The simultaneous existence of mother-child undernutrition in India: Does father's migration play a role?

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Abstract

Short Abstract

The impact of internal migration on the nutritional status of stay-behind members depends on the type of migration in low- and -middle income countries, including India. However, existing studies have not looked into the simultaneous existence of maternal and child undernutrition by the type of migration in India. Hence, the study assesses the role of father's migration on the nutritional status of mother-child dyads using the India Human Development Survey (2011-12). The nutritional status of the mother is assessed through BMI (underweight) and child through stunting (HAZ). The migration status of the father is categorised into non-migrant, seasonal migrant, and permanent migrant. The analytical models controlled for the sex of the child, maternal characteristics age, education, work, parity, and relevant household characteristics. Results showed that the simultaneous existence of maternal underweight and child stunting is significantly higher when the fathers are seasonal migrants compared to the non-migrants. The risk of clustered undernutrition is significantly higher among poor non-migrant and poor seasonal migrant households compared to households with non-poor non-migrant fathers. This pre-covid study raises questions about the current nutritional vulnerabilities among poor seasonal migrant households that are impacted by the loss of their informal jobs during the lockdowns imposed to combat the COVID-19 pandemic.

Key Words: mother-child dyad, seasonal migration, internal migration, father's migration, undernutrition.

Introduction

Migration profoundly affects all the spheres of life, including health, both at the place of origin as well as at the destination. Migrant children are reported to have a higher likelihood of child undernutrition (Prusty & Keshri, 2014; Pour et al., 2014a; Pour et al., 2014b; Ravindranath, 2019) while their households experience poor dietary diversity (Bowen et al., 2011; Choudhary & Parthasarathy, 2009; Ebrahim et al., 2010). Evidence on the impact of migration on the health of the family members continues to grow with 763 million internal migrants globally. However, most of these studies focus on migrants at their destination in major urban areas rather than their stay behind family members in smaller towns, villages or urban centres.

Globally, it has been observed that out-migration as a livelihood strategy has both positive as well as negative consequences on the left-behind family members, who are often addressed as stay-behind family members. On the one hand, the migration of their family member enhances the income of the stay-behind family through remittances (Cocks, 2021; Davis & Brazil, 2016; Mberu 2006; Taylor, Rozelle, and De Brauw 2003). This economic aspect is associated with a positive impact on the health of the stay-behind family members (Cockx, 2021; Zhou et al. 2015; Mu & Brauw, 2015). On the other hand, it could adversely affect the health of the stay-behind family members, including elderly parents (Adhikari et al., 2011; Falkingham et al., 2017; Scheffel & Jhang, 2018), wives (Lei & Desai, 2021; Roy & Nangia, 2006; Lu, 2012; Sevoyan & Agadjanian, 2010) and children at origin because of reduced child support especially when a mother is a migrant (Ban et al., 2017; Davis & Brazil, 2016; Graham & Jordan, 2013; Mohan et al., 2016; Nguyen, 2016; Sharma et al., 2021; Wickramage et al., 2015).

Though the literature claims that in low- and middle-income countries, the nutrition transition has resulted in increasing rates of overweight and undernutrition, a significant proportion of households in these countries experience undernutrition(Géa-Horta et al., 2016; Masibo et al., 2020; Patel et al., 2020; Pomati et al., 2021; Wojcicki, 2014). In India, 35.7% of children under-five years are underweight, 38.4% are stunted, and 21% are wasted, and a quarter of women in the reproductive age are underweight (IIPS & ICF, 2017). Previous studies have shown that maternal undernutrition increases the risk of undernutrition in children below five years (Adekanmbi et al. 2013; Akombi et al., 2017; Akombi et al., 2017a; Yisak et al. 2015). To ensure optimal cognitive growth and overall health and development, it is essential to address the challenges of malnutrition among stay behind wives and children.

Previous studies have not controlled for the type of migration. The studies on health that have investigated the migration status, typically focused on the stay-behind children, provide contradictory findings. For example, Ban et al. (2016) found that the stay-behind status was not associated with stunting among children aged three and below in China. Islam et al (2018) found that parental migration was a significant protective factor for child undernutrition in Bangladesh, with children who were cared for by their fathers had higher odds of stunting. They argue that remittance could be associated with better nutritional status among these children. In Tanzania, parental migration to urban areas and especially to large cities was significantly associated with improved child growth (Cockx, 2021). In a study in China with 141,000 children in ten provinces, the stay-behind children fared comparatively better on health, nutrition, and educational parameters as compared to those staying with both non-migrant parents (Zhou et al., 2015). In another study from China, there was no significant impact of parental rural to urban migration on the children's height though an improvement in their weight was observed (Mu & Brauw, 2015). Few studies argued that

stay-behind status is not associated with the risk of undernutrition among children. For instance, a study from the Philippines and Vietnam highlighted that there was no general advantage of migrant parents on the stay-behind children's stunting (Graham & Jordan, 2013). While another study found that the father's migration has a negative impact on the child's nutritional status, the inward remittance had no significant influence on the stature of the stay-behind children (Davis & Brazil, 2016). In Sri Lanka, the prevalence of underweight was higher among the stay-behind children as compared to those from non-migrants families (Wickramage et al., 2015).

In Indian settings, we have come across only two studies that have found an association of migration with the nutritional status of children. Lei et al., 2020 found a stark differential in the nutritional status of current and returned migrants. They found that children of returned migrants had lower BMI and height as compared to their counterparts. Contrarily, the father's absence was concomitant with lower height and BMI in communities with a high level of socioeconomic development but not in less developed communities. Rahaman et al., 2012, found that in eight low socioeconomic Indian states, the father's migration had no significant effect on the nutritional outcome of stay-behind children except underweight.

There are no national studies on the nutritional status of stay-behind wives in India. Further, the co-existence of at least two household members with undernutrition that put these migrant households at higher risk of vulnerability remains unexplored in India. Therefore, the aim of this study is to understand the co-existence of maternal and child undernutrition by the type of migration in India. Therefore, this study can be an essential contribution to the field of nutrition research.

Methods

Data

The data used in the present study is from the India Human Development Survey (IHDS), which was conducted during 2011-12. It was jointly conducted by the University of Maryland and the National Council of Applied Economic Research (NCAER), New Delhi. This survey covers a range of topics, including health, education, economy and family. It is a nationally representative survey covering 27,579 rural and 14,573 urban households, spreading across all the states and union territories (except Andaman & Nicobar Islands and Lakshadweep). The rural sample was drawn using stratified random sampling. The urban sample was a stratified sample of towns and cities within states (or groups of states) selected by probability proportional to population (PPP). Details regarding sample selection and sampling can be obtained elsewhere (Desai et al., 2015). At least one eligible woman aged 15 to 49 years was interviewed from each household. One respondent in a household was selected using a standard random number procedure if the household included more than one eligible woman. Height and weight measurements were obtained for children under age 5, aged 8-11 years, their mothers, and other available household members.

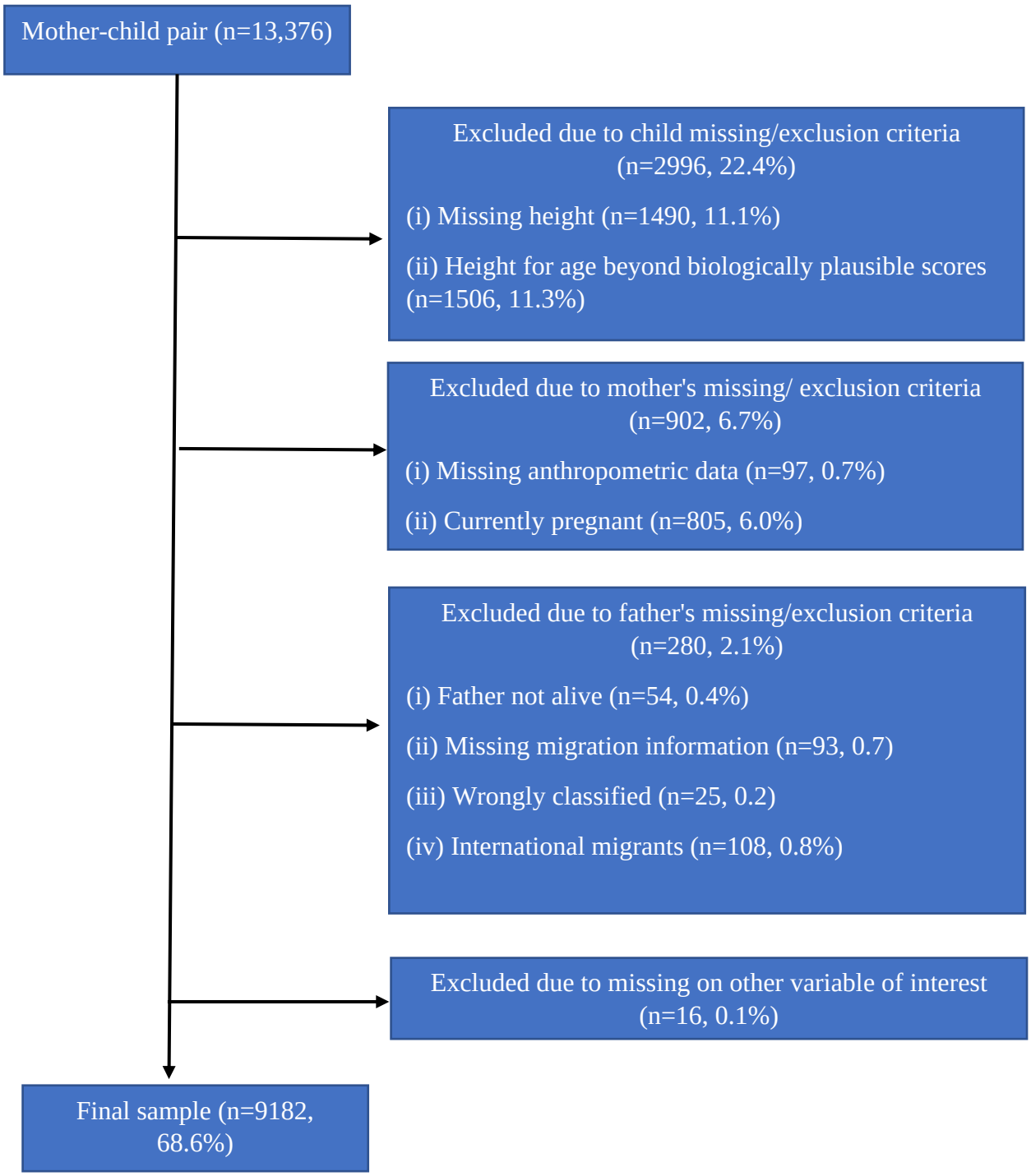
Our study uses the data for 18,677 children aged 0-5 years. As shown in Figure 1, nearly 22% of the respondents were excluded due to missing height data or implausible height for age values. Another 6.7% of the sample was excluded due to missing information related to their mothers. Due to missing father's information, including the migration status, nearly 2% of the sample was further excluded. Removing the cases with missing values on the other variables of interest further reduces the analytical sample to 9,182 mother-child dyads.

Dependent variables

The nutritional status of children aged below five years was assessed through anthropometric measurement, using age and gender-specific World Health Organization (WHO) standards (de Onis et al., 2007). Stunting is defined as a height-for-age z-score below –2 SD from the

median of the WHO reference population. Maternal nutritional status is assessed using body mass index (BMI), which was defined as the ratio of weight in kilograms to the square of the height in meters (kg/m2). A BMI below 18.5 kg/m^2 indicates maternal undernutrition. Mother-child pairs were formed for underweight mother-stunted child.

Figure 1: Flow chart for the mother-child pair sample, IHDS, 2011-12



Independent variables

The main independent variable the 'migration status of father' is categorised into three groups:

i) A father who has been living in the household for more than six months during a year preceding the survey is classified as a non-migrant. Any local move by the fathers (within the village) has been considered as non-migration.

ii) A father who migrated for at least one month in a year to find seasonal/short-term/temporary work, such as work in brick kiln/construction, construction, and tourism, during the last five years preceding the survey and returned at the time of the survey is defined as a seasonal migrant. They often migrate when there is less work in their village or town and keep moving between origin and destination throughout the year.

iii) A father who is currently away from his household for purposes other than seasonal migration is classified as a non-resident member permanent migrant, as referred to in the literature (Lei et al., 2020; Nayyar and Kim, 2018). Our study excludes permanent migrants who have migrated abroad and those who have migrated to another state in the same village. The statistical models controlled for child characteristics (sex; male, female), maternal characteristics, and household characteristics. Maternal characteristics include mother's age (in years), education level (illiterate, up to the primary, up to secondary, higher secondary and graduate and above), work status (not working, working). The socioeconomic status of the family was captured using caste that captures the social hierarchy based on historical discrimination experienced by certain social groups (scheduled castes, scheduled tribes, other backward classes and privileged caste), religion (Hindu, Muslim and others) and poverty status (poor, non-poor). Poverty status is calculated in the data based on the official Planning Commission poverty line as of 2005 (Desai and Vanneman, 2015).

Statistical methods

We used univariate, bivariate and multivariable logistic regression for the analysis. Predictors at multivariate models were reported in terms of ORs and 95% CI. Statistical significance was considered at $P < 0{\cdot}05$. The model I included the main exposure variable, the migration status of father, model 2 controlled for confounders and the final model included the interaction term of migration and poverty status. Sampling weights were applied to account for the survey sampling design used in the IHDS.

Results

Out of the 9,182 mother-child dyads, included in the study for maternal underweight and child stunting 9% (n=734) had seasonal migrant fathers, 9.9% (n=661) had permanent migrant fathers, and 81.1% (n=7787) had non-migrant fathers (Table 1). The majority of the sample were either normal weight mother-normal weight child or normal weight mother-stunted child. Around 17% of the pairs had coexistence of the underweight mothers and stunted children, whereas 5% had overweight mothers and stunted children. Around one-fifth had malnourished mothers (either underweight or overweight) but a normal weight child. Around 30% percent of the mother-child pairs belonged to poor households while 73.5% resided in rural areas. About half of them were females (47.2%). More than one-third of the mothers were illiterate (36.5%), whereas the majority of the mothers were not working (85.5%). Around one-fourth of the mother-child pairs were SCs and a similar percentage belonged to privileged castes. Also, most of them were Hindus.

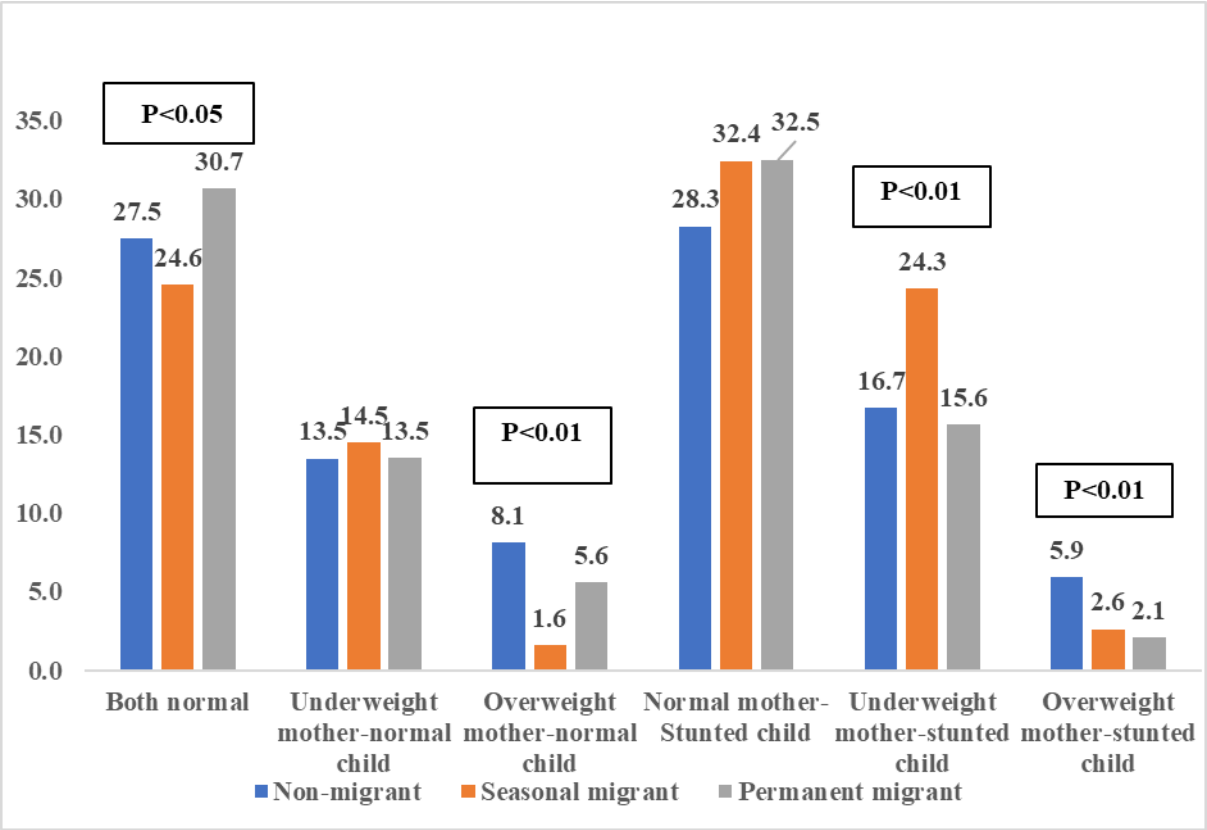
Figure 2 presents the percentage of nutritional status of mothers and children by the migration status of fathers usingbased on chi2 tests. We observed that the mother-child pairs with seasonal migrant fathers have a higher prevalence of underweight mothers and stunted children than the non-migrant households and households with permanent fathers. The

percentage of overweight mothers and stunted children is highest among those who have non-migrant fathers followed by seasonal and permanent migrant fathers. Moreover, the percentage of underweight mother-normal children and both normal were lowest among those whose fathers migrate seasonally.

Table 1: The profile of mother-child pair, IHDS, 2011-12

Characteristics	Percentage	N
Migration status of the father		
Non-migrant	81.1	7787
Seasonal migrant	9.0	734
Permanent migrant	9.9	661
Nutritional status of mother-child pair		
Both normal weight	27.6	2621
Underweight mother-normal child	13.6	1247
Overweight mother-normal child	7.3	742
Normal weight mother-stunted child	29.1	2569
Underweight mother-stunted child	17.3	1499
Overweight mother-stunted child	5.3	504
Poverty status		
Poor	29.2	2533
Non-poor	70.8	6649
Place of residence		
Rural	73.5	6539
Urban	26.5	2643
Sex of the child		
Female	47.2	4308
Male	52.8	4874
Parity mean [SD]	2.48 [1.65]	9182
Mother's age Mean [SD]	27.58 [5.10]	9182
Mother's education		
Illiterate (no education)	36.5	3064
Up to Primary	14.6	1314
Up to Secondary	33.8	3283
Higher Secondary	7.8	805
Graduate and above	7.4	716
Mother's work status		
Working	14.5	1338
Not working	85.5	7844
Caste		
Scheduled caste	23.9	2233
Scheduled tribe	8.6	801
Other backward caste	43.1	3756
Privileged caste	24.5	2392
Religion		
Hindu	81.1	7391
Muslim	15.0	1335
Others	3.9	456
Total	100	9182

Figure 2: Percentage of mother-child pairs by migration status of the father, IHDS, 2011-12



Note: P values are based on chi2 tests

Table 2 shows the results of logistic regression analysis. The unadjusted regression model (model 1) shows higher odds of the dual burden of undernutrition for households whose fathers are classified as seasonal migrants. Once we included other factors in the model (model 2) the dual burden of undernutrition among mother-child dyads is no longer associated with migration status. In model 3, the interaction analysis is used to explore how the association between seasonal migration and the dual burden of undernutrition is moderated by the poverty status of the household which illustrated that mother-child pairs that are poor non-migrants or with a seasonal migrant father had the highest odds of the dual burden of maternal underweight and child stunting. The odds of simultaneous existence of underweight mother and stunted child is higher in a family residing in rural than urban areas. It is lower among the female child. The odds of an underweight mother and stunted child

increase with the mother's increasing parity, whereas it decreases with the increasing age of the mothers. The educational status of mothers has a negative association with the undernutrition of mother and child. For instance, compared to the pairs where the mother had a graduate and above education, pairs who had an illiterate mother had higher odds of dual burden of undernutrition. The odds reduce to 2.06for those whose mothers had up to a secondary level of education. Compared to privileged caste, those belonging to the STs and the OBCs had higher chances of underweight mother and stunted child. The odds of dual burden of undernutrition were more than two times higher among those belonging to the Hindu and Muslims religion compared to others.

Table 2: Logistic regression assessing predictors of simultaneous existence of underweight mother-stunted child by background characteristics, IHDS, 2011-12 (N=9,182)

Background characteristics	Dependent variable- Mother underweight child stunted vs Others		
	Model I	Model II	Model III
Migration status of the father (Non migrant®)			
Seasonal migrant	1.60*** [1.25-2.05]	1.13 [0.87-1.46]	
Permanent migrant	0.92 [0.68-1.25]	0.79 [0.58-1.08]	
Poverty status (non-poor®)			
Poor		1.34*** [1.12-1.60]	
Migration status of father#Poverty status (Non-migrant#Non-poor®)			
Non-migrant#Poor			1.46*** [1.2-1.78]
Seasonal migrant#Non-poor			1.17 [0.83-1.66]
Seasonal migrant#Poor			1.55** [1.07-2.23]
Permanent #Non-poor			1.03 [0.71-1.5]
Permanent#Poor			0.69 [0.42-1.13]
Place of residence (Urban®)			
Rural		1.45*** [1.23-1.73]	1.44*** [1.22-1.71]
Sex of the child (Male®)			
Female		0.86 [0.74-1.01]	0.86 [0.74-1.01]
Parity		1.09** [1.03-1.16]	1.09** [1.03-1.16]
Mother's age		0.96*** [0.94-0.98]	0.96*** [0.94-0.98]
Mother's education (Graduate and above®)			
Illiterate		3.45*** [2.18-5.47]	3.44*** [2.17-5.43]
Up to Primary		2.46*** [1.55-3.93]	2.42*** [1.52-3.86]
Up to Secondary		2.07*** [1.33-3.22]	2.06*** [1.32-3.2]
Higher Secondary		1.22 [0.72-2.07]	1.22 [0.72-2.07]
Mother's work status (Not working®)			

Working	1.18 [0.92-1.52]	1.18 [0.92-1.52]
Caste (privileged caste®)		
Scheduled caste	1.24 [0.95-1.6]	1.23 [0.95-1.59]
Scheduled tribe	1.63*** [1.17-2.26]	1.62*** [1.17-2.24]
Other backward caste	1.24 [0.99-1.54]	1.24 [0.99-1.54]
Religion (Others®)		
Hindu	2.46*** [1.43-4.24]	2.46*** [1.43-4.25]
Muslim	2.40*** [1.34-4.3]	2.38*** [1.33-4.28]

Note: **p<0.05, ***p0.01

Discussion and conclusion

Our study is the first national study in India to show that the level of simultaneous existence of undernutrition among mother-child dyads in seasonal, permanent and non-migrant households. While the previous studies showed the co-existence of undernutrition, they have not focused on migration status of the household. Our results show that the dual burden of undernutrition is significantly higher in poor seasonal migrants compared to non-migrant non-poor households, which was associated with level of poverty. The risk of clustered undernutrition was also considerably higher among poor non-migrant households compared with non-migrant non-poor households. Simultaneous undernutrition in mother-child pairs was not observed when the fathers were poor permanent migrants.

While the current classification of migration serves the purpose of our study to some extent, we argue that more details on migration are required to provide additional insights that could be policy-relevant. For example, we classified non-resident members as permanent migrants following the literature. However, the exact migration period is not collected in the survey (Srivastava et al., 2020), which results in a lack of richness of information on this group. Previous studies have found that with increasing duration of migration, a person's economic status becomes better. We could not explore this dimension of migration due to a lack of data.

Our findings suggest that it is vital to classify migrant households into permanent and temporary households even though both kinds of male migrants leave their wives and

children at the place of origin to migrate alone. This distinction is essential to understanding the true nature of migration in India and its impact on nutritional status. Our study confirms the findings that suggest that the permanent/semi-permanent migrants are generally economically better off than temporary circular migrants (Keshri & Bhagat 2013). Our findings indicate that compared to non-poor permanent migrant households, poor temporary circulatory migrant households have significantly higher clustering of undernutrition. While these temporary migrants migrate to overcome poverty, our results show that they don't successfully overcome it asthey are often engaged in informal jobs and have uncertain employment conditions. They keep on shuttling between the place of origin and destination and frequently switch destinations to make ends meet (Deshingkar & Farrington, 2009; Keshri, 2020; Keshri and Bhagat, 2012; Kumar and Bhagat 2017). We believe that these men have very high levels of precariousness and uncertainty of incomewhich is reflected in the poor nutrition status of their wives and children.

Our study has other data limitations. For instance, it excludes migrant children who accompany their parents during their seasonal migration. Also, migrant fathers who have migrated seasonally and have not returned during the survey are not included in the survey.

The analysis also poses broader questions on the classification of seasonal and permanent migrant workers in India. As the datasets that collect information on nutrition and health often tend not to include information on migration, we recommend that information on migration could be included on a regular basis to improve the quality of evidence.

To conclude, the current analysis highlights nutritional clustering and double vulnerability among poor seasonal migrant households prior to the pandemic. Studies focusing on the impact of COVID-19 on farming communities and women suggests that household food expenditure and dietary diversity declined in these two communities. As seasonal migrants

move to escape hunger and improve their household consumption, our research raises furtherquestions on the nutritional vulnerabilities among seasonal migrant households during the pandemic who lost their informal jobs during the national and regional lockdowns Policy measures must focus on the nutritional vulnerabilities of seasonal migrant families to break the cycle of the clustering of undernutrition that will impact the mother-child dyads across their life course. Otherwise, the process of intergenerational transmission of poor health and stunting will continue showing its impact and will act as a barrier to achieving the No Hunger Sustainable Development goal.

References

Adekanmbi, V. T., Kayode, G. A., and Uthman, O. A. (2013). Individual and contextual factors associated with childhood stunting in Nigeria: a multilevel analysis. *Maternal & Child Nutrition*, *9*(2), 244–259.

Adhikari, R., Jampaklay, A., & Chamratrithirong, A. (2011). Impact of children's migration on health and health care-seeking behavior of elderly left behind. *BMC Public Health*, *11*. https://doi.org/10.1186/1471-2458-11-143

Akombi, B. J., Agho, K. E., Hall, J. J., Merom, D., Astell-Burt, T., and Renzaho, A. M. (2017). Stunting and severe stunting among children under-5 years in Nigeria: A multilevel analysis. *BMC Pediatrics*, *17*(1), 15.

Akombi, B. J., Agho, K. E., Merom, D., Hall, J. J., and Renzaho, A. M. (2017a). Multilevel Analysis of Factors Associated with Wasting and Underweight among Children Under-Five Years in Nigeria. *Nutrients*, *9*(1), 44. https://doi.org/10.3390/nu9010044

Ban, L., Guo, S., Scherpbier, R. W., Wang, X., Zhou, H., and Tata, L. J. (2017). Child feeding and stunting prevalence in left-behind children: a descriptive analysis of data from a central and western Chinese population. *International journal of public health*, *62*(1), 143–151.

Bowen, L., Ebrahim, S., de Stavola, B., Ness, A., Kinra, S., Bharathi, A. v., Prabhakaran, D., & Reddy, K. S. (2011). Dietary intake and rural-urban migration in India: A cross-sectional study. *PLoS ONE*, *6*(6). https://doi.org/10.1371/journal.pone.0014822

Choudhary, N., & Parthasarathy, D. (2009). Is migration status a determinant of Urban nutrition insecurity? empirical evidence from Mumbai City, India. *Journal of Biosocial Science*, *41*(5). https://doi.org/10.1017/S002193200900340X

Cockx, L. (2021). Moving towards a better future? Migration and children's health and education. *Economic Development and Cultural Change*. https://doi.org/10.1086/713931

Davis, J., & Brazil, N. (2016). Migration, remittances and nutrition outcomes of left-behind children: A national-level quantitative assessment of Guatemala. *PLoS ONE*, *11*(3). https://doi.org/10.1371/journal.pone.0152089

de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. (2007). Development of a WHO growth reference for school-aged children and adolescents. *Bulletin of the World Health Organization*, 85.

Desai, S, Dubey, A and Vanneman, R. (2015). *India Human Development Survey-II (IHDS-II)* [Computer file]. New Delhi: University of Maryland and National Council of Applied Economic Research.

Deshingkar P. & Farrington, J. (2009). *Circular migration and multilocational Livelihood strategies in rural India*. New York, NY: Oxford University Press.

Ebrahim, S., Kinra, S., Bowen, L., Andersen, E., Ben-Shlomo, Y., Lyngdoh, T., Ramakrishnan, L., Ahuja, R. C., Joshi, P., Das, S. M., Mohan, M., Smith, G. D., Prabhakaran, D., & Srinath Reddy, K. (2010). The effect of rural-to-urban migration on obesity and diabetes in india: A cross-sectional study. *PLoS Medicine*, *7*(4). https://doi.org/10.1371/journal.pmed.1000268.

Falkingham, J., Qin, M., Vlachantoni, A., & Evandrou, M. (2017). Children's migration and lifestyle-related chronic disease among older parents 'left behind' in india. *SSM - Population Health*, *3*, 352–357. https://doi.org/10.1016/j.ssmph.2017.03.008

Géa-Horta T, Silva Rde C, Fiaccone RL, Barreto ML, Velásquez-Meléndez G. Factors associated with nutritional outcomes in the mother-child dyad: a population-based cross-sectional study. Public Health Nutr. 2016 Oct;19(15):2725-33. doi: 10.1017/S136898001600080X. Epub 2016 Apr 28. PMID: 27121979.

Graham, E., & Jordan, L. P. (2013). Does having a migrant parent reduce the risk of undernutrition for children who stay behind in South-East Asia'. In *Asian and Pacific Migration Journal* (Vol. 22, Issue 3). https://doi.org/10.1177/011719681302200302

International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS

Islam, M. M., Khan, M. N., and Mondal, M. (2019). Does parental migration have any impact on nutritional disorders among left-behind children in Bangladesh?. *Public health nutrition*, *22*(1), 95–103.

Keshri, K. (2019). "Temporary Labour Migration" In S. Irudaya Rajan and M. Sumeetha (Ed.), *Handbook of Internal Migration in India*. Pp. 140-152. (New Delhi: SAGE India)

Keshri, K., & Bhagat, R. B. (2012). Temporary and seasonal migration: Regional pattern, characteristics and associated factors. *Economic & Political Weekly*, *47*, 81-88.

Keshri, K., & Bhagat, R. B. (2013). Socioeconomic determinants of temporary labour migration in India: A regional analysis. *Asian Population Studies*, *9*, 81-88.

Kumar, N. & Bhagat, R. B. (2017) "Interaction between Migration and Development: A Study of Income and Workforce Diversification in Rural Bihar" *Environment and Urbanization ASIA* Vo. 8, No. 1, 2017, pp. 20-136.

Lei, L., & Desai, S. (2021). Male out-migration and the health of left-behind wives in India: The roles of remittances, household responsibilities, and autonomy. *Social Science and Medicine*, *280*. https://doi.org/10.1016/j.socscimed.2021.113982

Lu Y. Household migration, social support, and psychosocial health: the perspective from migrant-sending areas. Soc Sci Med. 2012 Jan;74(2):135-42. doi: 10.1016/j.socscimed.2011.10.020. Epub 2011 Dec 1. PMID: 22169626; PMCID: PMC3259452.

Masibo, P. K., Humwa, F., & Macharia, T. N. (2020). The double burden of overnutrition and undernutrition in mother-child dyads in Kenya: demographic and health survey data, 2014. *Journal of nutritional science*, *9*, e5. https://doi.org/10.1017/jns.2019.39

Mberu, B. U. (2006). Internal migration and household living conditions in Ethiopia . *Demographic Research*, 14

Mohan, P., Agarwal, K., & Jain, P. (2016). Child malnutrition in Rajasthan: Study of tribal migrant communities. *Economic and Political Weekly*, *51*(33).

Mu, R., & de Brauw, A. (2015). Migration and young child nutrition: evidence from rural China. *Journal of Population Economics*, *28*(3). https://doi.org/10.1007/s00148-015-0550-3

Nguyen, C. V. (2016). Does parental migration really benefit left-behind children? Comparative evidence from Ethiopia, India, Peru and Vietnam. *Social Science and Medicine*, *153*. https://doi.org/10.1016/j.socscimed.2016.02.021

Patel, R., Srivastava, S., Kumar, P., & Chauhan, S. (2020). Factors associated with double burden of malnutrition among mother-child pairs in India: A study based on National Family Health Survey 2015–16. *Children and Youth Services Review*, *116*, 105256.

Pomati M, Mendoza-Quispe D, Anza-Ramirez C, Hernández-Vásquez A, Carrillo Larco RM, Fernandez G, Nandy S, Miranda JJ, Bernabé-Ortiz A. Trends and patterns of the double burden of malnutrition (DBM) in Peru: a pooled analysis of 129,159 mother-child dyads. Int J Obes (Lond). 2021 Mar;45(3):609-618. doi: 10.1038/s41366-020-00725-x. Epub 2021 Jan 5. PMID: 33402688; PMCID: PMC7906898.

Pour M. B., Bergström, A., Bottai, M., Magnusson, J., Kull, I., Wickman, M., & Moradi, T. (2014a). Body mass index development from birth to early adolescence; effect of perinatal characteristics and maternal migration background in a Swedish cohort. *PLoS ONE*, *9*(10). https://doi.org/10.1371/journal.pone.0109519

Pour M. B., Bergström, A., Bottai, M., Kull, I., Wickman, M., Håkansson, N., Wolk, A., & Moradi, T. (2014b). Effect of parental migration background on childhood nutrition, physical activity, and body mass index. *Journal of Obesity*, *2014*. https://doi.org/10.1155/2014/406529

Prusty, R. K., & Keshri, K. (2015). Differentials in child nutrition and immunization among migrants and non-migrants in Urban India. *International Journal of Migration, Health and Social Care*, *11*(3). https://doi.org/10.1108/IJMHSC-02-2014-0006

Rahaman, M., Hossain, B., Kundu, S., & Ajmer, S. (2021). Duration of Father Out-Migration and Its Impact on Nutritional Status of Left-Behind Children: A Cross-Sectional Study in Rural EAG States in India. *Indian Journal of Public Health Research & Development*. https://doi.org/10.37506/ijphrd.v12i3.16090

Ravindranath D, Trani JF, Iannotti L. Nutrition among children of migrant construction workers in Ahmedabad, India. Int J Equity Health. 2019 Sep 17;18(1):143. doi: 10.1186/s12939-019-1034-y. PMID: 31530283; PMCID: PMC6747750.

Roy & Nangia, 2005 A.K. Roy, P. Nangia. Reproductive health status of wives left behind by male out-migrants, S. Jatrana, M. Toyota, B.S.A. Yeoh (Eds.), Migration and Health in Asia, Routledge, New York (2005), p. 209.

Scheffel, J., & Zhang, Y. (2018). How does internal migration affect the emotional health of elderly parents left-behind? *Journal of Population Economics*, *32*(3), 953–980. https://doi.org/10.1007/s00148-018-0715-y

Sevoyan A, Agadjanian V. Male labour migration, spousal communication, and STI treatment in Armenia. Cult Health Sex. 2015;17(3):296-311. doi: 10.1080/13691058.2014.936042. Epub 2014 Jul 21. PMID: 25041070.

Sharma, S., Devkota, B., & Acharya, D. (2021). Impact of parental migration on health of Left Behind Children. *Global Journal of Health Science*, *13*(2), 77. https://doi.org/10.5539/gjhs.v13n2p77

Taylor, J. E., Rozelle, S., de Brauw, A. (2003). Migration and Incomes in Source Communities: A New Exonomic of Migration Perspective from China. *Economic Development and cultural Change*, 52(1).

Wickramage, K., Siriwardhana, C., Vidanapathirana, P., Weerawarna, S., Jayasekara, B., Pannala, G., Adikari, A., Jayaweera, K., Peiris, S., Siribaddana, S., & Sumathipala, A. (2015). Risk of mental health and nutritional problems for left-behind children of international labor migrants. *BMC Psychiatry*, *15*(1). https://doi.org/10.1186/s12888-015-0412-2

Wojcicki, J.M. The double burden household in sub-Saharan Africa: maternal overweight and obesity and childhood undernutrition from the year 2000: results from World Health Organization Data (WHO) and Demographic Health Surveys (DHS). *BMC Public Health* **14,** 1124 (2014). https://doi.org/10.1186/1471-2458-14-1124

Yisak, H., Gobena, T., and Mesfin, F. (2015). Prevalence and risk factors for undernutrition among children under five at Haramaya district, Eastern Ethiopia. *BMC Pediatrics*, *15*, 212.

Zhou, C., Sylvia, S., Zhang, L., Luo, R., Yi, H., Liu, C., Shi, Y., Loyalka, P., Chu, J., Medina, A., & Rozelle, S. (2015). China's left-behind children: Impact of parental migration on health,nutrition, and educational outcomes. *Health Affairs*, *34*(11). https://doi.org/10.1377/hlthaff.2015.0150.