RESEARCH ARTICLE

Journal of Ecophysiology and Occupational Health, *Vol 24(2), DOI: 10.18311/jeoh/2024/35726, 157-168, June 2024*

ISSN (Online) : 0972-4397
ISSN (Online) : 0974-0805

The Totos of India: Socioeconomic and Demographic Structure of a Particularly Vulnerable Tribe

Debashmita Banerjee and Benrithung Murry*

Department of Anthropology, University of Delhi, Delhi - 110007, India; benrithungmurry@yahoo.co.in

Abstract

Background: Indigenous populations are more vulnerable to the COVID-19 pandemic compared to the macroeconomic population. Due to poor social connections, the level of education, socioeconomic advancement, and sickness risk of the tribal population of India were affected. Thus, indigenous cultures are more susceptible to COVID-19. The present research aims to explore the population structure, socio-economic condition, and COVID-19 vaccination status among the Toto population of Alipurduar, West Bengal. **Methods:** The study used a cross-sectional design to collect household data among the Totos (PVTG), a vanishing sub-Himalayan population. The entire Toto community, comprising 294 households with 1374 individuals, was covered in Totopara. Data were collected through a pre-tested, semi-structured schedule and analyzed using Stata 14. **Results:** Demographic analysis has revealed a sharp decline in the sex ratio and decadal growth rate compared to the 2011 census. From the multiple logistic regression, it has been found that unmarried people were less likely to get fully vaccinated compared to married individuals. The employed population was 1.97 times more fully vaccinated compared to unemployed individuals. Similarly, smartphone non-users were less likely to get fully vaccinated and partially vaccinated compared to those individuals who do possess smartphones ($p<0.001$). **Conclusion:** Therefore, inactive government initiatives, low fertility, a lack of community involvement, and the policy inactivity of local institutions are the main causes of negative decadal growth. It is believed that participatory implementation is essential to improving awareness of neglect as well as the acceptance rate of public health care services.

Keywords: COVID-19 Pandemic, India, Particularly Vulnerable Tribal Group, Sub-Himalayan Tribe, Toto

1. Introduction

The Corona Virus Disease-2019 (COVID-19) pandemic has resulted in a disproportionate impact on morbidity and mortality among populations that were already disadvantaged[1,2]. The Indian government implemented an abrupt pandemic lockdown on March 24, 2020, which lasted until May 31, 2020, and had a significant impact on the country's population of 1.35 billion individuals[3]. The indigenous populations of India reside in geographically isolated regions that are characterized by inadequate healthcare infrastructure[4]. Additionally, there is a deficiency in prompt awareness among individuals to effectively address the COVID-19 pandemic, especially the vulnerable population in remote areas[5]. As a result, the tribal population is facing a greater degree of vulnerability to the COVID-19 pandemic in comparison to other communities[6].

10.42 crore Indians are classified as Scheduled Tribes (ST), accounting for 8.6% of the country's overall population[7]. Most of India's 550 tribal communities have assimilated into the dominant culture's way of life, while 75 particularly vulnerable groups persist in adhering to a semi-nomadic lifestyle[3]. Limited external interaction results in reduced educational attainment, slower socio-economic advancement, and heightened vulnerability to illnesses. Till now, baseline data is not accessible for more than half of the indigenous communities[8]. As a

**Author for correspondence*

Article Received on: 29.11.2023 Revised on: 23.02.2024 Accepted on: 28.02.2024

result, the indigenous communities are facing a greater degree of susceptibility to COVID in comparison to other mainstream groups. Individuals belonging to indigenous communities have had limited exposure to novel external pathogens due to their minimal contact with the outside world, in contrast to the non-vulnerable population of India[9]. Consequently, they exhibit a higher vulnerability to a range of viral illnesses. The indigenous populations have become more susceptible to the pandemic due to insufficient access to appropriate healthcare facilities as well as the limited availability of clean water, sanitation, and personal protective equipment[10]. In addition, the indigenous community is subject to significant socio-economic marginalization, resulting in a dearth of scientific research aimed at comprehending their specific infectious disease burden[11]. Additional research is needed, and it is recommended that the government allocate dedicated funding for research initiatives aimed at enhancing systematic disease surveillance in the under-researched tribal region.

According to the Ministry of Tribal Affairs (MoTA, 2013), West Bengal constitutes approximately forty tribal populations, including three Particularly Vulnerable Tribal Groups (PVTGs), viz. Birhor, Lodhas, and Toto. The studies regarding Birhor and Lodhas have been covered by notable anthropologists, viz., N.K. Bose[12], L.P. Vidyarthi[13], and Kapoor and Kshatriya[14], who worked on Lodhas in Midnapur district, West Bengal. Ample ethnographic and demographic research has been conducted among the above-mentioned tribes of India[15,16]. But the most understudied PVTG was Toto, regarding their demography, social status, and health care issues[17]. Despite being one of the disadvantaged tribes, no significant studies have been conducted even in the anthropological arena regarding their socio-demographic aspects, poor condition of health care practices, socio-cultural ways of life, and their language for better policy implementation in pre- and post-pandemic times. Thus, the present study aims to understand the demographic structure, socio-economic condition, and COVID-19 vaccination status among the Toto population of Alipurduar, West Bengal.

2. Methodology

2.1 Study Design

A community-based study was employed by utilizing a mixed-methods approach with a cross-sectional design to investigate the age-sex structure of the community to understand the demographic rates, socio-economic conditions, and COVID-19 vaccination status. The present study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The observational study design and the process of the fieldwork in Totopara village were ethically approved by the Institutional Ethics Review Board of the Department of Anthropology (Anth/2022-2023/593).

2.2 Study Area

The study has been conducted in an Indian village named Totopara. Totopara is one of the last villages in West Bengal on the Indo-Bhutan border. It is located at the foothills of the Himalayas, on the western bank of the Torsa River. It comes under Ballalguri Gram Panchayet, Madarihat Block, in Alipurduar district, West Bengal. This trapezoid-shaped village is interconnected through seven rivulets (Hauri, Dating-tee, Dip-tee, Kiting-tee, Choa-tee, Neeting-tee, and Goa-tee). Geographically speaking, Totos' home territory is 4 km long from north to south and 1.6 km wide from east to west. The nearest communication centre is Madarihat town, which is 32 km away from this village. Totopara consists of six hamlets known as Dumsigaon, Pujagaon, Mondalgaon, Panchayetgaon, Subbagaon, and Mitragaon (Figure 1).

2.3 Target Population

Toto is the smallest, particularly vulnerable tribal group in West Bengal[18]. The Toto population has been distributed in the many pockets of Alipurduar and New Jalpaiguri districts of West Bengal[19], as well as in the border area of Bhutan[20], because of their economic activities. Due to the COVID pandemic, the Toto population was getting restricted in a village called Totopara. Thus, the primary sampling unit of the present survey was Totopara, and the target population was Toto.

2.4 Sample Size Estimation

Studies of large sample sizes related to tribal populations are few, especially in the Indian scenario. For example, Thomas *et al.*,[20] used 70,000 participants from the tribal population of India to understand the health-seeking behaviour among tuberculosis patients. Bagavandas[21] assessed the quality of life of the tribal population through multilevel analysis among 1096 participants from 19

villages in India. The first community-based sampling was done by Sinha and Pal[22] comprised 130 households (n = 697) among the Toto population.

2.4.1 Inclusion Criteria of the Study

In 2022, the eligible age to take the COVID vaccination will be ≥ 18 years. The PVTG populations like Toto are declining through the decade, and therefore, to reduce the homogeneity of the study design, we propose to recruit all 294 households of the Toto population spread across six hamlets. The total population covered in this study is 1374 individuals, and 952 individuals were eligible for the COVID-19 vaccination in 2022.

2.4.2 Exclusion Criteria of the Present Research

We did not include those households that were abandoned by the Totos during the period of the fieldwork (6 months). We also exclude data that is given by a third party about a particular household.

2.5 Data Collection Instruments and Procedure

Data were collected after gaining consent from the official head of the tribal office in Alipurduar as well as the chief of the community. A pre-tested modified household schedule (household composition, family type, house type, occupational status, educational status, and COVID-19 vaccination status) was used for quantitative data collection from previously validated tools (NFHS-5)[23]. The relevant and standard statistical tools were used to analyze the data. All contents of the schedule were prepared in English and then translated into Bangla and Dengaka (the language of the Toto population).

2.6 Data Capture, Protection and Management

The data was recorded on a paper schedule after obtaining consent from each participant and then entered, cleaned, and coded in Microsoft Excel 2016. The data was further managed, modified, and codified for the future conceptual framework. A Unique Identification Number (UID) was given to every participant and household in the household schedule. The data was tabulated on a password-protected personal computer, and for each of the study participants, a thorough data dictionary was created. The complete set of data will be routinely reviewed for outliers, variable distribution, and missingness. For further analysis, the dataset was categorized into different sub-datasets and transferred to STATA-14 with a significance level of less than 0.05.

2.7 Data Analysis

The data underwent analysis using STATA-14. The data was subjected to analysis through the calculation of descriptive statistics, including measures such as the mean, Standard Deviation (S.D.), and frequency. The Shapiro-Wilk test has identified that the data was normally distributed. Frequently utilized statistical methodologies in academic research encompass the chi-square test and t-test to understand bivariate associations. To examine the association between the variables and the outcome, inferential statistics like multiple logistic regression were employed. The obtained results were deemed statistically significant at a significance level of 0.05.

2.8 Definition and Measurements of Variables

2.8.1 Outcome Variables

The dependent variable 'COVID vaccination status of the study population' had three categories, namely, 'Non-vaccinated', 'Partially vaccinated (single dose)', and 'Fully Vaccinated (double dose)'. Totos, who received no doses purposefully, had the most hesitant faith in Western medicine and the government doctors in Totopara. People who were partially vaccinated faced several side effects of vaccination, like fever, muscle pain, and skin redness due to the injection. Thus, they were very hesitant to take the next dose. These reasons were identified based on the existing literature[21,22].

2.8.2 Predictors

The sociodemographic variables about participants and their household characteristics were explored for association with their COVID-19 vaccination status. This dichotomous variable includes age (18-44, 45-59, and 60-95 years), sex (male and female), marital status (married and unmarried, widowed or divorced), educational status (literate and non-literate), occupational status (employed and unemployed), socio-economic strata (Udai Parekh Scale), and smartphone ownership (owners and non-owners).

3. Results

3.1 Age-sex Composition of the Toto Population

A cohort-wise distribution of age and sex is presented in Table 1. The total sex ratio of Totos is 827.1 (2022), which is less than that of West Bengal and India. In the case of a small population like Totos, a large imbalance in the relative numbers of men and women was observed in every age group except 45-49 years. Two major factors were found to be associated with imbalanced sex ratios across different age cohorts, such as the sex ratio at birth, differential mortality rates between the sexes in different age cohorts, individual losses and gains through migrations, and birth-favoured males. Though female infanticides were not observed in the populations during the time of fieldwork. From a bird's-eye view, most of the Toto young population is below the age of 30 years (29.1%, mean age: 26.9 (±16.42) years, median age: 24 years).

3.2 Characteristics of the Study Population

The gender-wise distribution of socio-economic characteristics of the study population is shown in Table 2. The mean difference between ages is not statistically significant among males (27.01±16.9 years) and females (26.97±15.84 years) due to the small difference in the ages of the two groups. Most women (48.3%) were deprived of education and unemployed (36.8%) compared to men. Because of this, a statistically significant difference has been observed between males (46.2%) and females (57.7%) in marital status ($p<0.01$). After attaining menarche, Toto girls usually get married in the Toto community. Most women work as wage labourers. It has been observed that only 0.5% of women belong to the middle class compared to 5.7% of men, with a statistically significant difference. On the contrary, a similar percentage of males and females belong to the lower socio-economic strata. Nearly half of the female population was illiterate. On the contrary, 42.1% of the male participants had completed

Table 1. Age-sex composition and sex ratios of the Toto population

Age Groups (Years)	Age-Cohort	Male	Female	Total	SR		Years	Toto					West Bengal	
					Age cohort	Age Groups		Male	Female	TP	DGR	SR	DGR	SR
0-14	0-4	49 (6.5)	32 (5.2)	81 (5.9)	653.1	743.3	1921	140	131	271	6.27	936	-2.91	905
	5-9	62 (8.2)	48 (7.8)	110 (8)	774.2		1931	130	204	334	23.25	1569	8.14	890
	10-14	76 (10.1)	59 (9.5)	135 (9.8)	776.3		1941	159	162	321	-3.89	1019	22.93	852
15-64	15-19	96 (12.7)	72 (11.6)	168 (12.3)	750	868.8	1951	161	160	321	-2.18	994	13.22	865
	20-24	99 (12.7)	96 (11.5)	195 (14.2)	969.7		1962	206	189	616	96.18	917	32.8	878
	25-29	87 (11.6)	83 (13.3)	170 (12.4)	954.02		1971	275	269	675	9.58	978	26.87	891
	30-34	57 (7.6)	51 (8.2)	108 (7.9)	894.7		1981	362	350	762	12.74	967	23.17	911
	35-39	56 (7.4)	48 (7.7)	104 (7.6)	857.1		1991	470	457	922	21.16	972	24.73	917
	40-44	46 (6.1)	35 (5.3)	79 (5.7)	760.8		2001	620	575	1157	25.49	927	17.77	934
	45-49	31 (4.1)	35 (5.6)	65 (4.7)	1129		2011	737	650	1387	19.88	882	13.93	950
	50-54	28 (3.7)	27 (4.3)	55 (4)	964.2		2013-15	-	-	-	-	-	-	951
	55-59	24 (3.2)	11 (1.8)	35 (2.5)	458.3		2014-16	-	-	-	--	--	-	937
	60-64	15 (2)	13 (2.1)	28 (2)	866.6		2015-17	-	-	-	-	-	-	939
							2016-18	-	-	-	-	-	-	941
65 ≤	65+	26 (3.5)	13 (2)	39 (2.8)	500		2017-19	-	-	-	-	-	-	944
Total	0-65+	752 (100)	622 (100)	1374 (100)	827.1		Present Study (2022)	752	622	1374	-0.1	827.1	-	-

The age composition and sex ratios of each age cohort of the Toto population are collected from the present study (2022).
The data on the decadal growth rate and sex ratios of the Toto population and West Bengal are collected from the Census 1921-2011[7], and SRS 2013-2019[57].
The data of the Toto population of 1962 were collected from the Indian Statistical Institute Survey.
TP=Total Population, DGR= Decadal Growth Rate, SR=Sex Ratio.

the secondary level of education. The difference between males and females in educational level is statistically significant.

3.3 Association of Socio-Demographic Factors and COVID Vaccination Status

The classification of vaccination status as being categorized into three groups, i.e., no (8.1%), partially (8.9%), and fully (83%) vaccinated, is shown in Table 3. Participants in the 18-44 years (76.7%) age group were much more vaccinated compared to other age groups (17.1% and 6.2%). After the side effects of the single dose, Totos got sceptical and decided not to take the second dose after the specific interval. There is no statistically significant relationship between vaccination and gender, education, or socio-economic status in the study population. 77% of fully vaccinated participants were found to be married. From the perspective of a significant bivariate association between socio-demographic characteristics and COVID-19 vaccination status, it has been estimated that age group, marital status, employment status, and smartphone ownership were significantly associated with vaccination status (Table 3).

3.4 Predictors of COVID Vaccination Status Among the Totos of India

To assess the relative importance of marital status, occupational status, and mobile phone ownership as important factors for COVID-19 vaccination status, multiple logistic regression analyses were performed (Table 4). It has been observed that marital status, occupational status, smartphone ownership, and age group were significant predictors of the COVID-19 vaccination status of the study population. It has been estimated that unmarried individuals were less likely to get fully and partially vaccinated compared to married people ($p<0.05$). This signifies that married participants were more inclined to get security than unmarried people. The employed study population was 2.17 ($p<0.001$) times more fully vaccinated, and 2.34 times

Table 2. Bivariate association between socio-demographic factors and gender in the Toto population

Socio-demographic factors	**Male (N=752) Mean (±SD)**	**Female (N=622) Mean (±SD)**	**P-Value (t-value)**	**Total (N=1374) Mean (±SD)**
Age (Years)	27.01 (16.9)	26.97 (15.84)	0.48 0.0490	26.99 (16.42)
Marital status	**Male (N=755) Count (%)**	**Female (N=622) Count (%)**	**P-Value (χ^2)**	**Total (N=1374) Count (%)**
Married	349 (46.2)	360 (57.8)	**<.001*** **17.927**	709 (51.4)
Unmarried	382 (50.6)	241 (38.9)		623 (45.4)
Separated/ Widow	24 (3.2)	21 (3.4)		45 (3.2)
Employment Status				
Unemployed	247 (32.8)	227 (36.5)	0.15 2.006	474 (34.6)
Employed	505 (67.1)	395 (63.5)		900 (65.4)
Socio-economic Scale				
Upper Class	43 (5.7)	3 (0.5)	**<.001*** **28.84**	46 (3.4)
Middle Class	617 (82)	538 (86.5)		1155 (84)
Lower Class	92 (12.2)	81 (13)		173 (12.6)
Levels of Education				
Non-literate	252 (33.5)	300 (48.2)	**<.001*** **31.19**	552 (40.2)
Primary	146 (19.4)	107 (17.2)		253 (18.4)
Secondary	317 (42.1)	193 (31.2)		511 (37.2)
Graduation and above	37 (5)	21 (3.4)		58 (4.2)

*P-value is considered to be statistically significant at P<0.05 in sociodemographic characteristics of the study population.

Table 3. Bivariate association between socio-demographic factors and COVID vaccination status

Socio-demographic characteristics	COVID vaccination status				
	Non-vaccinated Count (%) n=77 (8.1)	Partially vaccinated Count (%) n= 85 (8.9)	Fully Vaccinated Count (%) n= 790 (83)	P-Value (χ^2)	Total Count (%) n= 952 (100)
Age group					
18-44	63 (81.8)	71 (71.76)	606 (76.7)	**0.047* 9.634**	730 (76.7)
45-59	8 (10.4)	12 (14.12)	135 (17.1)		155 (16.3)
60-95	6 (7.8)	12 (14.12)	49 (6.2)		67 (7)
Gender					
Male	39 (50.4)	47 (55.3)	422 (53.4)	0.837 0.356	508 (53.4)
Female	38 (46.6)	38 (44.7)	368 (46.6)		444 (46.6)
Marital Status					
Married	31 (40.3)	59 (69.4)	609 (77.1)	**0.001* 58.79**	699 (73.4)
Unmarried	43 (55.8)	21 (24.7)	145 (18.3)		209 (22)
Widow/ Separated	3 (3.9)	5 (5.8)	36 (4.6)		44 (4.6)
Educational status					
Non-literate	27 (35.1)	38 (44.7)	382 (48.3)	0.05 12.608	447 (47)
Primary	6 (7.8)	9 (11)	70 (8.9)		85 (8.9)
Secondary	42 (54.5)	35 (41.2)	285 (36.1)		362 (38)
Graduation	2 (2.6)	3 (3.5)	53 (6.7)		58 (6.1)
Employment status					
Unemployed	34 (44.16)	6 (7.1)	65 (8.2)	**<.001* 93.791**	105 (11.03)
Employed	43 (55.8)	79 (92.9)	725 (91.8)		847 (88.97)
Socio-economic Scale					
Upper	0 (0)	7 (8.2)	40 (5.1)	0.099 7.812	47 (5)
Middle	73 (94.8)	77 (90.6)	724 (91.6)		874 (91.8)
Lower	4 (5.2)	1 (1.2)	26 (3.3)		31 (3.2)
Smartphone ownership					
Owned	24 (31.2)	54 (63.3)	438 (55.4)	**0.001* 19.925**	516 (54.2)
Not owned	53 (68.8)	31 (36.7)	352 (44.6)		436 (45.4)

The P-value is considered to be statistically significant at P<0.05 in the sociodemographic characteristics of the study population.

more partially vaccinated compared to unemployed individuals (p<0.001). On the other hand, smartphone non-users were less likely to get fully vaccinated and partially vaccinated compared to those individuals who do possess smartphones (p<0.001) (Table 4).

4. Discussion

The issue of the state of COVID-19 vaccines is significant and warrants attention. It is imperative to ensure that a substantial proportion of the population attains immunity against COVID-19 through vaccination to establish a secure and safeguarded population[24,25]. Studies have found that there is very little hesitancy towards COVID-19 vaccination in rural and especially tribal populations[9,23,25]. compared to the macro-economic population[26-28], of India. This may happen due to a lack of awareness about the COVID-19 pandemic, especially in the remote places of India. Most PVTGs usually live in isolated locations with poor healthcare facilities[25]. They also lack the timely understanding to effectively address the COVID-19 outbreak. Unfortunately, almost 50% of vulnerable indigenous tribes have no baseline data till now. By early March 2021, India had over 11.4 million

Table 4. Odds Ratio (OR) derived from multinomial logistic regression analysis for the risk factors of COVID-19 vaccination status

Variable (N=952)	Non-vaccinated	Partially vaccinated	Fully vaccinated	Fully vaccinated		Partially Vaccinated	
	Count (%) n=77 (8.1)	Count (%) n=85 (8.9)	Count (%) n=730 (83)	COR (95%CI)	AOR (95%CI)	COR (95%CI)	AOR (95%CI)
Age group							
18-44 years® (730)	63 (8.6)	61 (8.4)	606 (83)	1	1	1	1
45-59 years (155)	8 (5.2)	12 (7.7)	135 (87.1)	0.56 (0.19-1.32)	-0.38 (-1.2-0.45)	0.43 ((-0.52)- 1.39)	(-0.43) ((-1.47)- 0.60)
60-95 years (67)	6 (8.9)	12 (18)	49 (73.1)	(-0.16) ((-1.05)-0.722)	**-1.17 (-2.27- (-0.77))** *	0.72 ((-0.31)-1.76)	(-0.19) ((-1.4)-1.06)
Marital Status							
Married® (699)	31 (4.4)	59 (8.4)	609 (87.2)	1	1	1	1
Unmarried (209)	43 (20.6)	21 (10)	145 (69.4)	**(-1.7) ((-2.25) - (-1.26))** **	**(-1.28) ((-1.87)-(-0.69))** *	**(-1.3) ((-2.03)-(-0.68))** **	-0.645 ((-0.14)-1.40)
Separated (44)	3 (6.8)	5 (11.4)	36 (81.8)	(-0.49) ((-1.7)- 0.73)	0.34 ((-1.14)- 1.84)	(-0.13) ((-1.6)- 1.3))	0.24 ((-1.5)- 1.99)
Occupational status							
Unemployed® (105)	34 (32.4)	6 (5.7)	65 (61.9)	1	1	1	1
Employed (847)	43 (5.1)	79 (9.3)	725 (85.6)	**2.17 (1.66-2.69)** **	**1.70 (1.14-2.27)** **	**2.34 (1.39-3.28)** **	**1.97 (0.987-2.96)** **
Smartphone ownership							
Ownership ® (516)	24 (4.6)	54 (10.5)	438 (84.9)	1	1	1	1
Non-ownership (436)	53 (12.2)	31 (7.1)	352 (80.7)	**(-1.01) ((-0.50)-(-1.51))** **	**-0.59 (0.04-1.14)** *	**(-1.34) ((-0.69) -(-2.00))** **	**(-0.99) ((-0.29) -(-1.69))** **
Model $\chi 2$ value				***102.82*** **			
Cox and Snell R^2 of Model I				**0.0941**			

p<0.05 *, p<0.01* for crude and adjusted odds ratio, the reference category is non-vaccinated.
®= Reference Category.
Model I include variables age group, marital status, occupational status and mobile phone ownership for full vaccination and partial vaccination.

COVID cases and 159,000 deaths[6]. Indigenous people will be more susceptible to viral illnesses due to limited contact and a lack of healthcare, clean water, sanitation, and protective equipment to manage the healthcare system[29,30]. Along with this, economic marginalization and limited scientific research on their infectious illness burden also contribute to their vulnerability.

The present research is a community-based survey that assessed the population structure, COVID-19 vaccination status, and socio-economic determinants among the smallest PVTG in West Bengal. Presently, Totos inhabiting Alipurduar district on the Indo-Bhutan border have been primarily engaged as wage labourers in agriculture and husbandry. To increase their population growth, numerous facilities were provided by the government, such as roads, safe drinking water, electricity, schools, Anganwadi centres, primary healthcare centres, houses under the Indira Awas Yojana (IAY/GHS), and the Public Distribution System (PDS) for food grains. Nonetheless, the population remains poor and declining. The overview

of spatial distributions gives a clear idea of the dispersal of the Toto population and their negative growth rate (Figure 2), and poor conditions of health status. The sex ratio of the present study observed in 2022 is 827.1, which is very poor compared to W.B., other states, and the national average[7]. It has been observed from the prior data of the Indian census that the male Toto population was gradually increasing over time, but in the case of the female Toto population, it is decreasing continuously. It is seen that the pre-reproductive age group also has sharp differences between males and females, with the latter being lesser across the age cohorts. This is also seen in males being more vaccinated compared to females. Several scholars have reported that poor health outcomes in any population are primarily associated with disparities in socioeconomic conditions and poor educational levels[31-33]. This fundamental gap leads to unaffordable, inaccessible, poor quality, and sceptical thoughts regarding modern healthcare services[34,35]. To attain the SDGs, the National Health Mission has developed two different apparatuses, namely Janani Suraksha Yojana (JSY) and Janani Sishu Suraksha Yojana (JSSK), to eradicate IMR and MMR. However, the condition of the Toto population hasn't changed in a parallel way compared to other STs and PVTGs in India[36]. Previous studies have shown poor economic outcomes like the study population[37,38]. Due to the COVID-19 pandemic, this semi-nomadic community got restricted in Totopara and became involved in farming as their mode of livelihood, but their monthly income has been reduced compared to the previous year. Before that, they used to migrate to Bhutan, Assam, and Sikkim as working labour. Almost 84% (n = 1154) of the Toto population falls under the middle-class group based on the Udai-Parekh scale[39]. To summarize the issue of declining decadal growth, there is a lesser number of females in the reproductive age cohort compared to males. The preference of a male child can be another important triggering factor but female infanticide has not been observed. Another probable reasons can be that infant mortality and child mortality was greater among the females in these age cohorts. Thus, to enhance the annual growth rate, the government should promote an awareness campaign regarding the importance of girls in a population along with different developmental schemes.

There is evidence that the PVTG of India depends on forest resources like land, trees, wood, and many more[40]. Nowadays, indigenous people are breaking the shell of their ideologies and adapting the concept of Sanskritization[41]. Toto was a nomadic tribal group, but over time and with the special attention of the government[42], they gradually started farming and moved towards a settled lifestyle. Different types of occupations lead to economic heterogeneity, and thus, it creates a diverse socio-economic stratum, which also helps them to have awareness regarding public health programs, including the importance of the COVID vaccination. The present study has shown that employed individuals are two times more vaccinated compared to the unemployed (Table 4).

We have identified several socio-demographic factors associated with COVID-19 vaccine uptake. There seems to be an association between COVID-19 vaccination status and the age, employment, marital status, and smartphone ownership of the population. The resistance to vaccination among the elderly population has been comparatively higher than in the 18-44 age group. Although over 25% of adults in the 60-year-old age group have not yet received vaccinations and have not decided to do so. A similar outcome has been observed by Tan *et al.*,[43] among older adults in Singapore and the USA[44]. Contrasting assessments have found that the acceptance of the COVID-19 vaccine is high as age increases in Nigeria[24]. Apart from age as a socio-demographic determinant, marital status can be an important indicator of the vaccination status of other researchers in different neighbouring countries[45-47]. A meta-analysis among the global population has shown the acceptance of vaccination is 1.6 times higher among married individuals (pooled OR: 1.59, 95% CI=1.38-1.83)[48] which is like the outcome of the present study. Our research also finds that occupational status plays a major role in vaccination status among the study population. Employed people get 1.7 times more vaccinated compared to unemployed people. Similarly, a multicentered Asian study found that the employed population was 1.21 times more vaccinated compared to another group[49]. A contradictory outcome has been observed in the US-based household survey. It has been further described that vaccine hesitation was unaffected by poverty or work status[50].

4.1 Poor Health Care Issues Faced by Toto Population

Previous literature has shown that Totos have faced a double burden of different communicable and non-communicable diseases like metabolic syndromes[51], tuberculosis,

malnutrition[52], malaria, smallpox, and skin problems, like other tribal populations in the hilly terrain of the Himalayan belt[53]. Apart from that burden, the shortfall of healthcare infrastructure was worse than the scarcity. As a socio-economically disadvantaged population, it also faced an unmet need for a basic health care system. Totopara has shown that the place is unsuitable for basic maternal and child health check-ups and scientific delivery and care facilities. The present study has found that Toto people avoid allopathic medical treatment in any circumstances. But the situation is changing gradually due to growing educational pursuits. There are very few studies conducted on PVTG in post-pandemic years. Studies on their situations help policymakers enhance sustainability in their strategies, which may benefit the group in the future. Coming back to the Indian scenario, the effect of the nationwide lockdown from March 25th, 2020, affected directly the benefit of the midday meal scheme, Janani Surakhshaa Yojona[54], nutrition programming for tribal children, and Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY)[55], which were already in place in the present population and benefiting them to a greater extent, but presently these schemes have been stopped for more than two years[56].

4.2 Strengths and Limitations of the Study

The present study is the first cross-sectional study of the Toto population, where all the households are taken into consideration for a better understanding of the population structure of the Toto tribe. Second, the mixed-methods study design gave us more information about bad public health factors that might help the country bounce back from a negative decadal growth rate (Figure 2)[57]. Apart from its strengths, the present study has various limitations. Primarily, the research design employed in this study was cross-sectional. Therefore, it is not possible to establish causal inferences regarding the relationships observed in the data. Apart from that, the mandatory uptake of the COVID-19 vaccination policy by the Government of India (GoI) creates an obstacle to understanding Knowledge, Attitude, and Practice (KAP) regarding vaccine hesitancy.

5. Conclusion

Vaccines have demonstrated significant efficacy as a valuable intervention in combating infectious diseases and reducing the associated rates of mortality and morbidity[24]. The population exhibits a higher acceptance rate towards the concept of receiving the COVID vaccination, and the level of awareness falls well below the threshold of national studies, which needs improvement. From the present study, vaccination status was affected by age, family structure, employment status, and exposure to media. The ownership of a smartphone may create scepticism regarding vaccination, which further increases the prevalence of non-vaccination in the study population. Furthermore, the pandemic adversely affected the employment and economics of the study population. Thus, only the employed population was able to travel to PHCs and schools to receive the vaccine. The healthcare providers were reluctant to provide vaccination information to the tribal population due to socio-demographic and linguistic barriers.

6. Recommendation

The study briefly highlights the probable reasons behind the negative decadal growth rate of the study populations. The poor socio-demographic status of Totos calls for attention, as they have been facing it for decades. This is due to a poor educational level and a lack of awareness, especially among the females of the Toto population. There are three major reasons behind the negative decadal growth of the Toto population. Despite several governmental schemes and policy implementations, the policy inactivity of local institutions and bodies, the lack of community participation, and low fertility are major reasons behind negative decadal growth. Participatory implementation is seen as crucial to eradicating the negligence of public health awareness and increasing COVID vaccination. Public health providers (doctors, nurses, and ASHA workers) need to be empathetic towards the marginalized community of the present study area. Furthermore, sensitization of the people about the benefit of girls' education would be rewarding for the declining Toto population. Such efforts would provide exposure to reproductive health, child health, and proper sanitary practices. Poor health and hygiene are one of the main reasons for the high mortality rates. Totos are yet to be an integral part of mainstream society, including those with whom they share close social proximity, such as the Nepali and Bengali-speaking populations in the study area. They are also gradually losing their own tribal identity, and the Government of India (GoI)

needs to make a concerted effort to preserve the socio-cultural and linguistic identity of this PVTG lest they disappear over time. The formulation of appropriate policies, including socio-cultural and health care policies, for these vanishing tribal people, is the need of the hour. More studies and government research grants are needed to improve systematic vaccination surveillance in the least-researched tribal population as well as the PVTGs of India.

7. Acknowledgement

I, Debashmita Banerjee, would like to acknowledge ICSSR, for considering me as their doctoral fellow (RFD/2021-2022/GEN/HLTH/378). We are thankful to all the study participants (especially Mr. Bhabesh Toto and Mr. Dhaniram Toto) for providing data, and the Department of Anthropology, University of Delhi, for providing help in data analysis.

8. Contribution Details

The concept, design and definition of intellectual content were primarily developed by Prof. Benrithung Murry. Furthermore, the literature search, data acquisition in the fieldwork, data cleaning and statistical analysis were done by Miss. Debashmita Banerjee. The manuscript was prepared by Miss. Debashmita Banerjee and the manuscript editing and review were done together by both authors.

9. References

1. Leggat-Barr K, Uchikoshi F, Goldman N. COVID-19 risk factors and mortality among Native Americans. DemRes. 2021; 45:1185-218. https://doi.org/10.4054/DemRes.2021.45.39
2. Thakur N, Lovinsky-Desir S, Bime C, Wisnivesky JP, Celedón JC. The structural and social determinants of the racial/ethnic disparities in the U.S. COVID-19 pandemic. What's Our Role? Am J Respir Crit Care Med. 2020; 202(7):943-9. https://doi.org/10.1164/rccm.202005-1523PP PMid:32677842 PMCid: PMC7528789
3. Giri D. Tribal perspectives in India: Critical responses. Booksclinic Publishing; 2020. p. 230.
4. Negi DP, Abdul Azeez EP. Diminishing traditional methods and inaccessible modern healthcare: The dilemma of tribal health in India. Journal of Health Research. 2021; 36(5):867-77. https://doi.org/10.1108/JHR-01-2021-0001
5. Ali J, Singh S, Khan W. Health awareness of rural households towards COVID-19 pandemic in India: Evidence from rural impact survey of the World Bank. J Public Aff. 2022;e2819. https://doi.org/10.1002/pa.2819 PMid:35937031 PMCid: PMC9347369
6. Agoramoorthy G, Hsu MJ. COVID-19 and India's vulnerable indigenous populations. Am J Hum Biol. 2021; 34(2):e23608. https://doi.org/10.1002/ajhb.23608 PMCid: PMC8212087
7. Census of India 2011, National Population Register and Socio-Economic and Caste Census [Internet]. [cited 2023 Aug 16]. Available from: https://censusindia.gov.in/nada/index.php/catalog/42619
8. Pandya V, Mazumdar M. Making sense of the Andaman islanders: Reflections on a new conjuncture. Economic and Political Weekly. 2012; 47(44):51-8.
9. Kasi E, Saha A. Pushed to the margins: The crisis among tribal youth in India during COVID-19. Critical Sociology. 2021; 47(4-5):641-55. https://doi.org/10.1177/0896920521994195
10. Power T, Wilson D, Best O, Brockie T, Bourque Bearskin L, Millender E, *et al.* COVID-19 and Indigenous peoples: An imperative for action. J Clin Nurs. 2020; 29(15-16):2737-41. https://doi.org/10.1111/jocn.15320 PMid:32412150 PMCid: PMC7272911
11. Matthewman S, Huppatz K. A sociology of Covid-19. Journal of Sociology. 2020; 56(4):675-83. https://doi.org/10.1177/1440783320939416
12. Bose NK. Cultural anthropology and other essays. Indian Associated Publishing Company; 1953. p. 269.
13. Vidyarthi LP. Rise of anthropology in India: A social science orientation. Concept Publishing Company; 1978. p. 484.
14. Kapoor AK, Kshatriya GK. Fertility, and mortality differentials among selected tribal population groups of northwestern and Eastern India. J Biosoc Sci. 2000; 32(2):253-64. https://doi.org/10.1017/S0021932000002534 PMid:10765614
15. Panda S. The development of primitive tribal groups: A case of Lodha and Birhor of West Bengal. Worldwide Journal of Multidisciplinary Research and Development. 2015; 1:28-35.
16. Bandyopadhyay S. Development experience and livelihood of a traditional hunting-gathering tribe of Eastern India. The Eastern Anthropologists. 2018.
17. Kumar MM, Pathak VK, Ruikar M. Tribal population in India: A public health challenge and the road to the future. J Family Med Prim Care. 2020; 9(2):508-12. https://doi.org/10.4103/jfmpc.jfmpc_992_19 PMid:32318373 PMCid: PMC7113978

18. Basak J, Majumdar D, Pal N, Paul S, Mukhopadhyay S, Mukhopadhyay A. Effort to protect Totos, the smallest tribe in the world. Blood. 2009; 114(22):5113. https://doi.org/10.1182/blood.V114.22.5113.5113
19. Bhattacharyya D, Mukhopadhyay A, Chakraborty A, Dasgupta S, Mukhopadhyay S, Pal N, *et al*. Incidence of the Hb E [β26(B8) Glu→Lys, *GAG*> *AAG*] variant in Totos, one of the smallest primitive tribes in the world. Hemoglobin. 2013; 37(1):26-36. https://doi.org/10.3109/03630269.2012.746942 PMid:23215760
20. Thomas BE, Thiruvengadam K, Vedhachalam CAS, Rao VG, Vijayachari P, *et al*. Prevalence of pulmonary tuberculosis among the tribal populations in India. PLoS ONE. 2021; 16(6). https://doi.org/10.1371/journal.pone.0251519 PMid:34086684 PMCid: PMC8177518
21. Bagavandas M. Development of the multifactor index for assessing the quality of life of a tribal population of India: multilevel analysis approach. BMC Public Health. 2021; 21(1):383. https://doi.org/10.1186/s12889-021-10338-2 PMid:33602175 PMCid: PMC7893862
22. Sinha D, Pal BC. Population dynamics among the Totos of West Bengal: A positive response to culture contact. J Biosoc Sci. 1983; 15(2): 237-45. https://doi.org/10.1017/S0021932000014528 PMid:6841387
23. Moosan H, Stanley A, Prabhakaran AO, Vijayakumar K, Jayasree AK, Gopakumar S. Comparison of healthcare utilisation pattern and its correlates among the tribal and nontribal population of Kerala. Indian J Community Med. 2019; 44(Suppl 1):S57-61. https://doi.org/10.4103/ijcm.IJCM_46_19 PMid:31728093 PMCid: PMC6824181
24. Sarkar A, Dalui A, Sarkar P, Das M, Basu R, Sardar JC. COVID vaccine hesitancy among the tribal population and its determinants: A community-based study at Berhampore block of Murshidabad District, West Bengal. Indian Journal of Public Health. 2023; 67(1):21.
25. Nascimento TCDC, do Valle Costa L, Ruiz AD, Ledo CB, Fernandes VPL, Cardoso LF, *et al*. Vaccination status and long COVID symptoms in patients discharged from hospital. Sci Rep. 2023; 13(1):2481. https://doi.org/10.1038/s41598-023-28839-y PMid:36774419 PMCid: PMC9922040
26. Murray, Piot P, Christopher JL. The potential future of the COVID-19 pandemic: Will SARS-CoV-2 become a recurrent seasonal infection? JAMA. 2021; 325(13):1249-50. https://doi.org/10.1001/jama.2021.2828 PMid:33656519
27. Ogboeze JC, Ekiyor CP, Moroh JE, Moroh TG, Ezurike WN, Onyebuchi AC, *et al*. Awareness, perceptions, and acceptance of the COVID-19 vaccine in South-eastern Nigeria. Journal of Public Health and Development. 2022; 20(3):26-42. https://doi.org/10.55131/jphd/2022/200303
28. Mehmood Q, Tebha SS, Aborode AT, Aayush. COVID-19 vaccine hesitancy among Indigenous people in India: An incipient crisis. Ethics Med Public Health. 2021; 19: 100727. https://doi.org/10.1016/j.jemep.2021.100727 PMid:34632033 PMCid: PMC8486639
29. Rao KM, Kumar RH, Krishna KS, Bhaskar V, Laxmaiah A. Diet and nutrition profile of Chenchu population - A vulnerable tribe in Telangana and Andhra Pradesh, India. Indian J Med Res. 2015; 141(5):688-96.
30. Bhattacharya A, Ranjan P, Ghosh T, Agarwal H, Seth S, Maher GT, *et al*. Evaluation of the dose-effect association between the number of doses and duration since the last dose of COVID-19 vaccine, and its efficacy in preventing the disease and reducing disease severity: A single centre, cross-sectional analytical study from India. Diabetes Metab Syndr. 2021; 15(5):102238. https://doi.org/10.1016/j.dsx.2021.102238 PMid:34364299 PMCid: PMC8321688
31. Samanta S, Banerjee J, Kar SS, Ali KM, Giri B, Pal A, *et al*. Awareness, knowledge, and acceptance of COVID-19 vaccine among the people of West Bengal, India: A web-based survey. Vacunas. 2022; 23:S46. https://doi.org/10.1016/j.vacun.2022.01.002 PMid:35125985 PMCid: PMC8808715
32. Sain S, Chattopadhyay A, Haldar D. Awareness, acceptance, and hesitancy about COVID-19 vaccine among residents of urban and rural health training centre field practice area of a medical college at Kolkata: A cross-sectional survey. Asian J Med Sci. 2023; 14(9):3-8. https://doi.org/10.3126/ajms.v14i9.54891
33. Gupta D, Fischer H, Shrestha S, Shoaib Ali S, Chhatre A, Devkota K, *et al*. Dark and bright spots in the shadow of the pandemic: Rural livelihoods, social vulnerability, and local governance in India and Nepal. World Development. 2021; 141: 105370. https://doi.org/10.1016/j.worlddev.2020.105370 PMid:36570100 PMCid: PMC9758400
34. Kahambing JG. Migration and indigenous health during COVID-19. Journal of Public Health. 2022; 44(3):e455-6. https://doi.org/10.1093/pubmed/fdab290 PMid:34308484 PMCid: PMC8344649
35. Braveman P, Gottlieb L. The social determinants of health: It's time to consider the causes of the causes. Public Health Rep. 2014; 129(1_suppl2):19-31. https://doi.org/10.1177/00333549141291S206 PMid:24385661 PMCid: PMC3863696
36. Galobardes B. Childhood socioeconomic circumstances and cause-specific mortality in adulthood: Systematic review and interpretation. Epidemiologic Reviews. 2004; 26(1):7-21. https://doi.org/10.1093/epirev/mxh008 PMid:15234944
37. Lynch JW, Kaplan GA, Salonen JT. Why do poor people behave poorly? Variation in adult health behaviours and psychosocial characteristics by stages of the socioeconomic

life course. Social Science and Medicine. 1997; 44(6):809-19. https://doi.org/10.1016/S0277-9536(96)00191-8 PMid:9080564

38. Bango M, Ghosh S. Social and regional disparities in utilization of maternal and child healthcare services in India: A study of the post-national health mission period. Front Pediatr. 2022; 10:895033. https://doi.org/10.3389/fped.2022.895033
39. Balarajan Y, Selvaraj S, Subramanian S. Health care and equity in India. The Lancet. 2011; 377(9764):505-15. https://doi.org/10.1016/S0140-6736(10)61894-6 PMid:21227492
40. Vellakkal S, Gupta A, Khan Z, Stuckler D, Reeves A, Ebrahim S, *et al*. Has India's national rural health mission reduced inequities in maternal health services? A pre-post repeated cross-sectional study. Health Policy Plan. 2017; 32(1):79-90. https://doi.org/10.1093/heapol/czw100 PMid:27515405 PMCid: PMC5886191
41. Srinivas MN. Religion and society among the Coorgs in South Asia. Oxford: Oxford University Press; 2003. p. 296.
42. Dhargupta A, Goswami A, Sen M, Mazumder D. Study on the effect of socio-economic parameters on the health status of the Toto, Santal, Sabar and Lodha Tribes of West Bengal, India. Studies of Tribes and Tribals. 2009; 7(1):31-8. https://doi.org/10.1080/0972639X.2009.11886592
43. Tan M, Straughan PT, Cheong G. Information trust and COVID-19 vaccine hesitancy amongst middle-aged and older adults in Singapore: A latent class analysis approach. Social Science and Medicine. 2022; 296:114767. https://doi.org/10.1016/j.socscimed.2022.114767 PMid:35144226 PMCid: PMC8812088
44. Reiter PL, Pennell ML, Katz ML. Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated? Vaccine. 2020; 38(42): 6500-7. https://doi.org/10.1016/j.vaccine.2020.08.043 PMid:32863069 PMCid: PMC7440153
45. Lakshmi VV, Paul M. Socio-economic conditions of tribal communities in Telangana and Andhra Pradesh- A review. Acta Scientific Agriculture. 2019; 3:104-9. https://doi.org/10.31080/ASAG.2019.03.0571
46. Lal DS, Devanna S. Socio-economic development of primitive tribes: An empirical study in Adilabad District.
47. Majumder S. Socioeconomic status scales: Revised Kuppuswamy, BG Prasad, and Udai Pareekh's scale updated for 2021. J Family Med Prim Care. 2021; 10(11):3964. https://doi.org/10.4103/jfmpc.jfmpc_600_21 PMid:35136753 PMCid: PMC8797108
48. Nindrea RD, Usman E, Katar Y, Sari NP. Acceptance of COVID-19 vaccination and correlated variables among global populations: A systematic review and meta-analysis. Clin Epidemiol Glob Health. 2021; 12:100899. https://doi.org/10.1016/j.cegh.2021.100899 PMid:34746514 PMCid: PMC8559452
49. Marzo RR, Sami W, Alam MdZ, Acharya S, Jermsittiparsert K, Songwathana K, *et al*. Hesitancy in COVID-19 vaccine uptake and its associated factors among the general adult population: A cross-sectional study in six Southeast Asian countries. Trop Med Health. 2022; 50(1):4. https://doi.org/10.1186/s41182-021-00393-1 PMid:34983692 PMCid: PMC8727234
50. Morales DX, Beltran TF, Morales SA. Gender, socioeconomic status, and COVID-19 vaccine hesitancy in the US: An intersectionality approach. Sociology of Health and Illness. 2022; 44(6):953-71. https://doi.org/10.1111/1467-9566.13474 PMid:35500003 PMCid: PMC9348198
51. Debnath M, Chaudhuri TK. HLA-A and HLA-B distribution in Toto - a vanishing sub-Himalayan tribe of India. Tissue Antigens. 2006; 67(1):64-5. https://doi.org/10.1111/j.1399-0039.2005.00517.x PMid:16451204
52. Dhargupta A, Goswami A, Sen M, Mazumder D. Study on the effect of socio-economic parameters on the health status of the Toto, Santal, Sabar and Lodha tribes of West Bengal, India. Studies of Tribes and Tribals. 2009; 7(1):31-8. https://doi.org/10.1080/0972639X.2009.11886592
53. Bhattacharyya D, Mukhopadhyay A, Chakraborty A, Dasgupta S, Mukhopadhyay S, Pal N, *et al.* Incidence of the Hb E [β26(B8) Glu→Lys, *G* AG> *A* AG] variant In Totos, one of the smallest primitive tribes in the world. Hemoglobin. 2013; 37(1):26-36. https://doi.org/10.3109/03630269.2012.746942 PMid:23215760
54. Bango M, Ghosh S. Social and regional disparities in utilization of maternal and child healthcare services in India: A study of the post-national health mission period. Front Pediatr. 2022; 10:895033. https://doi.org/10.3389/fped.2022.895033
55. Srivastava S, Bertone MP, Basu S, De Allegri M, Brenner S. Implementation of PM-JAY in India: A qualitative study exploring the role of competency, organizational and leadership drivers shaping early roll-out of publicly funded health insurance in three Indian states. Health Research Policy and Systems. 2023; 21(1):65. https://doi.org/10.1186/s12961-023-01012-7 PMid:37370159 PMCid: PMC10294452
56. Sardar A, Paul S, Mondal P. Ethno-medicinal practices among the Toto tribe in Alipurduar, West Bengal. Int J Community Med Public Health. 2021; 8(6):2869. https://doi.org/10.18203/2394-6040.ijcmph20211
57. Sample Registration System (SRS)-Bulletin; 2020. Retrieved from: https://censusindia.gov.in/nada/index.php/catalog/42687