Article

Caste and Socioeconomic Inequality in Child Health and Nutrition in India: Evidences from National Family Health Survey

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Abstract

This study is on caste inequality in child health outcomes: mortality, malnutrition and anaemia for the year 1998/99 to year 2019/21 and examines the association of socio-economic factors with outcomes. Disparity ratio (DR) and Concentration Index (CI) are computed to examine inequality in outcomes. The association of socio-economic factors was modelled using logit regression. The study finds marginalised group were more likely to have poor health outcomes. The disparity ratio found increased among SC and ST compared to *Others* during 1998-99 and 2019-21. The value of the concentration index was found high on U5MR among SC and ST. Among SC and ST, the child health outcome greatly varies for poorest and richest. Odds ratio is 40-60 per cent higher for SC and ST compared to children belonging to *Others.* On socio-economic factors; land ownership and wealth status contribute significantly but house ownership not so. Caste-based inequality is still impacting health and nutrition of children in the country. The more focused inclusive policy and clustering of marginalised groups at regional level can be helpful in improving health and nutrition of marginalised children concentrated in different regions with equity lens to push the SDG Goals.

Keywords

Caste, land, mortality, malnutrition, SC/ST, SES

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Introduction

Inequities in health constitute one of the main challenges for public health globally. Globally, socioeconomic status (SES) or social position as measured by social determinants; such as education, income or occupations having association with a wide range of health indicators (Braveman & Gottlieb, 2014; Darin Mattsson et al., 2017; Feinstein, 1993; Wilkinson, 2002; Williams, 1990). In the Indian context, socioeconomic status is a reflection of social stratification manifested through the caste system (Mishra, 2006) and caste has been considered broadly as a proxy for socio-economic status and poverty (Borooah, 2012; Childers & Chiou, 2016; Kulkarni et al., 2020; Subramanian, et al., 2006). In India, within the axis of socioeconomic and cultural dimensions, ethnicity is studied widely through social/caste groups, which play a significant role in shaping health outcomes (Acharya, 2013; Baru et al., 2010; Bora et al., 2019; Borooah, 2010; Nayar, 2007; Raushan, 2020; Raushan & Mutharayappa, 2014; Raushan & Prasad, 2017). Poor social and economic status of those castes lower on the caste hierarchy is bound to have an influential effect on health (Dommaraju et al., 2008; Kulkarni et al., 2020; Mohanty, 2011; Thorat & Madheswaran, 2018). It also causes depletion to the developmental aspects of the country's health policy.

Caste-based inequalities in health have two broader perspectives: First, caste-based social and economic deprivations regulate health outcomes of different castes like SC/ST and place them at the bottom of the caste ladder and *Others* caste on the top. Scheduled Caste, Scheduled Tribes and in some cases the Other Backward Classes are considered as poor and socially disadvantaged groups (Acharya, 2013; Nayar, 2007; Raushan, 2020; Raushan & Acharya, 2018; Thorat & Neuman, 2012). Second, disadvantage and discrimination endured by the low and poor caste keep them away from the mainstream and dissuades them from availing health and healthcare facilities and impedes their responses to health and healthcare ultimately leading to poor health outcomes (Acharya, 2013; Baru et al., 2010; Borooah, 2010; Raushan, 2020; Raushan & Acharya, 2018).

Most of previous studies have divided caste groups into SC/ST and non-SC/ST except few which considered each social group as a separate group (Raushan & Acharya, 2018; Raushan & Mutharayappa, 2014; Subramanian, et al., 2006). Importantly there are emerging trends of caste-based studies on health outcomes getting noticed (Bora et al., 2019; Prasad & Raushan, 2020). SC and ST are not the homogenous groups and have their own cultural traits (although within the group there is heterogeneity) but the case may be the same for OBC and forward caste. Even within a group like ST, which is located in central India may be different from ST of north-east, west or south India which needs separate investigation considering a different approach to generate policy-level evidence.

Improvement in child health is a key indicator on progress towards the third goal of the United Nations' Sustainable Development Goals: A universal guarantee of a healthy life and well-being at all ages. Among them; mortality, malnutrition and anaemia are the key indicators. Mortality as a negative outcome has been used as an indicator to measure the status of child health and also the overall health status of the country. The association between caste and child mortality is well documented across literature (Bora et al., 2019; Deshpande, 2002; Mohindra et al., 2006; Nguyen et al., 2013; Ram et al., 2016; Raushan et al., 2016; Sahu et al., 2015; Subramanian, et al., 2006; Vikanes et al., 2010). Studies discuss malnutrition at early ages leads to poor child growth and development (Walker et al., 2005) on the one hand and a higher incidence of morbidities and mortalities on the other hand (Walker et al., 2007).

Malnutrition is responsible for nearly half of all deaths among children under five years, and together with poor diets, is a major driver of the global burden of disease. At least 57 countries are experiencing serious effects of both under nutrition, including stunting and anaemia, and adult overweight and obesity (Haddad et al., 2015). Anaemia in young children is a serious concern because it can result in impaired cognitive performance, low behavioural and motor development, coordination, language development, and scholastic achievement, as well as increased morbidity from infectious diseases. Iron deficiency anaemia used to be regarded as one of the 'Top Ten Risk Factors' for death (Dubey et al., 1994). During the first decade of twenty-first century, India was the largest contributor to child anaemia among developing countries (Pasricha et al., 2010).

Several studies have discussed that socio-economic status of a household is one of the factors responsible for high mortality, malnutrition and anaemia among children. Studies have found that caste differences in infant and child mortality are substantially reduced when parental socio-economic characteristics are held constant (Ram et al., 2016). Dommaraju et al. (2008) has found a complex relationship between caste and child mortality and postulated that although there are inter-caste inequality but it does not mean that there are no differences within the lower caste groups and those differences can be explained by the disparity in economic positions occupied by the group (Dommaraju et al., 2008). Household income, poverty, and mother's education are the strongest factors that influence child nutrition in developing countries (Glewwe, 1999).

Association of caste and child health inequality has been found significant in many studies (Borooah, 2004; Nayar, 2007; Prasad & Raushan, 2020; Ram et al., 2016; Saikia et al., 2019; Subramanian, et al., 2006) and require further investigation with a new approach. Previous studies have provided ample evidences of poor outcome on many health and healthcare indicators among SC/ST than the rest (Nayar, 2007; Prasad & Raushan, 2020) but the progress and current scenario of child health inequality along caste and socio-economic lines is missing. Hence, this study is framed

to examine the inequality in child health and malnutrition and its linkage with socio-economic factors that alter child health in the country. It is important for policy drive that includes the development and wellbeing of every individual as persisting disparity and inequality have remained issues of concern in the policy domain.

Data and Methods

The data used in the study is the latest available Indian version of demographic and health survey data i.e., National Family Health Survey (NFHS)-5 collected during 2019/21. However, the previous three rounds of NFHS-2: 1998/99, NFHS-3: 2005/06 and NFHS-4: 2015/16 is also used in the study. Internationally, NFHS is Demographic Health Survey (DHS) version for India; a large-scale cross-sectional survey that provides estimates from demographic and health parameters at national and state levels. However, for the first time, NFHS-4 had provided estimates at the district level for some of the selected demographic, health and healthcare indicators. NFHS-5 also adopted a two-stage sample design. Details of the sample size, design, and sample weight can be obtained from the NFHS reports (IIPS & ICF, 2022).

NFHS-5 collected data from a total of 6,36,699 households. The study is based on health, nutrition and anaemia among the children born in the last five years at the time of the survey during 2019/21. In NFHS-5, there were a total of 2,32,920 children under five years of age. Of those; 47,848 are from SC; 47,118 from ST; 89,093 from OBC; 36,573 from *Others* and the remaining 12,228 either don't know their caste identity or information is missing. Hence, the caste group specific analysis is restricted to 2,20,632 children for this specific study.

Outcome Variables

The outcome variables are child health and nutrition indicators. Globally, mortality is used to evaluate progress on health status whereas stunting, underweight and anaemia are considered to evaluate the nutritional status of children. On Nutrition; stunting reflects the inability to receive adequate nutrition over a long period of time and is also marked by recurrent and chronic illness. Underweight is a composite index of height-for-age and weight-for-height. It takes into account both acute and chronic malnutrition. Iron deficiency is one of the leading causes of disability in developing as well as developed countries , well known as anaemia.

For the purpose; on mortality-neonatal mortality rate (NMR), infant mortality rate (IMR) and under five mortality rate (U5MR) is considered. On nutrition; underweight, stunting and anaemia is considered. Mortality rate is calculated per 1000 live births whereas malnutrition is calculated on proportion of children having specific kind of

malnutrition. As per the world health organisation, recommended cut off points of less than minus two standard deviations is considered for underweight and stunting (WHO, 2006). For anaemia, the Hb level below 11 g/dl is considered as anaemic (IIPS & ICF, 2022).

Exposure Variables

The independent variable is caste groups- Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Classes (OBC) and *Others,* as per Govt. of India classification of caste into four broader social or caste groups. The Scheduled Caste (SC) and Scheduled Tribe (ST) are among the most disadvantaged caste groups having poor to poorest socio-economic development. The OBC are considered low in the traditional caste hierarchy. Whereas *Others* is the caste category which have higher social status and are well-off on socio-economic development (Raushan, 2020). Indicators pertaining to economic status and educational level are considered for the reflection of socio-economic status. For economic status; own land, housing and wealth index is considered. Mother's education is considered for level of education variable.

Statistical Analysis

Univariate, bivariate and multivariate methods is performed to find the factors associated with caste and socio-economic inequality in child health. Progress on health outcomes and disparity ratio (DR) across the social groups is calculated for the selected variables at four different time points: 1998/99, 2005/06, 2015/16 and 2019/21 considering the last two decades. State level map provides areas of high mortality at regional level for U5MR among SC and ST. However, some states and UTs have been dropped where sample children of ages below five years born in the last five years were less than 30 for a specific caste group. Based on the latest round of data, a total of 20 interaction groups considering caste and wealth index is constructed to understand socio-economic differentials in child health indicators.

Further, income-based inequality for SC and ST children are measured on Concentration Index (CI) and Concentration Curve (CC). Finally, logit regression is performed, first only with social groups and then independently for land, housing and wealth index to understand the differential risk of each factor on poor health outcomes. Finally full model is employed considering gender and mother's education, other than indicators of economic status as discussed previously. The results of logit regression are presented through odds ratio at five per cent significance level. Somewhere, 10 per cent significance level is considered and appropriate justification is provided for the same.

Concentration Index

Income-related inequality in child health and malnutrition using wealth score as the economic indicator is calculated using concentration index (CI) and the concentration curve (CC), and a binary outcome variables. In the study, wealth score is used as a proxy of income widely used in health studies across the world. The concentration index is defined as twice the area between the concentration curve and the line of equality. The concentration curve is obtained by plotting the cumulative proportion of outcomes against the cumulative proportion of the population ranked by the economic indicator (World Bank, 2008). It can be written as,

$CI = 2*cov W (Y_i, R_i)$

Where,

Y_i = outcome of the 'i'th individual

R_i = Fractional rank of the 'i'th individual (for weighted data) on HH economic status

'$covW$' = Weighted covariance.

The value of CI quantifies the extent of inequality and varies between +1 and -1. A negative value indicates concentration of specific outcome among poorest/poor and the curve lies above the line of equality. In case of positive value, the opposite happens. The larger the absolute value, the greater the inequalities. Index value zero reveals absence of socio-economic inequality.

Logistic Regression

The association of socio-economic factors are regressed on binary logistic regression. Logit regression models relationship between a binary response variable (P) and one or more explanatory/predictor variables (X). The model is like as follows:

Logit $(P) = Log \{P/(1-P)\} = \alpha + \beta X$; where, X is explanatory or predictor variable of P.

Or, Logit $(P) = b_0 + b_1 X_1 + b_2 X_2 + \text{---------} + b_k X_k$

Or, Log $(P/1-P) = b_0 + b_1 X_1 + b_2 X_2 + \text{---------} + b_k X_k.$

Where, $X_1, X_2, \text{------} X_k$ are predictor variables and (P/1-P) is the Odds.

Odds ratio is used to compare the odds for two groups, in the same way that the relative risk is used to compare risks (Westergren et al, 2001) and it can be understood as

$$\text{Odd Ratio} = \text{Odd Ratio} = \frac{p/(1-p)}{q/(1-q)}$$

Where, p and (1-p) is the probability of occurring and not occurring for the first group, and

q and (1-q) is the probability of occurring and not occurring for the second group.

Results of the Study

Progress on Child Health Outcomes

In India, progress on child health outcomes have been widely accepted and are the reflection of various programme and policy interventions during the last two decades. Looking at indicators like mortality, malnutrition and anaemia; continuous decline has been observed. However in case of anaemia, an increase is also observed as reflected from 2019/21 NFHS data. Across caste lines, continuous decline except for anaemia has also been observed for all the groups between 1998/99 and 2019/21. However, marginalised caste groups like Scheduled Caste and Scheduled Tribe continue to have the highest rates of mortality and malnutrition.

Looking at mortality, SC children have the highest neonatal death per 1000 live births across all the groups. However; on malnutrition and anaemia, the highest prevalence is found among ST children throughout the study period. It is also observed that there is no much difference between SC and ST children on the said indicators. Like in 1998/99; NMR, IMR and U5MR is found 53/1000, 83/1000 and 119/1000 among SC whereas it was 53/1000, 84/1000 and 127/1000 among ST children. In 2019/21 it is declined to 29, 41 and 49 per 1000 for SC to 29, 42 and 50 per 1000 for ST children respectively. Same is found for malnutrition and anaemia is pervasive from figure 1 and appendix table 1.

Caste Disparity in Health Outcomes

The persisting disparity and differentials in child health of marginalised and better-off groups have remained issues of concern in the policy domain. Here, Disparity Ratio (DR) has calculated for SC and ST children at four time points spanning over two decades is presented in table 1. On all the indicators under study; the DR is found high for SC and ST at all four time points, with exception for NMR among ST during 2005/06. Another interesting point is that the disparity ratio on all the three indicators of mortality has increased over the period for both SC and ST compared to *Others*. Among SC for NMR, the DR is increased from 1.31 in 1998/99 to 1.42 in 2005/06 and 1.50 in 2019/21. For IMR and U5MR it is found increased from 1.34 to 1.41 to 1.45; and 1.44 to 1.45 to 1.49 respectively. Among ST; DR for NMR also found increased from 1.31 to 1.35 to 1.48; for IMR it increased from 1.36 to 1.38 to 1.49; and for U5MR, it remained 1.53 in 1998/99 and found same as in 2019/21.

On underweight and stunting, the DR is found highest for SC and ST to *Others* in 2005/06. However over the last two decades, DR has been found either to decline or remained same as of the previous round. The same has been found in the case of anaemia. It is noted that the DR for anaemia is found almost same in 2019/21 compared to 1998/99 for both the SC and ST to *Others* children. But, we can't clearly pose here that the pattern of disparity ratio is same, either for SC or ST and consistent on all the indicators under the study. Even DR for indicators of malnutrition and anaemia among ST to *Others* is found more than SC to *Others* over the study period.
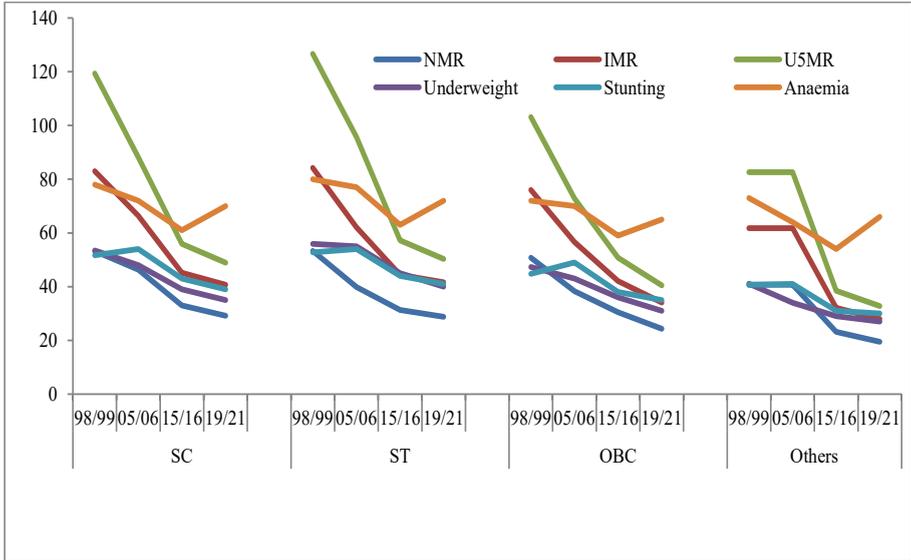
Figure 1: Progress on mortality, malnutrition and anaemia among children: 1998/99 to 2019/21

Source: Calculated by authors using various round of NFHS data

Table 1: Disparity ratio in outcomes among SC and ST in India (with respect to Others): 1998/99 – 2019/21

	NMR	IMR	U5MR	UWT	STN	ANE
SC to Others						
1998/99	1.31	1.34	1.44	1.30	1.27	1.07
2005/06	1.14	1.07	1.07	1.41	1.32	1.13
2015/16	1.42	1.41	1.45	1.34	1.39	1.13
2019/21	1.50	1.45	1.49	1.30	1.30	1.06
ST to Others						
1998/99	1.31	1.36	1.53	1.36	1.30	1.10
2005/06	0.98	1.00	1.16	1.62	1.32	1.20
2015/16	1.35	1.38	1.49	1.55	1.42	1.17
2019/21	1.48	1.49	1.53	1.48	1.37	1.09
UWT: Underweight, STN: Stunting, ANE: Anaemia						

Source: Calculated by authors using various round of NFHS data

Socio-Economic Inequality in Health Outcomes

Inequality in health outcomes constitutes a major policy challenge and a widely used measure is socioeconomic status (SES) measured usually on social determinants like education, caste, income or occupation. As in the case of India, caste and economic status plays a major role in shaping the outcomes, but how it contributes within specific caste group is less studied. Hence, how economic status makes a difference

within the SC and ST groups, are central to this section. With the increasing economic status irrespective of the caste group affiliation, the health outcomes improve. Like among SC; the NMR is almost 2.5 times lower among richest compared to the poorest, it was 2.5 times and 2.8 times low for IMR and U5MR. The pattern is found consistent among ST also with 2-2.5 times lower among richest than the poorest. The same has been found in the case of underweight and stunting among both SC and ST as close to two times differences between the poorest and richest but in case of anaemia, it is found 1.1 times less among SC and 1.2 times less among ST. Details on prevalence are provided in Table 2.

Table 2: Socio-economic inequality among SC and ST on health and nutrition in India, 2019/21

	Per 1000			Per cent		
	NMR	IMR	U5MR	UWT	STN	ANE
SC						
Poorest SC	39	52	70	44	49	73
Poorer SC	31	44	54	37	41	71
Middle SC	23	36	43	31	37	70
Rich SC	24	32	40	27	31	67
Richest SC	16	21	25	21	26	67
ST						
Poorest ST	32	46	56	45	45	77
Poorer ST	30	42	53	38	40	73
Middle ST	22	35	40	34	36	73
Rich ST	18	24	27	27	29	67
Richest ST	15	22	22	25	21	63
India	25	35	43	32	36	68

Source: Calculated by authors using fifth round of NFHS data

Another inequality measure, Concentration index (CI), is also widely used and pervasive to reflect the concentration of inequality. CI is calculated for SC and ST on selected indicators and provided in Table 3. The convention is that the index value takes a negative sign when curve lies above the line of equality, indicating disproportionate concentration of the health variable among the poor. Here, for all the indicators, the generated sign is negative for SC and ST reflects the concentration of high mortality, malnutrition and anaemia among the poor children. Among the SC, the inequality is higher for under five mortality, lower for underweight and stunting to lowest for anaemic children. Among ST, the inequality is observed high for under five mortality to lower for underweight and anaemia and lowest for stunting. Based on these two groups, it can be added here that that the inequality is high among SC children compared to the ST children (Figure 2).
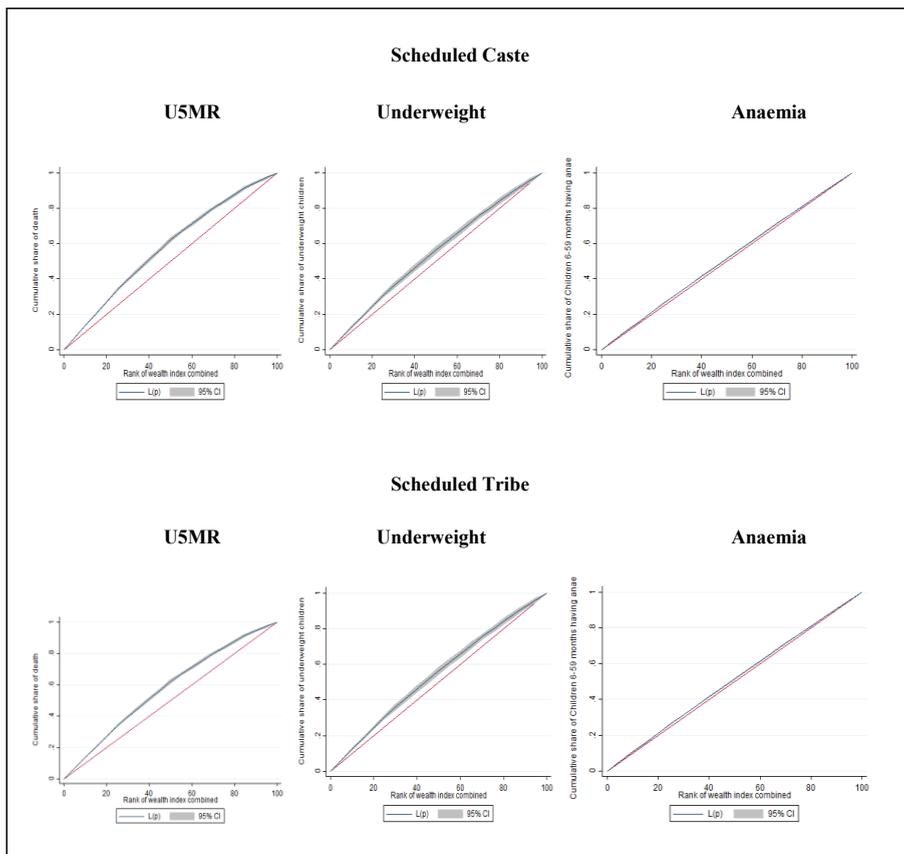
Figure 2: Concentration curve for mortality, malnutrition and anaemia among SC and ST children in India, 2019/21

Source: Calculated by authors using fifth round of NFHS data

Table 3: Concentration index for mortality, malnutrition and anaemia: 2019-21

	U5MR		Underweight		Stunting		Anaemia	
	CI	Std. Error	CI	Std. Error	CI	Std. Error	CI	Std. Error
SC	-0.139	0.012	-0.079	0.022	-0.052	0.015	-0.018	0.002
ST	-0.092	0.012	-0.074	0.019	-0.003	0.013	-0.022	0.002
India	-0.172	0.006	-0.092	0.011	-0.045	0.007	-0.029	0.001

Source: Calculated by authors using fifth round of NFHS data

Results of Logistic Regression Analysis

In this section; results of U5MR, underweight, stunting and anaemia based on logit regression analysis is presented. The risk of poor health and nutrition is presented using odds ratio at five per cent significance level. However, for some economic variable

especially for land, significance level is considered at 10 per cent. This can be found in Table 4-6. The risk of poor health and malnutrition across caste groups is presented in Table 4. The relative risk is found highest among SC followed by ST with reference to *Others* caste children. For instance, SC and ST children carry 51 per cent (OR: 1.51, p<0.001) and 30 per cent (OR: 1.30, p<0.001) more risk of under five mortality than the *Others* caste children. In case of underweight and stunting it is 65 per cent and 48 per cent more among SC (p<0.001), and 61 per cent and 58 per cent more among ST children with reference to *Others* caste children. Significantly, there were 25 per cent more anaemic children among SC. Although, there was 3 per cent less anaemic children among ST compared to *Others* caste children but not extracted significant.

Table 4: Odds ratio of child health and nutrition in India, 2019/21

	U5MR N=220632		Underweight N=200319		Stunting N=199760		Anaemia N=173919	
	OR	P>z	OR	P>z	OR	P>z	OR	P>z
Social groups (ref=*Others*)								
SC	1.51	0.000	1.65	0.000	1.61	0.000	1.25	0.000
ST	1.30	0.000	1.48	0.000	1.58	0.000	0.97	0.121
OBC	1.26	0.000	1.47	0.000	1.37	0.000	1.07	0.000
Cons	0.03	0.000	0.32	0.000	0.42	0.000	1.91	0.000

Source: Modelled using fifth round of NFHS unit level data

Table 5: Odds ratio of child health and nutrition regressed on own land, housing and wealth index in India, 2019/21 (Controlled on social group)

	U5MR		Underweight		Stunting		Anaemia	
	OR	P>z	OR	P>z	OR	P>z	OR	P>z
Land and House (ref: No)								
Own land in rural	0.81	0.001	1.05	0.079	1.05	0.089	1.02	0.582
Own house in urban	1.24	0.160	1.04	0.518	1.05	0.380	1.02	0.718
Own land and house- total	0.90	0.052	1.07	0.007	1.06	0.013	0.98	0.383
House but no land in urban	1.42	0.092	0.93	0.437	1.03	0.691	0.87	0.078
House but no land- total	0.99	0.918	1.01	0.849	1.03	0.456	0.83	0.000
Wealth Index (ref: Poorest)								
Poorer	0.81	0.000	0.71	0.000	0.77	0.000	0.84	0.000
Middle	0.63	0.000	0.58	0.000	0.63	0.000	0.81	0.000
Richer	0.55	0.000	0.46	0.000	0.49	0.000	0.73	0.000
Richest	0.38	0.000	0.34	0.000	0.38	0.000	0.68	0.000

Source: Modelled using fifth round of NFHS unit level data

In table 5, results of logit regression is presented for the economic variables modelled on different dependent variables. The odds ratio is presented for such economic variables like own land, own house and wealth index. It can be understand that each variable is controlled independently in separate model for the respective dependent variable. For land and housing, the mix picture emerged. In rural areas having own land reduces the risk of under five mortality by 19 per cent (p<0.001) whereas on malnutrition and anaemia it increases the risk by 2-5 per cent at 10 per cent significance level. Whereas having own house in urban areas although contributes high in case of under five mortality and revealed 25 per cent more death but found insignificant. For other dependent variables also, own house in urban areas does not have much impact in altering the health and nutritional status. There is the possibility that quality of housing in urban areas may trigger the impact in the opposite direction. When considering own land and housing, the risk of under five mortality is found 10 per cent less but for rest of the variables it appears as it was expected. Considering own house but no land in urban areas increases mortality by 42 per cent (p<0.10) but found 13 per cent less on anaemia at 10 per cent significance level. However, those having own house but no land irrespective of rural or urban, having 17 per cent reduces risk of anaemia significantly (OR: 0.83, p<0.001). On wealth index; with increase in wealth status; the level of mortality, malnutrition and anaemia reduces. It is found highly significant across all wealth categories on all the dependent variables (Table 5).

Table 6: Results of logit regression on child health, malnutrition and anaemia in India, 2019/21

	Death		Underweight		Stunting		Anaemia	
	N=33381		N=30617		N=30518		N=26587	
	OR	P>z	OR	P>z	OR	P>z	OR	P>z
Social Group (ref=Others)								
SC	1.14	0.183	1.35	0.000	1.33	0.000	1.18	0.000
ST	0.93	0.509	1.05	0.258	1.08	0.086	0.83	0.000
OBC	1.10	0.317	1.29	0.000	1.20	0.000	0.97	0.492
Sex (ref=Male)								
Female	0.84	0.003	0.89	0.000	0.87	0.000	0.98	0.401
Own Land (ref=No)								
Yes	0.85	0.077	1.04	0.350	0.99	0.879	1.18	0.000
Own House (ref=No)								
Yes	0.98	0.808	1.00	0.955	1.04	0.376	0.86	0.000
Wealth Index (ref=Poorest)								
Poorer	0.85	0.025	0.72	0.000	0.81	0.000	0.88	0.002
Middle	0.63	0.000	0.66	0.000	0.69	0.000	0.86	0.000
Richer	0.52	0.000	0.53	0.000	0.57	0.000	0.81	0.000
Richest	0.44	0.000	0.43	0.000	0.49	0.000	0.76	0.000

	Death		Underweight		Stunting		Anaemia	
	N=33381		N=30617		N=30518		N=26587	
	OR	P>z	OR	P>z	OR	P>z	OR	P>z
Mother's Education (ref=No Education)								
Primary	0.77	0.005	0.85	0.000	0.90	0.013	0.90	0.020
Secondary	0.76	0.000	0.76	0.000	0.76	0.000	0.80	0.000
Higher	0.48	0.000	0.55	0.000	0.58	0.000	0.66	0.000
Constant	0.08	0.000	0.72	0.000	0.91	0.038	2.88	0.000

*Source:* Modelled using fifth round of NFHS unit level data

Table 6 presents full model on selected dependent variables controlled on variables of economic status and mother's education level. The socio-economic factors, especially wealth index and mother's education contribute significantly among caste groups on all the selected dependent variables but not the land and housing for all dependent variables. Executing the anaemia level differences along different levels of wealth and education are found large. Like, on under five mortality richest households having 56 per cent less deaths with reference to poorest households (p<0.001). This has been found to be 57 per cent, 51 per cent and 24 per cent in case of underweight, stunting and anaemia. On gender, females have significant advantage of 11-16 per cent less mortality and malnutrition. Own land is found significant only on under five mortality (OR: 0.85, p<0.10) and anaemia (OR: 1.18, p<0.001). Whereas own housing is not found significant excluding for anaemia. Here, it can be added here that along the different indicators of economic status, wealth index seems robust indicator reflecting the significant factors across all the dependent variables like mortality, malnutrition and anaemia in this study. However, more studies pertaining to land and housing can strengthen the caste based inequality in health and malnutrition in India.

Discussion and Conclusion

The country development on human and socio economic indicators especially on the health front is well recognised in terms of declining mortality and increasing longevity. The global concerns for equality and equity as manifested since Alma Ata Declaration to Sustainable Development Goals (SDGs) have pushed it further. Despite the positive changes, there have been noticeable differences on health outcomes other than access to healthcare services along caste and socio-economic line as evident from the studies (Acharya, 2013, 2018; Baru et al., 2010; Bora et al., 2019; V. Borooah, 2010; Childers & Chiou, 2016; Kulkarni et al., 2020; Nayar, 2007; Prasad & Raushan, 2020; Raushan, 2020; Raushan & Acharya, 2018; Raushan & Mutharayappa, 2014; Raushan & Prasad, 2017; Subramanian, et al., 2006). This paper examined progress on child health indicators among different caste groups. Magnitude of disparity, socio-economic inequality to differential effect of socio-

economic factors such as land, house ownership and wealth index including education remained major concerns of this paper.

It is the first of its kind of study that included a wide range of child health indicators and examined along the caste lines. Novelty of the study is that the disparity ratio for SC and ST is calculated at different points of time over 1998/99 to 2019/21 for the first time and brings out the regional level concentration of U5MR among SC and ST at the state level (Map 1). Using the latest data, economic inequality is measured for each caste group. Economic factors- own land, own house and wealth index is modelled independently with caste group and extracted the differential effects of each factor on child health and malnutrition.
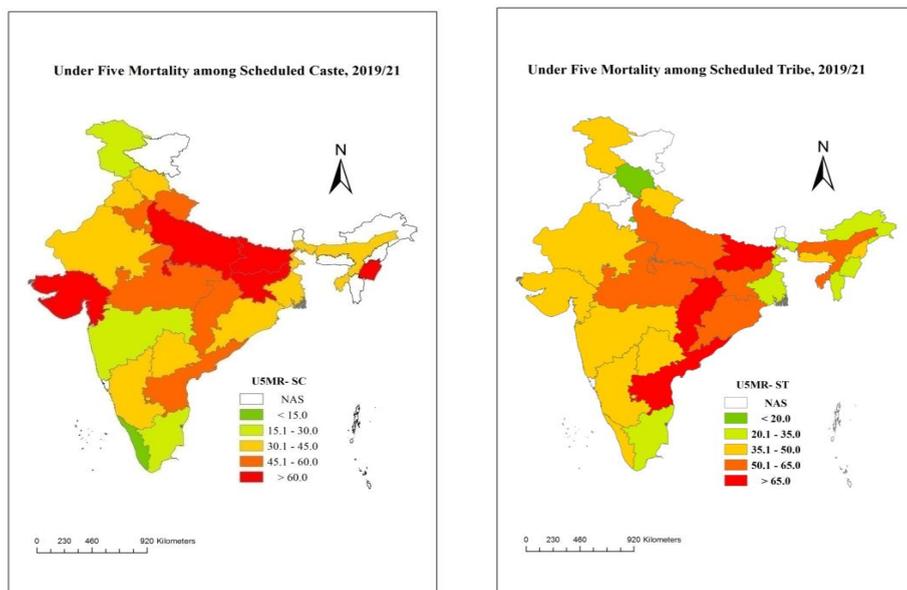
Map1: State level disparity in under five mortality (U5MR) among SC and ST in India, 2019/21 (per 1000)

Note: NAS: Not adequate sample to calculate U5MR

The findings of the study are robust and revealed that even after consistent efforts towards pushing to equity through national level policies, programme and intervention; marginalised groups are bearing the increased burden of child mortality, malnutrition and anaemia during the study period- 1998/99 and 2019/21. The previous studies had come up with more or less similar findings but those studies were cross sectional in the nature (Acharya, 2018; Bora et al., 2019; Childers & Chiou, 2016; Deshpande, 2002; Prasad & Raushan, 2020; Raushan, 2020; Raushan & Acharya, 2018). Although there is a continuous decline except for anaemia evident across the caste group, SC and ST children still have the highest rates of mortality and malnutrition. It is also noted that there is not much difference between SC and ST children on those indicators. To deepen the concentration of death among SC and ST at regional

level, U5MR is calculated. More or less a high U5MR is found to be similar in states of central and eastern India with some limitations as evident from Map 1. The findings are in the line of previous studies and strengthen the findings of the study (Saikia et al., 2019).

Emerging evidences reveal that disparity ratio (DR) seems high for SC and ST during 1998/99 to 2019/21. Notably, disparity ratio was found increased for NMR, IMR and U5MR for both SC and ST to *Others* during the period. On underweight and stunting, the DR is found to be highest for SC and ST to *Others* in 2005/06. Throughout, the DR on malnutrition and anaemia among ST appears more than SC. Although, DR has found to be either declining or remained similar like as the previous round on malnutrition and anaemia. However, we cannot clearly pose a statement that the pattern of disparity ratio remained consistent for SC or ST, needs careful interpretations.

As assortment of studies have finds that socioeconomic status (SES) plays a major role in shaping inequality in health outcomes (Braveman & Gottlieb, 2014; Darin Mattsson et al., 2017; Dommaraju et al., 2008; Kulkarni et al., 2020), we constructed socio-economic groups based on caste and wealth index, is an addition. It brought out that with increasing economic status irrespective of caste group, the health status improves. Notably within SC and ST; poorest than richest are having two to three times high mortality and malnutrition. The inequality based on CI value that was found negative for SC and ST on all the selected indicators reflects the concentration of high mortality, malnutrition and anaemia among poor children (Glewwe, 1999; Nguyen et al., 2013; Subramanian, et al., 2006). However, among SC and ST, the inequality is high on under five mortality and low on underweight and stunting to lowest for anaemia. Even within these two caste groups, inequality seems more among SC compared to the ST children.

Further, different indicators pertaining to economic status like land, housing and wealth index is modelled independently and revealed a mixed picture. In rural areas having own land reduces the risk more for mortality than the malnutrition and anaemia significantly (Rammohan & Pritchard, 2014; Vu et al., 2021). Whereas having own house in urban areas does not have a greater impact on turning down mortality and malnutrition. There is the possibility of structure, location and quality of housing in urban areas triggering the impact in opposite direction (Thomson et al., 2013).

As there is evidence that although marginalised people have own house in urban areas but for most of them it's just like a shelter and in many cases it cannot be compared with own housing facility of better-off households in urban areas (Vaid & Evans, 2017; Nix et al., 2020). In case of wealth index, with improving levels, the level of mortality, malnutrition and anaemia reduces. It is found highly significant across all the levels for all the dependent variables in the study (Braveman& Gottlieb, 2014; Childers & Chiou, 2016; CSDH, 2008; Darin Mattsson et al., 2017; Dommaraju et al., 2008; Kulkarni et al., 2020; Subramanian, et al., 2006) and validating the findings

of the previous studies. Here, it can be added that along the different indicators of economic status; wealth index seems a robust indicator altering mortality, malnutrition and anaemia among children significantly in the study.

The study contributes to the persisting disparity and inequality in child health and nutrition in India across caste lines with a high burden among SC and ST even though progress is emancipated among such groups. Along the socio-economic inequality among caste groups in India, the finding of the study made significant contributions and strengthen the previous studies (Acharya, 2013, 2018; Baru et al., 2010; Bora et al., 2019; Borooah, 2010; Childers & Chiou, 2016; Raushan & Acharya, 2018; Subramanian, et al., 2006). In rural areas, having land pushes one to positive change, but having housing in urban areas needs deeper investigation with structure, location and quality of housing and linkages with health outcomes. The effect of education is also found significant across all the indicators under the study and consistent with other studies (CSDH, 2008). However, more studies pertaining to land and housing can strengthen the caste-based inequality in child health and malnutrition in India. Finally, caste-based inequality is the reality of India impacting the health of the people. An inclusive policy needs to be more focused at regional levels where such marginalised groups have high concentration and poor outcomes along with poor socio-economic development (Raushan & Acharya, 2018).

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Appendix Table

Table A1: Progress on mortality decline between 1998/99 to 2019/21, India

Caste Group	Year	NMR	IMR	U5MR	UWT	STN	ANE
SC	1998/99	53.2	83	119.3	53.5	51.7	78
	2005/06	46.3	66.4	88.1	48	54	72
	2015/16	33	45.2	55.9	39	43	61
	2019/21	29.2	40.7	48.9	35	39	70
ST	1998/99	53.3	84.2	126.6	55.9	52.8	80
	2005/06	39.9	62.1	95.7	55	54	77
	2015/16	31.3	44.4	57.2	45	44	63
	2019/21	28.8	41.6	50.3	40	41	72
OBC	1998/99	50.8	76	103.1	47.3	44.8	72
	2005/06	38.3	56.6	72.8	43	49	70
	2015/16	30.5	42.1	50.8	36	38	59
	2019/21	24.3	34.1	40.5	31	35	65
Others	1998/99	40.7	61.8	82.6	41.1	40.7	73
	2005/06	40.7	61.8	82.6	34	41	64
	2015/16	23.2	32.1	38.5	29	31	54
	2019/21	19.5	28	32.8	27	30	66

Source: Calculated by authors using various round of NFHS data

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