Factors associated with under-five mortality in Scheduled Tribes in India: An analysis of national family health survey-5 (2019-2021)

Aswathy Kunjumon[1], Sivakami Nagarajan[1], Fathima Sherin Ottakkam Thodukayil[1] & Sigamani Panneer[2]

[1]Department of Social Work, School of Social Sciences and Humanities, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu & [2]Centre for the Study of Law and Governance, Jawaharlal Nehru University, New Delhi, India

Background & objectives: Under-five mortality is high among the Scheduled Tribes (ST) in India compared with the general population. This study examined the association of different maternal, child, socio demographic, and household factors associated with under-five mortality among Scheduled Tribes in India.

Methods: Data from the National Family and Health Survey (NFHS)-5 (2019-2021) for the ST, across all Indian States and Union Territories were used for analyses. Binary and multivariate logistic regression were performed to identify the association of maternal, child, socio-demographic, and household factors with under-five mortality among the ST population.

Results: Different maternal, child, socio demographic, and household factors were significantly associated with under-five mortality. The odds of under-five mortality were highest among women who gave birth to their children at home [Adjusted odds ratio (AOR): 1.42; 95% confidence interval (CI): 1.268-1.59] as compared with women who gave birth at institution. Literate women have lesser odds of under-five mortality than women with no formal education (AOR: 0.666; 95% CI: 0.501-0.885). The risk of under-five mortality was higher among four or more birth order children (AOR: 1.422; 95% CI: 1.246-1.624) compared with the first to third birth order children. The odds of under-five mortality decreased among children with a rich wealth index (AOR: 0.742; 95% CI: 0.592-0.93) compared to children with a poor wealth index.

Interpretation & conclusions: Analyses of under-five mortality among ST in India showed a significant association between different maternal, child, sociodemographic, and household factors. Grass-roots-level interventions such as promoting female education, addressing vast wealth differentials, and providing family planning services with a focus on reducing under-five mortality are essential in improving the survival of under-five children among the ST population in India.

Key words Child factors - India - maternal factors - NFHS-5 - Scheduled Tribes - under-five mortality

The Under-five Mortality Rate (U5MR) represents the number of children who die by the age of five yr per 1,000 live births[1]. It is the decisive metric in assessing a nation's healthcare and developmental

progress because U5MR provides valuable insights into the health and survival of its youngest population. During the year 2020, ~5 million children under the age of five yr lost their lives in the world, primarily due to preventable and treatable causes of preterm birth complications, birth asphyxia/trauma, pneumonia, diarrhoea, and malaria, all of which can be prevented or treated through the provision of accessible and affordable health and sanitation interventions[2]. The prevailing infant and child mortality rates serve as the reflection of the social and economic advancement of a country. At the global level, the total number of deaths in children under-five yr of age decreased significantly from 12.6 million in 1990 to 5.0 million in 2020[3]. Moreover, the global U5MR demonstrated a remarkable decline of 61 per cent, decreasing from 93 deaths per 1000 live births in 1990 to 37 deaths per 1000 live births in 2020[3]. This improvement depicts the social and economic advancement of countries worldwide.

India holds a pivotal position in global endeavours to end preventable deaths among newborns and children under the age of five. The National Family Health Survey (NFHS)-1[4] reported that, in India, one in nine children die before reaching the age of five (109.3/1000 live births). This situation changed to 41.9 deaths per 1000 live births in NFHS-5 2019-2021[5].

Global and Indian studies report associations of different socioeconomic and demographic factors with infant and child mortality[6-8]. While maternal factors associated with infant and child mortality include the mother's age at the time of childbirth, education, work status, place of delivery, full antenatal care and safe delivery[9], child-related factors consist of sex, birth order, birth interval and birth weight[10], and household factors include place of residence, drinking water facility, toilet facility, wealth, religion and ethnicity[11].

Even after the massive improvement in the socioeconomic and demographic advancement of the country, the U5MR among Scheduled Tribes (ST) in India remains high compared with the general population[5]. India is home to 705 ST groups with a collective count of 1045,45,716 individuals, constituting 8.6 per cent of the Indian population[12]. According to the NFHS-5 survey in 2019-2021, the U5MR was 50 deaths per 1000 live births among the ST population compared to the national average of 41.9[5]. This significant disparity in U5MR highlights the backwardness faced by the ST population concerning child health. In this scenario, it is crucial to identify the socioeconomic and demographic factors that put the tribal population in India at an increased risk of under-five mortality (UFM) compared with the general population. Moreover, it is crucial to prioritize proper attention and care for the children belonging to the ST category to address these disparities effectively. The present study examines the socioeconomic and demographic factors associated with UFM among ST in India by using the NFHS-5 dataset.

Material & Methods

This study was conducted at the department of Social Work, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu from July 2023 to September 2023.

Study design and data source: This study used the NFHS-5 data available in the public domain (*https://www.dhsprogram.com*) and based on information gathered from 6,36,699 households, 724,155 women in the age groups of 15 to 49 yr, and 101,839 men within 15-54 yr. The NFHS-5 data were collected all over India through two phases: the first phase from June 17, 2019 to January 30, 2020 and the second phase from January 2 to April 30, 2021[13]. The survey was carried out by the International Institute for Population Science (IIPS) under the guidance of the Ministry of Health and Family Welfare (MoHFW), Government of India. NFHS-5 fact sheet of India provides information on key health indicators, including infant and child mortality rates. The study extracted data for under-five children from the 'Children's Recode' dataset'. 'Children's Data - Children's Recode (KR)' has one record for every child of interviewed women born in the five yr (0-59 months) preceding the survey.

Study sample: The current study is based on data from the Children's Recode dataset encompassing responses collected from 28 Indian States and eight Union Territories from a total of 2,23,920 responses. The study specifically focuses on 47,118 women between the ages of 1 to 49 yr who met the inclusion criteria of the study. Data sorted based on the NFHS question 'belong to a scheduled caste, scheduled tribe, and other backward class'. If the answer included 'Scheduled Tribe' in the response, the responding women contributed to the samples of this study. The final sample size was 47,118 women between the ages 15 to 49 yr.

Outcome and explanatory variables: The outcome variable of the study was UFM among ST in India.

The explanatory variables were broadly classified into maternal, child, sociodemographic, and household factors. Mother's current age (≤24, 25-29, 30-34, and ≥35 yr), level of education (no education, primary, secondary, and higher), age at first birth (≤24, 25-29, 30-34, and ≥35 yr), place of delivery (home and institution), delivery by caesarean section (yes/no) and complete antenatal care (yes/no) were taken into account under maternal factors. The sex of the child (male or female), birth order (1-3, ≥4), and incidence of diarrhoea (yes/no) were included under child factors. Type of state [Empowered Action Group (EAG)/Non-EAG], place of residence (urban/rural), source of drinking water (improved/unimproved), and toilet facility (improved/unimproved), religion (Hindu, Christian, Muslim and others), number of household members (1-5, ≥6), and wealth status (poor, middle and rich), were included under the sociodemographic and household factors affecting U5MR. The explanatory variables to be explored were decided upon based on prior literature search[9,10].

Statistical analysis: Frequency and percentage distribution table was prepared for different maternal, child, socio demographic and household factors examined in this study. Logistic regression was initially performed to estimate the independent variables' unadjusted odds ratio (UOR). All those variables found to be statistically significant (*P*<0.05) were considered for the multiple logistic regression to estimate the adjusted odds ratio (AOR) in association with U5MR among the ST population in India. The significance level was defined at *P*<0.05. All statistical analyses were performed using the IBM Statistical Package for the Social Sciences (SPSS) software, version 26 (IBM Corp., Armonk, N.Y., USA)

Results

Cross-tabulation of maternal, child, sociodemographic and household factors and UFM: The cross-tabulation of maternal, child, sociodemographic, and household factors and UFM among ST population in India is shown in Table I. In 47,118 maternal responses, under-five mortality reported was 1,810. In a total of 47,118 respondents, 13,276 belonged to the age group of <24 yr, and 36.43 per cent of the respondents were in the age group of 25-29 yr, (17,166); 3.5 per cent of this experienced UFM. The education status of the respondents varied between mothers with no formal education, primary, secondary and higher education. The incidence of UFM was 661 among women who

had no formal education, and it was 64 among higher educated women. Out of 11,793 home deliveries, 588 children, constituting five per cent of the total, faced under-five mortality. Similarly, among 4,859 women who did not receive antenatal care during pregnancy, 237, accounting for 4.9 per cent, lost their children before reaching the age of five. Most ST respondents (42,082/47118; 89%) were rural dwellers, while 5,036 were residents in urban settings. Four per cent of rural dwellers and 2.7 per cent among urban dwellers faced the problem of under-five death. The majority of the respondents belonged to the Hindu religion (25599/47118; 54%), while 16386, 1322, and 3811 belonged to Christianity (35%), Muslim (3%), and other religions (8%), respectively. The incidence of under-five mortality was high among Hindus (1171). In terms of wealth index, UFM was high among the poor wealth index family (1507), and the number was less among the middle and rich wealth index households (189 and 114, respectively). While considering the child factors of under-five mortality, it was identified that the death was higher among male children than the female. About 1024 male children died under the age of five, and the number was 78 among female children. Furthermore, 4.3 per cent of 8859 children born in a birth order of >4 experienced under-five death.

Bivariate analysis-UFM among the ST population in India: The Bivariate analysis of maternal, child, sociodemographic and household factors affecting UFM among the ST population in India is shown in Table II. In terms of the maternal factors, the likelihood of death of children below the age of five yr was low among women in the age group 25-29 yr [crude odds ratio (COR): 0.825; 95% confidence interval (CI): 0.734-0.927], and ≥35 yr (COR: 0.842; 95% CI: 0.723-0.982), compared with women in the age group of ≤24 yr. Compared to lesser age at first birth (≤24 yr), the likelihood of death of under-five children was low among women in the age group 25-29 yr (COR: 0.82; 95% CI: 0.711-0.946) and 30-34 yr (COR: 0.661; 95% CI: 0.495-0.881). Also, the death among under-five children differed significantly with the level of the mother's education. UFM was less likely when the mothers had primary (COR: 0.776; 95% CI: 0.676-0.891), secondary (COR: 0.644; 95% CI: 0.579-0.716) or higher (COR: 0.385; 95% CI: 0.297-0.499) level of education, compared with children born to mothers who did not have any formal education. The children born at home were 1.46 times more susceptible to UFM (COR: 1.464; 95% CI: 1.324-1.62) than those born at a

Table I. Cross-tabulation of maternal, child, sociodemographic, and household factors and UFM among the Scheduled Tribe (ST) population in India

Variables		Under-five mortality		Total
		Yes, n(%)	No, n(%)	
Maternal factors				
Respondent's current age (yr)	<24	564(4.2)	12712(95.8)	13276
	25-29	606(3.5)	16560(96.5)	17166
	30-34	396(4)	9507(96)	9903
	>35	244(3.6)	6529(96.4)	6773
Education of the respondent	No education	661(5.1)	12324(94.9)	12985
	Primary	308(4)	7401(96)	7709
	Secondary	777(3.3)	22485(96.7)	23262
	Higher	64(2)	3098(98)	3162
Delivery by caesarean section	Yes	158(3.4)	4525(96.6)	4683
	No	1652(3.9)	40783(96.1)	42435
Place of delivery	Home	588(5)	11205(95)	11793
	Institution	1222(3.5)	34103(96.5)	35325
Antenatal care	Yes	1573(3.7)	40686(96.3)	42259
	No	237(4.9)	4622(95.1)	4859
Age at first birth	<24	1520(4)	36573(96)	38093
	25-29	224(3.3)	6571(96.7)	6795
	30-34	49(2.7)	1785(97.3)	1834
	>35	17(4.3)	379(95.7)	396
Child factors				
Sex of the child	Male	1024(4.3)	22976(95.7)	24000
	Female	786(3.4)	22332(96.6)	23118
Birth order	1-3	1427(3.7)	36832(96.3)	38259
	>4	383(4.3)	8476(95.7)	8859
Had diarrhoea recently	Yes	137(4.2)	3141(95.8)	3278
	No	1673(3.8)	42167(96.2)	43840
Sociodemographic and household factors				
Wealth index	Poor	1507(4.3)	33258(95.7)	34765
	Middle	189(2.7)	6825(97.3)	7014
	Rich	114(2.1)	5225(97.9)	5339
Household members	1-5	1171(4.8)	23113(95.2)	24284
	>6	639(2.8)	20537(97.2)	22834
Religion	Hindu	1171(4.6)	24428(95.4)	25599
	Christian	492(3)	15894(97)	16386
	Muslim	40(3)	1282(97)	1322
	Others	107(2.8)	3704(97.2)	3811
Source of drinking water	Improved	1525(3.8)	38215(96.2)	39746
	Unimproved	285(3.9)	7093(96.1)	7372
Toilet facility	Improved	1112(3.4)	31596(96.6)	32708
	Unimproved	698(4.8)	13712(95.2)	14410
State type	EAG	917(5.1)	16953(94.9)	17870
	Non-EAG	893(3.1)	28355(96.9)	29248
Type of place of residence	Rural	1672(4)	40410(96)	42082
	Urban	138(2.7)	4898(97.3)	5036

EAG, empowered action group

health facilities/centres. Antenatal care (ANC) during pregnancy was also found to be significantly associated with the death of under-five children. Compared to the mothers who received ANC, UFM was 1.32 (COR: 1.326; 95% CI: 1.153-1.525) times higher in mothers who did not receive any ANC during pregnancy.

Child factors, including sex and birth order, were found statistically significantly associated with UFM. Compared to male under-five children, female children had better chances of survival (COR: 0.79; 95% CI: 0.718-0.868) among the ST population in India.

Furthermore, UFM was higher among children born in a birth order of ≥4 (COR: 1.166; 95% CI: 1.039-1.309) than in a 1-3 birth order.

Among the sociodemographic and household factors, type of state, place of residence, availability of toilet facilities, religion, number of household members and wealth index were significantly associated with UFM among the ST population in India (Table II).

Multivariate analysis-UFM among the ST population in India: Among the maternal factors, mothers who

Table II. Bivariate analysis of maternal, child, sociodemographic, and household factors affecting UFM among the ST population in India

Variables		COR	95% CI	*P* value
Maternal factors				
Current age (yr)	≤24		Ref	
	25-29	0.825	0.734 - 0.927	0.001**
	30-34	0.939	0.823 - 1.07	0.346
	≥35	0.842	0.723 - 0.982	0.028*
Level of education	No education		Ref	
	Primary	0.776	0.676 - 0.891	0.001**
	Secondary	0.644	0.579 - 0.716	0.001**
	Higher	0.385	0.297 - 0.499	0.001**
Age at first birth (yr)	≤24		Ref	
	25-29	0.82	0.711 - 0.946	0.006*
	30-34	0.661	0.495 - 0.881	0.005*
	≥35	1.079	0.662 - 1.759	0.76
Delivery by caesarean section	Yes		Ref	
	No	1.16	0.983 - 1.37	0.08
Place of delivery	Home	1.464	1.324 - 1.62	0.001**
	Institution		Ref	
Received antenatal care for pregnancy	Yes		Ref	
	No	1.326	1.153 - 1.525	0.001**
Child factors				
Sex of the child	Male		Ref	
	Female	0.79	0.718 - 0.868	0.001**
Birth order number	1-3		Ref	
	≥4	1. 166	1.039 - 1.309	0.001**
Had diarrhoea recently	Yes		Ref	
	No	0.91	0.761 - 1.087	0.297
Sociodemographic and household factors				
State type	EAG		Ref	
	Non-EAG	0.582	0.53 - 0.64	0.001**
Type of place of residence	Rural		Ref	
	Urban	0.681	0.571 - 0.812	0.001**
				Contd...

Variables		COR	95% CI	P value
Source of drinking water	Improved		Ref	
	Unimproved	1.007	0.885 - 1.146	0.917
Type of toilet facility	Improved		Ref	
	Unimproved	1.446	1.313 - 1.593	0.001**
Religion	Hindu		Ref	
	Christian	0. 646	0. 58 - 0.719	0.001**
	Muslim	0.651	0.473 - 0.896	0.009*
	Others	0.603	0.493 - 0.737	0.001**
Number of household members	1-5		Ref	
	≥6	0.568	0.515 - 0.627	0.001**
Wealth index	Poor		Ref	
	Middle	0.611	0.524 - 0.713	0.001**
	Rich	0.482	0.397 - 0.584	0.001**

Significance at P^* <0.05; ** <0.001. COR, crude odds ratio; CI, confidence interval; Ref, reference

had secondary [adjusted odds ratio (AOR): 0.872; 95% CI: 0.774-0.982), or higher (AOR: 0.666; 95% CI: 0.501-0.885) levels of education had low odds of UFM of their children when compared to those respondents who did not have any formal education. The odds of UFM was 1.4 times higher among children born at home (AOR: 1.42; 95% CI: 1.268-1.59) than the children born at health facilities/centres. Similarly, in the children of mothers who did not receive any ANC during their pregnancy, the odds of UFM was 1.228 times higher (AOR: 1.228; 95% CI: 1.058-1.426) than in mothers who had received ANC (Table III). Among the child factors, the birth order of ≥4 (AOR: 1.422; 95% CI: 1.246-1.624) was observed to have increased odds of UFM than those children born between the birth order of 1-3. Also, compared to male children, female children had lower odds of under-five death (AOR: 0.795; 95% CI: 0.722-0.874). Among the sociodemographic and household factors, the children from the non-EAG of India were less likely to experience UFM (AOR: 0.716; 95% CI: 0.635-0.807) compared to children from the EAG States. Similarly, compared with children from a smaller family size (1-5 family members), the odds of UFM was low (AOR: 0.477; 95% CI: 0.428-0.531) among children who belonged to a family with more than six members. Furthermore, compared to those children in the poor wealth index, those in the middle and rich wealth quintile had reduced odds (AOR: 0.827; 95% CI: 0.701-0.976 and AOR: 0.742; 95% CI: 0.592-0.93, respectively) of UFM (Table III).

Discussion

The present study identified that the likelihood of under-five death among children was significantly low in educated mothers compared with mothers who did not have any formal education. Similar findings were reported from other Indian studies where UFM was associated with the level of the mother's education[10,11]. A study conducted in rural northern Ghana also identified a similar phenomenon where mothers' education emerged as a strong predictor of UFM[14]. Noticeably, educated mothers are more likely to have a permanent source of income, good health knowledge and the capacity to make decisions on children's health[15]. It has also been recorded that through regular health checkups, timely vaccinations, proper hygiene and ensuring a nutritious diet for her children, an educated mother contributes to reducing mortality and morbidity rates[10].

ANC utilization was another maternal factor observed to be significantly associated with UFM among the ST population in India. Mothers who received full ANC during their pregnancy demonstrated a reduced likelihood of experiencing UFM among their children compared to mothers who did not receive any ANC as other researchers in India found[9]. Furthermore, a study that used Ethiopian Demographic and Health Survey (EDHS) data in 2016 revealed a decreased odds of (AOR: 0.27) UFM among women who had ANC visits during pregnancy[16]. This investigation further underlined that the mothers receiving ANC had

Table III. Multivariate analysis of maternal, child, socio-demographic, and household factors affecting UFM among the ST population in India

Variables		AOR	95% CI	*P* value
Maternal factors				
Level of education	No education	Ref		
	Primary	0.916	0.794 - 1.056	0.227
	Secondary	0.872	0.774 - 0.982	0.024*
	Higher	0.666	0.501 - 0.885	0.005*
Age at first birth (yr)	≤24	Ref		
	25-29	0.938	0.811 - 1.086	0.394
	30-34	0.812	0.605 - 1.088	0.163
	≥35	1.246	0.76 - 2.042	0.384
Received antenatal care for pregnancy	Yes	Ref		
	No	1.228	1.058 - 1.426	0.007*
Place of delivery	Institution	Ref		
	Home	1.42	1.268 - 1.59	0.001**
Child factors				
Sex of child	Male	Ref		
	Female	0.795	0.722 - 0.874	0.001**
Birth order number	1-3	Ref		
	≥4	1.422	1. 246 - 1.624	0.001**
Sociodemographic and household factors				
State type	EAG	Ref		
	Non-EAG	0.716	0.635 - 0.807	0.001**
Type of place of residence	Rural	Ref		
	Urban	0.986	0.812 - 1.197	0.886
Type of toilet facility	Improved	Ref		
	Unimproved	1.022	0.916 - 1.139	0.701
Religion	Hindu	Ref		
	Christian	0.699	0.608 - 0.805	0.001**
	Muslim	0.814	0.586 - 1.129	0.217
	Others	0.636	0.516 - 0.783	0.001**
Household members	1-5	Ref		
	≥6	0.477	0.428 - 0.531	0.001**
Wealth index	Poor	Ref		
	Middle	0.827	0.701 - 0.976	0.025*
	Rich	0.742	0.592 - 0.93	0.01*

Significance at *P** <0.05; ** <0.001.AOR, adjusted odds ratio. Notes: Maternal adjusted-factors: current age; delivery by caesarean section; child adjusted-factors: had diarrhoea recently; sociodemographic and household adjusted-factors: source of drinking water

a higher chance of receiving post-natal care for their children, which was considered crucial for under-five child survival[16]. Notably, many investigators have urged that UFM can be reduced by maintaining the stipulated frequency of ANC[17] under standard of care.

The present study identified that the child's birth order was a significant factor influencing UFM among the child factors. Other studies conducted among the STs in rural India similarly revealed that the risk of UFM was 42 per cent higher among four or more

birth-order children than the first birth-order child[11]. A study conducted in the Southern Nations, Nationalities and Peoples' Region (SNNPR) of Ethiopia with high U5MR regions identified that children with a birth order of second or above were associated with increased odds of under-five death compared to children with a birth order of first[18]. It was noted that when birth order increased, there was a decrease in the care given by the mother because of having more children[18].

Similar to our findings, an analysis of cross-sectional data from Nigeria Demographic and Health Surveys (NDHS) in the years 2003, 2008 and 2013 identified that, compared to the female gender, the chances for UFM were 1.24 times higher with male gender[19]. This sex difference associated with UFM indicated greater capacity of survival among females resulting from a fundamental genetic advantage[15,18].

The influence of wealth quintile on UFM, as observed by us, was recorded in different studies across India[10,11]. Children of mothers from lower-income households, in these investigations, had a higher risk of UFM than children of mothers from families with higher wealth index[20,21]. On the other hand, it was also identified that compared to children from a smaller family size, the children from a larger family size were less likely to die before the age of five yr. This was consistent with the findings of other previous studies[22,23], which could be due to the possibility that larger households being capable of providing an expanded support network for childcare.

EAG States are the classification made by the Ministry of Health and Family Welfare, Government of India in 2001 including the States of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and Uttarakhand for achieving the national health goals by monitoring and facilitating the Millennium Development Goal[24]. These States experience a higher infant mortality rate than the country's national average[25]. Numerous studies have also documented increased rate of UFM among the EAG States in India[24,26] and have identified associated challenge[27]. Furthermore, the prevalence of under nutrition among children in the form of stunting, wasting, and underweight have been recorded in more than 30 per cent in most EAG States[28], which might have contributed to increased infant and child mortality rates[29].

Our findings should be taken into account in the light of study limitations. Some important predictors of U5M, including the mother's occupation and the child's birth weight, could not be included in the study due to the lack of information in the NFHS-5 dataset. Also, due to the retrospective nature of the data, recall bias could have affected the mothers' responses.

In conclusion, this study among ST in India using the NFHS-5 dataset showed an association between maternal, child, socio demographic and household factors affecting UFM in India. Based on these findings, we suggest that grass-roots-level efforts are necessary to reduce UFM, with a need to target individual-level intervention focusing on mothers. Promoting female education, addressing the vast wealth differentials and providing family planning services would be important steps in improving under-five survival among Scheduled Tribes in India.

Conflicts of Interest: None.

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For correspondence: Dr Sivakami Nagarajan, Department of Social Work, School of Social Sciences and Humanities, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu, 610005, India
e-mail: sivakami@cutn.ac.in