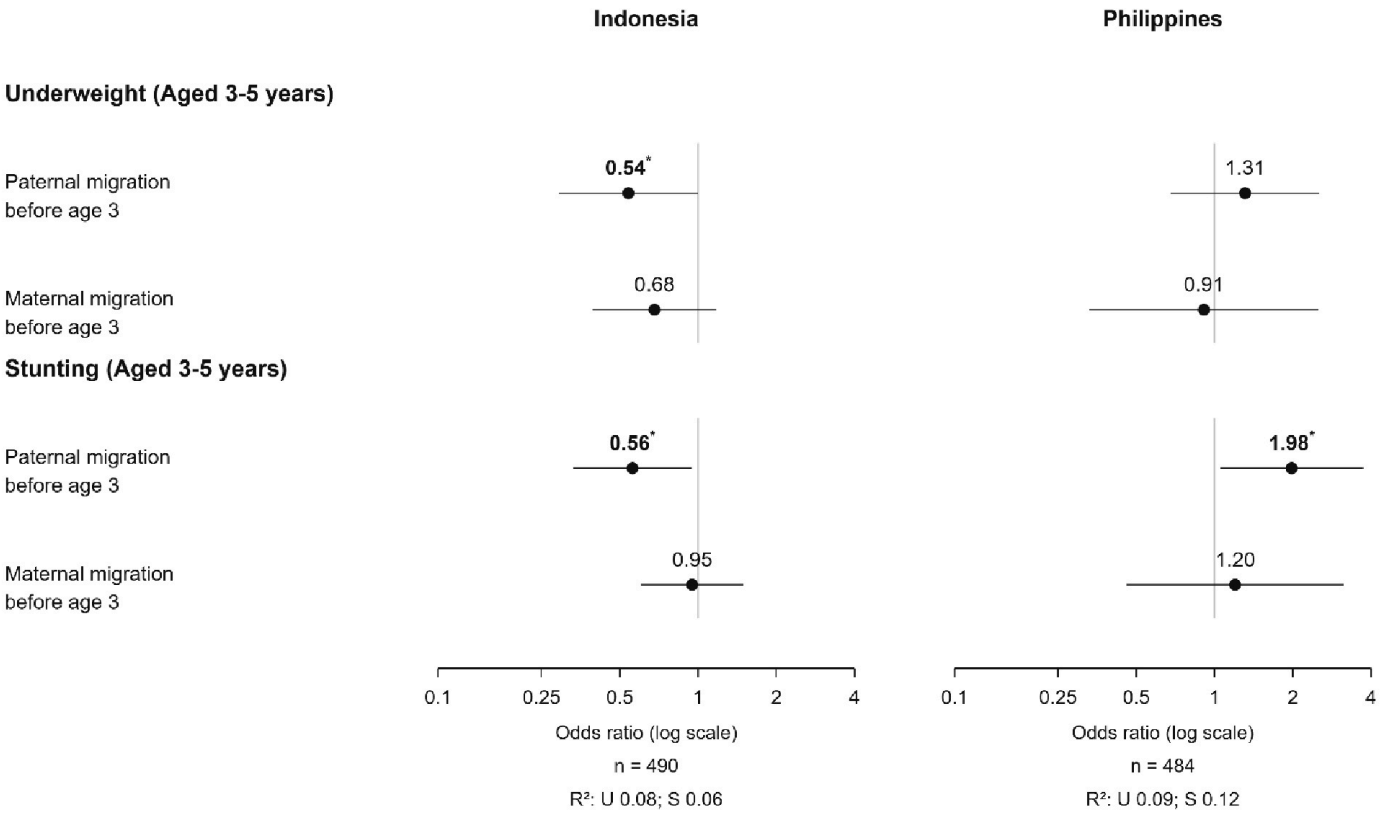
Figure 1. Association Between Parental Migration and Child Nutritional Outcomes (Fixed-effects Model)



Points represent regression coefficients (B) and 95% confidence intervals. The vertical line represents B=0. The reference group was children living with non-migrant parents. Models were adjusted for child age, home environment, and time-use variables. *p<0.05.

Figure 1

Figure 2. Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Children Aged 3 to 5 years

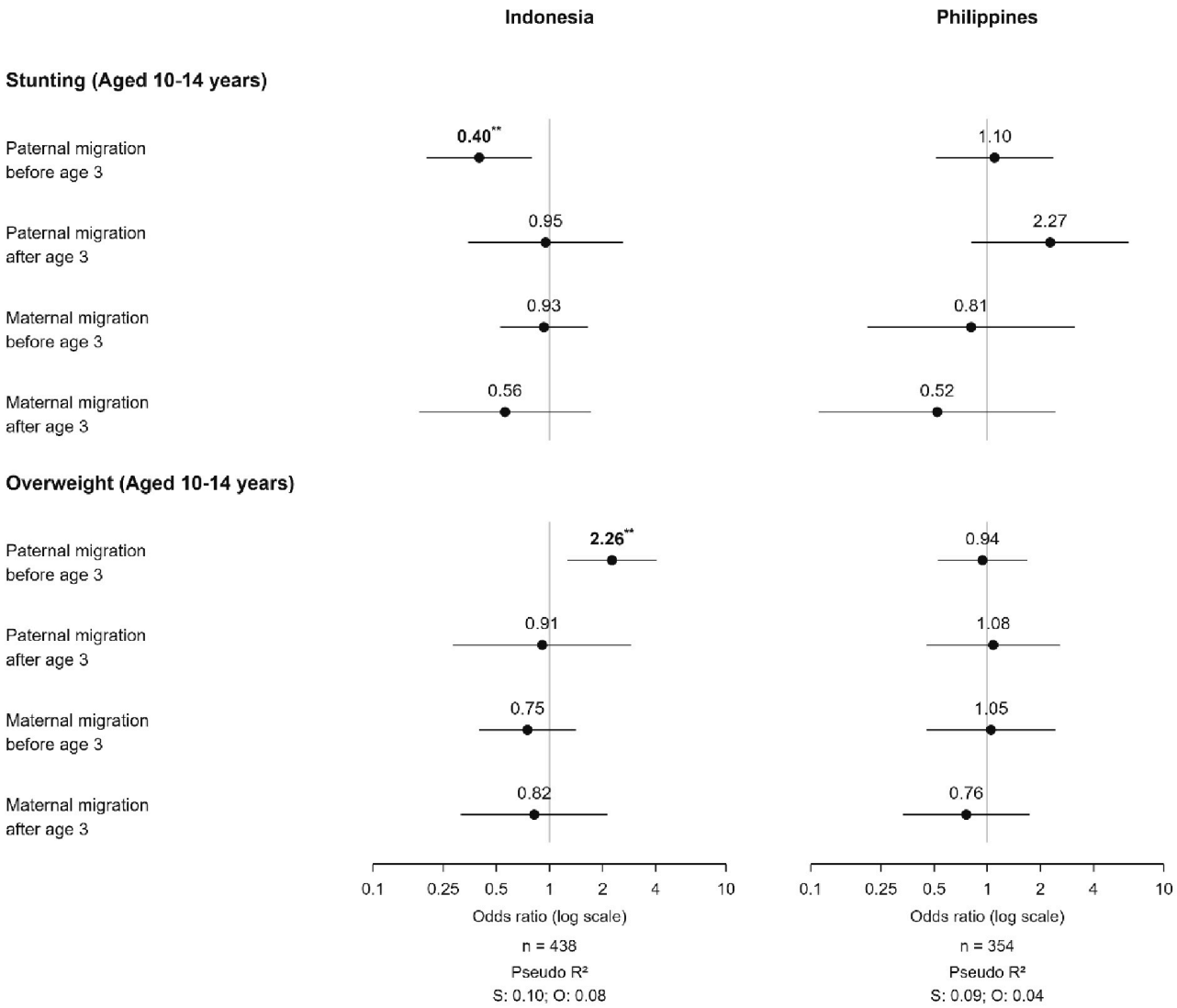


Points represent odds ratios (ORs) and 95% confidence intervals. The vertical line represents OR=1. The reference group was children with no exposure to parental migration before age 3. Models were adjusted for demographic characteristics, household income, home environment and time use variables. *p<0.05.

Figure 2

Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Children Aged 3 to 5 years

Figure 3. Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Adolescents Aged 10 to 14 years



Points represent regression coefficients (B) and 95% confidence intervals. The vertical line represents B = 0. The reference group was children living with non-migrant parents. Models were adjusted for demographic characteristics, household income, home environment and time use variables. **p < 0.01.

Figure 3

Association Between Early Childhood Exposure to Parental Migration and Nutritional Outcomes Among Adolescents Aged 10 to 14 years

Supplementary Files

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