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TRANSITION IN DETERMINANTS OF WASTING AMONGST CHILDREN UNDER 5 YEARS OF AGE OVER A PERIOD OF TWO DECADES IN INDIA

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Abstract: Childhood wasting is a serious public health concern in India. Thus, there was a strong need to identify determinants of stunting and analyse transition in its determinants over a period. National Family and Health Surveys (NFHS) are extensive, multi-phased surveys covering all states/Union territories of India. Primary analysis included children (<5y) from each NFHS surveys; NFHS 2 (N= 5,313), NFHS 3 (12,960) and NFHS 4 (48,265) respectively. Children with reported wasting were 14.1% , 19.1% and 21% in NFHS 2, 3 and 4 respectively. During NFHS 2, higher odds of wasting were Child's age in months (OR: 0.412, $p < 0.001$), gender of the child (OR: 0.672, $p < 0.01$) and birth order (OR: 2.942, $p < 0.01$). During NFHS 3, significant factors affecting wasting are Child's age in months (OR: 1.622, $p < 0.001$), Gender of the child (OR: 0.651, $p < 0.001$) and Maternal BMI (OR: 0.619, $p < 0.05$). During NFHS 4, the higher odds of wasting were child's age in months (OR: 1.624, $p < 0.001$), size of child at birth (OR: 1.586, $p < 0.001$) and the Number of Antenatal visits (OR: 1.463, $p < 0.001$). Programs and policies already in place need to be enhanced, and a focus has to be placed on factors that have consistently emerged over the past 20 years as indicators of childhood wasting.

Index Terms **– wasting, NFHS, determinants, undernutrition, health, maternal BMI, Gender**

INTRODUCTION

Wasting frequently suggests recent and significant weight loss as a result of a children not eating enough and/or having an infectious condition, such as diarrhoea, which led them to lose weight. A young child who is moderately or severely wasted is more likely to die, although therapy is available.

The gravity of the situation lies here, when the facts and figures states that, globally around 45% of death of children under 5 years of age is due to undernutrition further stating that 47 million children under 5 are wasted and 14.3 million are severely wasted (WHO,2021). According to the Global Nutrition target, India has made no progress towards achieving the target for wasting, with 17.3% of children under 5 years of age affected, which is higher than the average for the Asia region (9.1%) and among the highest in the world (Global Nutrition Report, 2019). The World Health Assembly, Global Nutrition Target of reducing and maintain childhood wasting to less than 5%, seems impossible.

Several Studies indicated the factors affecting wasting were mothers' education, low maternal BMI, multiple births, low maternal stature, child's age in months, birth order, lower birth weight, sex of the child,lower immunization, household wealth, region of residence, inadequate dietary diversity, breastfeeding and complementary feeding, lack of safe drinking water (Khan et al., 2019, Darteh et al., 2017, Harding et al., 2018, Aheto et al., 2015, Gebre et al., 2019, Habyarimana, 2016)

The determinants of child malnutrition differ from one study to the other due to differences in the country settings. Most of the studies lacked analysis of transition in determinants over a period of time. An in-depth understanding of the transition in determinants, if any, should help in understanding the prospective changes in future. In order to support the ongoing programmes for healthcare and nutrition, an understanding of the determinants will help in coming up with recommendations for reducing adverse outcomes.

METHODOLOGY

Survey data and study population

Data from NFHS -2 (1998-1999), NFHS- 3 (2005-2006), and NFHS 4 (2015-2016) was used after obtaining permission from Demographic and Health Survey (DHS). NFHS are nationally representative household surveys that use a stratified two-stage survey methodology to collect detailed health and nutrition data from children and their mothers. Weights from the surveys were used to make national and regional estimates more representative. Ethical clearance was obtained from Institutional ethics committee and the allotted number is IECHR/FCSc/2020/60.

Study population and sampling size

Figure 1 shows the scheme for selection of sample for analysis.

Outcome Variables

Wasting defined as WHZ less than -2 SD of the median for their age and gender according to the WHO Child Growth Standards (de Onis, 2006).

Independent Variables

The independent variables were Socio- demographic profile of the population, maternal Characteristics, nutritional status of the children, Infant Young and child feeding (IYCF) practices, Maternal and child health (MCH) services etc.

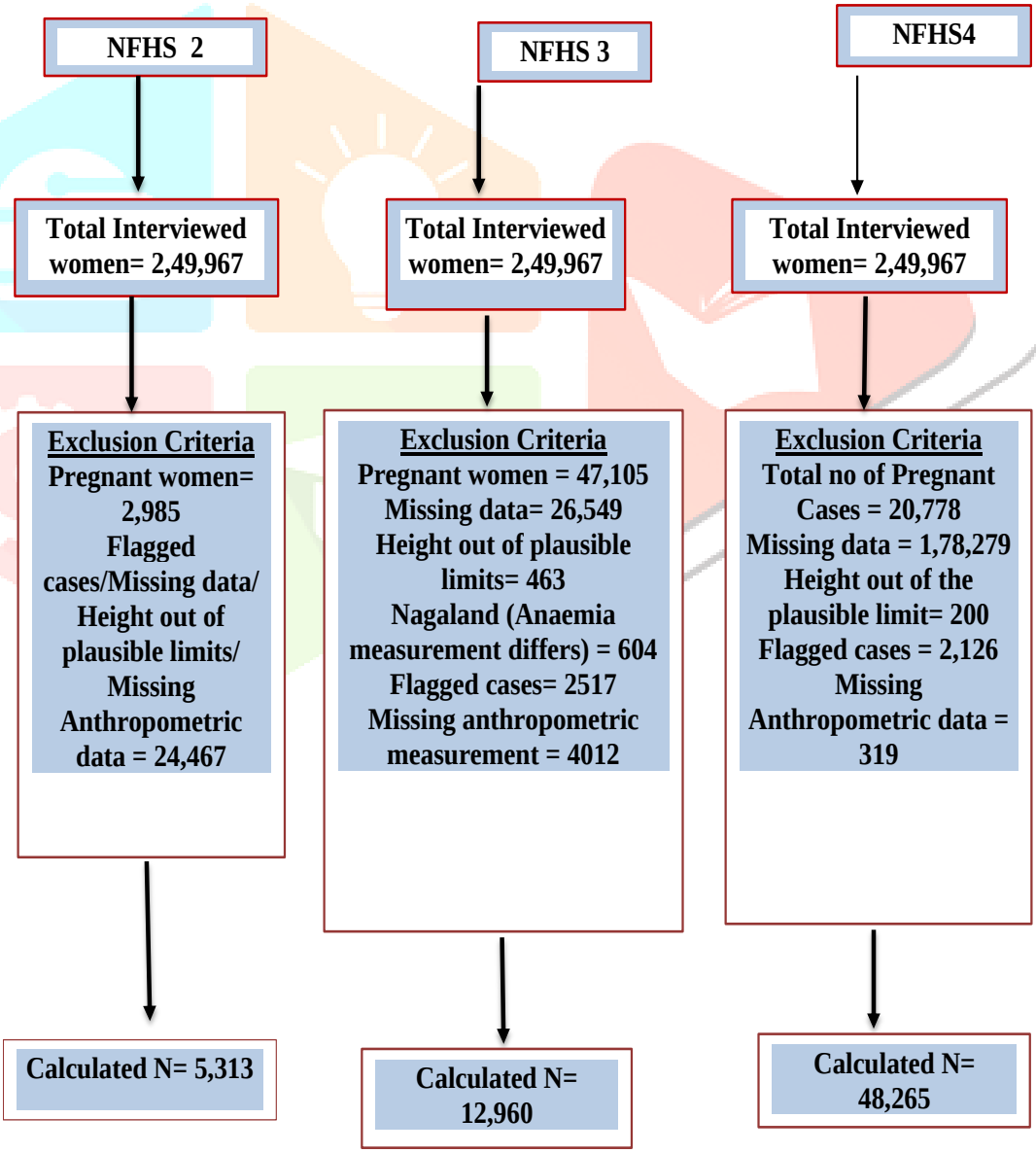

Figure 1- Sample selection scheme

Statistical analysis

For selected variables frequencies and percentages of the all the parameters were calculated and arranged. Means and standard deviation of each parameter were calculated and expressed numerically. Crosstabs were computed between the nutritional status of children i.e., wasting and other variables of interest which determines the interaction between the variables. Binary logistic regression was performed to establish determinants and ascertain effects of selected characteristics on the likelihood that children were wasted (WHZ scores <-2sd). The statistical significance and strength of magnitude (as measured by odds of stunting) tabulated helped in understanding the transition in determinants. The statistical analysis was done using SPSS version 26.

RESULTS

Determinants of wasting according to NFHS 2

The sample size of selected children was 5,313 of which 64.4 % resided in rural areas of which 9.7% were wasted children. Higher odds of stunting were observed in children of age group 24-35 months (OR: 0.412, $p < 0.001$). Male child had higher odds of wasting (OR: 0.672, $p < 0.01$). As the birth order (OR: 2.942, $p < 0.01$) increased the odds of wasting increased.

Determinants of wasting according to NFHS 3

The sample size of selected children was 12,960 of which 65.6 % resided in rural areas and 13.3 % were wasted children. Highest odds of wasting were observed in children of age group 12 – 24 months (OR: 1.622, $p < 0.001$). Male child (OR: 0.651, $p < 0.001$) was more prone to wasting as compared to female counterparts. As the maternal BMI (OR: 0.619, $p < 0.001$) increases odds of wasting reduces. As mothers' education (OR: 1.307, $p < 0.01$) increases odds of wasting increases.

Determinants of wasting according to NFHS 4

The sample size of selected children was 48,260 of which 71.9 % resided in the rural areas and 15.4 % were wasted. Highest odds of wasting were observed in children of age group 12 – 24 months (OR: 1.624, $p < 0.001$). Higher odds of wasting were observed in children with small size (OR: 1.586, $p < 0.001$). As the number of antenatal visits (OR: 1.463, $p < 0.001$) increased the odds of wasting was lowered. Male children (OR: 0.714, $p < 0.001$) were more prone to wasting. As the maternal BMI (OR: 0.668, $p < 0.001$) increases odds of wasting reduces

Table 1- Odds of Wasting amongst children (06-59 months) by selected characteristics- India NFHS 2, 3 and 4 (N=48,265)

Parameters	95% CI								
	Wasting (WHZ <-2sd) NFHS 2			Wasting (WHZ <-2sd) NFHS 3			Wasting (WHZ <-2sd) NFHS 4		
	Odds ratio	Lower	Upper	Odds ratio	Lower	Upper	Odds ratio	Lower	Upper
Place of Residence									
Urban									
Rural	1.280	.988	1.658	.841	.705	1.003	.895**	.819	.979
Wealth Index									
Poorest	NA								
Poor				.917	.751	1.120	1.020	.929	1.120
Middle				.809	.652	1.005	1.003	.901	1.117
Richer				.831	.645	1.070	.905	.799	1.025
Richest				.767	.555	1.062	1.179*	1.014	1.372
Number of Household members									
0-5									
6-10	1.089	.830	1.429	1.074	.919	1.255	.887**	.825	.954
11-15	1.212	.845	1.736	.930	.708	1.221	.815**	.715	.928
16-20	.708	.354	1.417	.969	.496	1.892	.754	.548	1.038
21-25	1.058	.329	3.396	.420	.118	1.494	1.115	.670	1.853
>25	2.020	.184	22.162	.742	.077	7.166	.433	.108	1.736
Gender									
Male									
Female	.672**	.534	.846	.651***	.567	.747	.714***	.668	.762
Age (in months)									
0-5									
6-11	.545*	.337	.880						
12-23	1.617*	1.059	2.469	1.622***	1.273	2.068	1.624***	1.442	1.830
24-35	.412***	.261	.649	.913	.710	1.173	.579***	.510	.656
36-47	NA			.820	.631	1.067	.933	.821	1.060
48-59				.794	.603	1.045	1.190*	1.043	1.357
Birth Order									
First									
Second or Third	1.386*	1.013	1.895	.924	.752	1.134	.977	.892	1.071
Fourth or Fifth	1.411	.841	2.365	.798	.608	1.048	.997	.857	1.159
Sixth or more	2.942**	1.437	6.020	.878	.621	1.241	.991	.819	1.200
Size at birth									
Very large	NA			.911	.600	1.381	1.474***	1.245	1.746
Larger than average				1.082	.730	1.603	1.334***	1.152	1.544
Average				1.348	.891	2.040	1.525***	1.280	1.819
Smaller than average				1.693*	1.072	2.674	1.586***	1.277	1.970
Very small				1.236	.643	2.374	1.372*	1.045	1.802

Breastfeeding initiation within 1 hour									
Yes									
No	1.101	.862	1.406	1.134	.982	1.310	.973	.907	1.044
Ever Vaccinated									
No									
Yes	1.093	.866	1.381	.873	.731	1.042	.965	.920	1.013
Prevalence of Anaemia									
Severe	NA			.821	.576	1.170			
Moderate				.918	.634	1.329	.858	.677	1.087
Mild				.958	.660	1.390	.847	.667	1.076
No Anaemia							.819	.646	1.039
Mother's Age in Years									
15-19	NA								
20-29				1.002	.675	1.487	1.254	.976	1.611
30-39				.989	.628	1.559	1.298	.989	1.704
40-49				1.043	.584	1.864	1.159	.828	1.621
Mother's Age at first birth (in Years)									
15-19									
20-29	1.611	1.187**	2.186	.947	.808	1.110	1.089*	1.010	1.174
30-39	3.864	1.031*	14.488	1.880*	1.021	3.463	.989	.754	1.297
40-49	.874	.482	1.585	-	-	-	.186*	.036	.971
Number of Antenatal visits									
0									
1-2	1.025	.685	1.533	.946	.780	1.147	1.048	.948	1.158
3-4	1.245	.843	1.841	.934	.760	1.147	1.032	.935	1.140
5-8	.937	.617	1.423	.957	.756	1.213	1.280***	1.152	1.423
9-12	1.391	.783	2.469	.804	.569	1.136	1.463***	1.271	1.683
13-15	.373	.053	2.607	1.963	.921	4.185	1.461*	1.063	2.009
≥ 16	1.507	.454	5.005	.946	.780	1.147	1.079	.827	1.407
Educational attainment									
No education									
Primary	.980	.708	1.355	1.307**	1.054	1.619	.896*	.806	.995
Secondary	.925	.678	1.261	1.115	.915	1.359	1.026	.938	1.123
Higher	.883	.569	1.370	1.407	.938	2.109	.789**	.677	.920
Body Mass Index (Kg/m^2)									
<16.0									
16.0-18.5	.737	.478	1.136	.760*	.589	.979	.668***	.578	.771
18.5-22.9	.770	.500	1.187	.619***	.480	.797	.603***	.525	.693
23- 25	.509	.252	1.026	.561**	.382	.825	.565***	.477	.669
>25	.829	.444	1.548	.427***	.287	.636	.439***	.372	.520
Prevalence of anaemia (Mothers)									
Severe									
Moderate	NA			1.009	.575	1.769	.814	.582	1.138
Mild				1.151	.667	1.988	.889	.641	1.233
No Anaemia				1.049	.607	1.815	.893	.644	1.240

Transition in determinants of wasting over two decades

The results depicted the factors significantly associated with wasting in NFHS 2 were, child's age in months (OR: 0.412, $p < 0.001$), gender of the child (OR: 0.672, $p < 0.01$) and birth order (OR: 2.942, $p < 0.01$) (Figure 2).

In NFHS 3, the factors were Age in months (OR: 1.622, $p < 0.01$), Gender of the child (OR: 0.651, $p < 0.001$), Maternal BMI (OR: 0.619, $p < 0.001$), Mother's education (OR: 1.307, $p < 0.01$) and size at birth (OR: 1.693, $p < 0.05$).

In NFHS 4, the factors which were significantly associated with wasting were child's age in months (OR: 1.624, $p < 0.001$), size of the child at birth (OR: 1.586, $p < 0.001$) smaller than average children were more likely to be wasted, number of antenatal visits (OR: 1.463, $p < 0.001$), Gender of the child (OR: 0.714, $p < 0.001$), Maternal BMI (OR: 0.668, $p < 0.001$), place of residence (OR: 0.895, $p < 0.01$). Weaker associations were observed in wealth index and mother's education. Child's age in months and gender were common in all the surveys hence emphasis must be laid to improve it. Maternal BMI and size at birth were common for two surveys NFHS 3 and 4 (Figure 2).

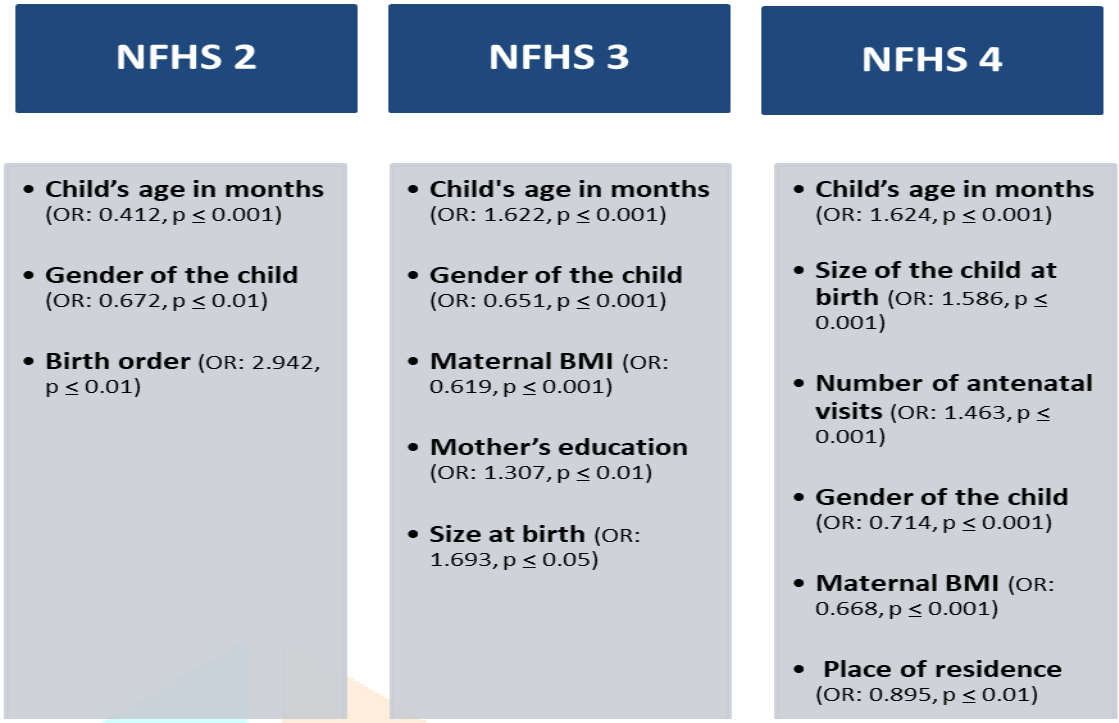

Figure 2: Transition in Determinants of Wasting Over Two Decades

DISCUSSION

Emphasis must be laid on the predictors, which constantly emerged as the determinant in all the three surveys. |The present study found that wasting prevalence was higher in children between 12- 35 months. Size of the child at birth and gender were found to be strong determinants of wasting. The demand for nutrients increases with the age of the child. Adequate complementary feeding along with breastfeeding is crucial for child's growth and development (Dewey KG & Adu-Afarwuah S, 2008; Frongillo et al., 2017; Nguyen et al, 2017). There are ample programmes in India for upliftment of the girl child, as discrimination and female foeticide was on rise. Sex of the child was an important determinant for wasting and surprisingly male child was more prone to undernutrition as compared to girl child. Interventions and programmes that run in India such as ICDS since the last 40 years are unable to meet India's target of achieving malnutrition free India. Scaling up the interventions for children under five may help in avoiding undernutrition (Alderman et al.,2019).

Mother's nutritional state is associated with child's nutrition (Akombi et al., 2017). The risk of wasting was more in children born to women with BMI lower than normal (<18.5 kg/m2). The importance of adolescent female reproductive health is nowadays well recognised in developing nations, particularly in terms of the outcome of enhanced nutrition for children under the age of five (Negash et al.,2015). Although, Government of India runs programmes for improving maternal and child health such as Janani Suraksha Yojana (JSY), Janani Shishu Suraksha Karyakram (JSSK), LaQshya and Pradhan Mantri Surakshit Matritva Abhiyaan still maternal BMI has been an important determinant for wasting during NFHS 3 and 4.

Higher the wealth index and mother's education, awareness and behaviour towards infant and young feeding practices is enhanced (Senarath & Dibley, 2012). Development of women and child in rural areas was launched in 1982- 83 as a sub scheme of Integrated rural development programme. One of the reasons might be there are less poverty alleviation programmes which help urban women, all programmes focus on the rural poor. Mahila Samkhya Program, Kasturba Gandhi Balika Vidyalaya Scheme (KGBV), National Programme for Education of Girls at Elementary Level (NPEGEL), Sarv Sikhsha Abhiyan programmes for women's education. Despite these programmes maternal education was an important predictor of wasting.

RECOMMENDATIONS

In order to make these programmes more successful the approach shouldn't be from top to bottom but vice versa. Instead of standardising nationwide policy rules, it should be made area or region specific. Researches have shown that the states are performing better through small innovations. Best practices should be adopted.

Mother's nutritional and health state is crucial in early child growth and development, mother's nutritional status should be taken into account when developing policies to reduce child malnutrition.

Convergence must be strengthened between different ministries, centre and state.

CONCLUSION

Despite decline in wasting rates over the decade, India is home to world's highest number of children who are wasted. Understanding determinants which cause stunting and transition in determinants over a period of two decades was necessary to highlight key areas where focus is required. Present study helped in identifying gaps in programmes and policies and recommending suggestions to the practitioners which might aid in reducing stunting in India.

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