Effect of Birth Interval on Childhood undernutrition: Evidence from a recent Large scale survey in India

Harihar Sahoo[1], Holendro Singh Chungkham[2] and Strong P. Marbaniang[3]

Birth interval is the length of time between a child's birth and a previous and/or subsequent sibling's birth. A short subsequent birth interval can place the child at risk for several reasons. The short birth interval can lead to preterm birth and low birth weight as the mother may not have recovered her nutritional status. Because of short birth interval mother's nutrient reserves become depleted, which lead to the increasing risk of intrauterine growth retardation, that adversely affect infant nutrient stores at birth and nutrient delivery via breast milk (Afeworki et. al., 2015; WHO, 2000; 2009). Short birth interval often prompts weaning of the current child, or at least a reduction in the volume of breast milk consumed, and reduced breast milk intake can have adverse effect on both nutritionally and in terms of resistance to infection (Yimer, 2000; lsrat and Khan, 2006; Kathryn, Devey and Cohen, 2004). Due to short birth interval, caring for a new infant also reduces the amount of time that the mother can devote to caring for the older child. The subsequent pregnancy may alter care practices that affect the current child's health (Mazumderet.al., 2000).

Undernutrition among children is caused by several factors, but birth spacing is often overlooked even though it is strongly associated with stunting and underweight. The negative effects of short birth interval are most clearly demonstrated in areas where infant mortality is high. Information on the effects of birth spacing on malnutrition in India, however, is inadequate. Although there is some circumstantial evidence suggesting a negative association, large-scale studies exploring the relation between birth spacing and undernutrition among children are still lacking. The aim of the present study is therefore to determine to what extent the length of preceding birth interval influences the undernutrition among children and which contextual factors thereby play a crucial role using a recent nationally representative large-scale database available in India known as National Family Health Survey (NFHS) carried out during 2015-16. The NFHS-4 provides the normalized *z*-scores for height-for-age and weight-for-age. The two outcome variables, stunting and underweight are calculated from the normalized scores as per the standards of World Health Organization i.e., a child is classified as stunted or underweight if his/her z-score is two or more standard deviations below the mean.

The association between outcome variables (stunting and underweight) and set of predictors was examined by two-way bivariate analyses using chi-squared tests. Further, Multivariate analysis is also used to explore the relationship between birth intervals and outcome variables stunting and underweight controlling for several characteristics of child and mother. This may inflate the standard errors of the estimated odds ratio from the fitted logistic regression, therefore we controlled for this clustering effect by using the "robust cluster" in the regression model to obtain unbiased standard errors.

[1] Assistant Professor, International Institute for Population Sciences, Deonar, Mumbai, India. E.Mail: hariharsahoo@gmail.com
[2] Assistant Professor, Indian Statistical Institute, Tezpur, Assam, India. E.Mail: holendrosingh@gmail.com
[3] Research Scholar, International Institute for Population Sciences, Deonar, Mumbai, India. E.Mail: marbaniangstrong@gmail.com

The results revealed that in almost all the regionthe percentage of stunting and underweight among the children born with an interval of less than 24 months is always higher than the children born after an interval of greater than 59 months (Table 1). There is a wide interstate variation have been found in the prevalence of stunting and underweight. Controlling the effect of other variables, it is evident that as the birth interval decreases the rate of stunting increases. Children born within 24 months (OR=1.28,95%CI: 1.24, 1.33) were significantly more likely to be stunted than those born during 36-59 months. Similarly, the chance of being stunted for children born after 24-35 months (OR=1.14, 95% CI:1.10, 1.18) were significantly higher than those born after 36-59 months. Increase in birth interval shows lower chances of stunting where children born after 60 months or more (OR=0.89,95% CI:0.85, 0.93) were significantly less likely to be stunted compared to those born after 36-59 months. Among the household resources, there is a statistically significant relationship between the household wealth index (standard of living index) and stunting. Almost 51% and 24% of children in the poorest and richest quintiles of wealth index are respectively stunted. The risk of stunting decreases as the wealth index quintile increases, where children who are in poorest quintile(OR=1.38, 95% CI:1.32, 1.43) were significantly more likely to be stunted compared to those in middle quintile. Those children who are in better off household i.e. in the richest quintile are 32% (OR=0.68, 95% CI:0.65, 0.72) less likely to be stunted compared to those who are in middle quintile. Maternal education is also associated with stunting. The odds of stunting for children whose mothers have primary (OR=0.90, 95% CI:0.86, 0.93), secondary (OR=0.76, 95% CI:0.74, 0.79) and higher (OR=0.59, 95% CI:0.55, 0.64) education were significantly less likely than those mothers who do not have any education. Most of the factors related to reproductive and outcomes are significantly associated with stunting. The odds of stunting for children of unwanted pregnancy (OR=1.04, 95% CI: 0.99, 1.09) were significantly higher as compared to children of wanted pregnancy. Children having older siblings' death have lesser odds of stunting compared to their counterparts. Children who have low birth weight (OR=1.44, 95% CI:1.40, 1.49) were significantly having higher odds of experiencing stunting than children of normal birth weight. Quality of care given to mothers before birth of a child is also very important; children of mothers who got pre-natal cares of below-standard have a 1.09 time higher odds of being stunted compared to those who got standard pre-natal care.

The logistics regression model shows the increase in the rate of underweight with a decrease in birth intervals after controlling for other characteristics in the model. Children born with a birth interval of 24 months (OR=1.26, 95% CI: 1.22, 1.31) were significantly more likely to be underweight than those born after 36-59 months. The chances of being underweight for children born during 24-35 months (OR=1.13, 95% CI:1.09, 1.17) were significantly higher than those born after 36-59 months. Lower chances of underweight were associated with higher birth interval, children born after 60 months or more (OR=0.93, 95% CI:0.89, 0.97) were significantly less likely to be underweight compared to those born after 36-59 months.

It has been a topic of discussion in the literatures that undernutrition leads to child mortality and morbidity in most of developing countries. Therefore, it is important to investigate the biological, social, and behavioral mechanisms by which adequate birth spacing might contribute to child health. Of these, birth interval plays an important role in child undernutrition. The finding shows that short birth intervals are associated with an increased risk of child stunting and underweight. A child of birth interval 0-23 months has a higher odds of experiencing stunting and underweight as compared to a child of higher birth interval.Older child experience a higher chance of stunting and underweight as compared to infants. A child with age 12-23 has a higher chance of experience stunting whereas a child with age 24-35 months have a higher chance of underweight. Low birth weight is another predictor of stunting and underweight. The risk of a child experience stunting and underweight decreases as the mothers level of education increases. Children whose mothers were belonging from the poorest wealth quintile have a higher chance of being stunting and underweight. Children of mothers who have received quality prenatal care were less likely to experience stunting and overweight.

Overall, our results indicate that short proceeding birth intervals are associated with diminished height by early childhood. Our results suggest that interventions that aim to increase birth intervals, including family planning and reproductive health services, may still be important in improving stunting in children as well as positively contributing to child health more generally. Encouraging women to space births through family planning services and educational awareness could contribute to reducing childhood undernutrition, improve maternal health, and provide healthy childhood development. Birth intervals can be lengthened through various approaches, but are principally increased through the use of family planning methods and extended exclusive breast-feeding. Longer spacing between two births allows for the optimum use of the parent time inputs and resources for eachchild, which, in turn, improves child health.

References:

Afeworki R, Smits J, Tolboom J, van der VenA (2015) Positive Effect of Large Birth Intervals on Early Childhood Hemoglobin Levels in Africa Is Limited to Girls: Cross-Sectional DHS Study. PLoS ONE 10(6): e0131897, 1-14. doi:10.1371/journal. pone.0131897.

Kathryn G, Devey R, Cohen J. (2004). Birth Spacing Literature: Maternal and Child Nutrition Out Comes. Programme in International Nutrition. University of California, Davis. Sept 2004.

Lsrat Rayhan M, Khan MSH (2006). Factors causing malnutrition among under five children in Bangladesh. *Pakistan Journal of Nutrition*, 5:558-62.

Mazumder AB, Barkat-E-Khuda, Kane TT, Levin A, Ahmed S (2000). The Effect of Birth Interval on Malnutrition in Bangladeshi Infants and Young Children. *J BiosocSci,* 32:289-300.

WHO (2000). Nutrition for Health and Development: A Global Agenda for Combating Malnutrition, Geneva: WHO.

WHO (2009). WHO Anthro for personal computers Manual: Software for assessing growth of the world's children. Geneva: WHO, 2009.

Yimer G (2000). Malnutrition among children in Southern Ethiopia: Levels and risk factors. *Ethiopian Journal of Health Development*, 14:283-92.

Table 1: Percent of stunting and underweight by birth intervals and by States/Union Territories

Nutritional status/ Birth Intervals	Stunted						Underweight					
	0-23	24-35	36-59	≥60	Total	p*	0-23	24-35	36-59	≥60	Total	p*
North												
Haryana	40.3	37.4	34.6	30.6	37.0	0.002	34.3	34.8	29.5	24.9	32.4	<0.001
Himachal Pradesh	31.6	32.5	27.2	15.7	28.3	<0.001	26.9	24.1	21.9	16.7	23.1	0.004
Jammu & Kashmir	35.8	33.1	27.3	23.8	30.3	<0.001	23.4	19.8	15.4	14.4	18.3	<0.001
Delhi	39.3	37.5	32.8	27.7	34.2	0.131	45.0	27.3	28.4	22.0	30.0	<0.001
Punjab	32.0	31.0	21.3	25.1	27.6	<0.001	25.7	23.4	21.4	22.1	23.2	0.296
Rajasthan	44.9	43.2	38.0	30.6	41.0	<0.001	42.0	41.1	37.0	31.9	39.3	<0.001
Uttarakhand	41.2	37.9	31.4	28.5	35.6	<0.001	33.2	30.8	25.2	21.7	28.6	<0.001
Central												
Chhattisgarh	41.5	37.7	39.2	33.8	38.5	0.010	41.9	40.6	39.4	35.8	39.9	0.07
Madhya Pradesh	49.2	45.1	38.1	34.8	43.7	<0.001	51.6	46.4	40.7	35.9	45.6	<0.001
Uttar Pradesh	52.4	49.6	45.6	39.8	48.3	<0.001	44.2	41.3	38.2	34.1	40.5	<0.001
East												
Bihar	52.7	50.5	47.3	44.1	49.9	<0.001	48.9	46.3	43.4	39.5	45.9	<0.001
Jharkhand	50.4	47.6	45.4	38.9	46.4	<0.001	53.7	50.6	47.4	42.8	49.2	<0.001
Odisha	43.7	41.7	36.2	32.2	37.8	<0.001	42.4	41.6	38.4	33.7	38.8	<0.001
West Bengal	47.6	39.9	36.7	30.2	37.7	<0.001	43.2	40.5	33.3	32.7	36.7	<0.001
North-East												
Arunachal Pradesh	40.8	32.7	26.9	27.3	31.4	<0.001	21.8	19.4	16.9	18.8	19.0	0.189
Assam	43.9	42.8	37.0	33.4	38.5	<0.001	34.4	33.9	30.7	24.4	30.4	<0.001
Manipur	39.6	34.9	29.6	26.6	32.4	<0.001	17.5	14.8	12.4	15.0	14.5	0.039
Meghalaya	50.8	46.7	39.9	43.8	45.5	<0.001	33.5	30.7	28.9	29.3	30.7	0.258
Mizoram	36.7	33.2	30.9	26.9	32.2	0.002	17.9	15.4	12.5	10.9	14.3	0.002
Nagaland	34.2	32.7	28.0	18.8	30.4	<0.001	18.4	19.5	16.8	12.8	17.7	0.053
Sikkim	40.4	47.7	27.8	27.9	32.7	0.010	17.5	18.5	19.4	12.0	15.7	0.317
Tripura	33.8	42.7	30.8	20.2	29.8	0.001	28.6	32.0	25.4	25.0	27.0	0.57
West												
Goa	17.5	39.6	14.3	20.4	22.7	0.013	12.5	39.6	25.0	25.9	26.3	0.039
Gujarat	49.0	45.5	38.0	32.9	42.4	<0.001	48.8	47.5	38.6	36.5	43.7	<0.001
Maharashtra	43.6	38.3	35.2	25.5	37.3	<0.001	43.4	40.9	37.2	28.2	39.0	<0.001
South												
Andhra Pradesh	36.4	34.3	32.5	33.8	34.5	0.719	33.4	33.3	32.4	31.0	32.9	0.952
Karnataka	44.2	43.3	37.9	33.3	41.0	<0.001	40.3	40.9	37.1	29.0	38.4	<0.001
Kerala	18.0	22.8	21.7	19.2	20.6	0.603	19.5	16.9	15.9	17.1	16.9	0.817
Tamil Nadu	35.5	29.1	25.0	23.6	28.9	<0.001	31.8	27.1	22.7	20.6	26.2	<0.001
Telangana	38.4	30.3	28.1	36.0	33.2	0.022	33.4	29.7	27.3	41.2	31.8	0.028
Union Territories												
A & N Islands	24.7	26.0	23.4	28.4	25.6	0.910	19.2	19.2	31.2	10.8	20.2	0.02
Chandigarh	41.7	23.1	31.0	30.0	31.3	0.566	16.7	34.6	24.1	30.0	26.3	0.514
D & N Haveli	48.3	52.1	41.2	20.0	42.5	0.060	44.8	62.5	35.3	28.0	44.4	0.013
Daman & Diu	22.2	38.0	29.7	16.7	28.3	0.153	25.9	28.0	31.3	22.2	27.7	0.804
Lakshadweep	33.3	20.8	17.4	23.8	22.3	0.614	20.0	25.0	23.9	14.3	19.6	0.548
Puducherry	31.9	27.5	22.6	25.0	26.6	0.407	23.9	26.7	18.8	19.2	22.1	0.391
India	**46.1**	**43.0**	**37.9**	**32.2**	**40.9**	**<0.001**	**41.0**	**38.5**	**33.9**	**28.7**	**36.5**	**<0.001**

Note: A & N = Andaman and Nicobar; D & N = Dadar and Nagar; **chi-square* test for significance difference between stunting/underweight and birth intervals for each state.