Caste and Infant Mortality In India

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Abstract: *In this paper, I shed light on a puzzle in India. Scheduled Caste children are less likely than Scheduled Tribe children to survive their first birthday, even though Scheduled Castes have higher wealth, educational attainment, and access to state services than the Scheduled Tribes. This highlights a critical inequality puzzle with far-reaching policy implications. I find that where Scheduled Caste and Scheduled Tribe children stay leads to differences in these mortality outcomes.*

Acknowledgements*: This paper was written for the course "Development Economics" at University of Texas at Austin. I would take the opportunity to thank Dean Spears, Manuela Angelucci and Leigh Linden – my course professors for providing valuable knowledge and feedback. I would also like to thank Raissa Fabregas, Bill Spellman, Chandler Stolp, Sangita Vyas and Vivek Shastri for their constant insights and support during the writing of this paper.*

INTRODUCTION

In this paper, I present an inequality puzzle present in health and the development literature. Scheduled Tribe children in India have lower wealth, educational attainment, and face worse access to state services such as piped water and health infrastructure compared to the majority

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Scheduled Caste children. However, six out of 1,000 or more Scheduled Caste children, as compared to Scheduled Tribe children, are likely to die before their first birthday. Four out of six Scheduled Caste children are likely to die in the first month of their life. In this paper, I describe this puzzle and subsequently try to understand the causal mechanism behind this difference in infant and neonatal mortality rates between the Scheduled Castes and Scheduled Tribes in India.

India is a diverse country with different castes and cultures. There are four main categories into which the Indian community is divided – General Castes, Other Backward Classes (OBCs), Scheduled Castes (SC) and Scheduled Tribes (ST). General castes are socially and economically advantaged compared to the other caste groups. SCs and STs are the constitutionally designated groups of historically disadvantaged people in India. Scheduled Castes (also called "Dalits") rank lowest in Hindu society and are often called the "untouchables." They frequently face discrimination from other castes. STs are economically the most disadvantaged population of the country. They are the indigenous tribes of India (called the "Adivasis"). The STs have a social identity that is outside the caste system. They tend to live in isolated villages that are not well served by state services like well-connected roads, public health services, etc. SCs and STs form about 16.6 percent and 8.6 percent of India's population, respectively (according to India's 2011 census).

LITERATURE REVIEW

Relative to global levels, India has a high infant mortality rate and neonatal mortality rate. With 22.7 deaths out of 1,000 births before the baby's first-month mark, India has been performing poorly in terms of child survival rates.[1] Using a nationally representative survey of 1.1 million households, Diego Bassani et. al find the main causes of neonatal and child mortality in India. Accounting for 78 percent (0.79 M/1.01 M) of all neonatal deaths, the three main causes are prematurity and low birthweight (0.33 M; 99% CI 0.31-0.35 M); neonatal infections (0.27 M; 99% CI 0.25-0.29 M); and birth asphyxia and birth trauma (0.19 M; 99% CI 0.18-0.21 M). Two causes that account for 50 percent (0.67 M/1.34 M) of all deaths between the ages of 1 and 59 months are pneumonia (0.37 M; 99% CI 0.35-0.39 M) and diarrheal diseases (0.30 M; 99% CI 0.28-0.32 M).[2] Kishor (1993), Murthi et al. (1995), Claeson et al. (2000), Pande (2003), and Bassani et al. (2010) study the difference in child mortality rate by gender.[3] Bhalotra et al. (2008) study the difference in infant mortality

rates by religion.[4] Geruso and Spears (2018), in their seminal paper, find that Hindu children are more likely than Muslim children to die before their first birthday because of the practice of open defecation among their community.[5] Very few studies look at the differences in infant mortality by caste status in India. Dommaraju et al. (2008) use National Family Health Survey (NFHS-2) to indicate that net of individual-level and community-level controls, children belonging to low castes have higher risks of death.[6] Bora et al. (2019) show that 78 percent of the caste-based gap in Under 5 Mortality is due to the effect of women's education levels and household wealth between the SC/ST and non-SC/ST population.[7] Ram et al. (2016), using the NFHS-2 and NFHS-3, address that mortality rates among STs are lower than SCs but provide no further analysis.[8]

This paper is the first to use the recent NFHS-4 data to address the puzzle that despite higher wealth and education among SCs, they are more likely to die before their first birthday as compared to ST children. This paper is also the first to try and find the causation behind this difference. I follow Geruso and Spears (2018) methodologically for this paper.

THE PUZZLE OF HIGH SC MORTALITY

Methodology

For my analysis, I use the data from the most recent round of the National Family Health Survey (NFHS) of India in 2015 and 2016. The NFHS (India's version of the Demographic and Health Survey) is a large, nationally representative survey that collects data from women aged fifteen to forty-nine. Respondents report birth histories, including deaths and stillbirths, from which I calculate infant and neonatal mortality rates. The NFHS also includes information on household assets, household physical infrastructure, and health behaviors.

NFHS-4 sample size is expected to be approximately 568,200 households. This yields a total sample of 625,014 women and 93,065 men eligible for the interview. The NFHS-4 sample is a stratified two-stage sample. The 2011 census served as the sampling framework for the selection of Primary Sampling Units (PSUs). PSUs were villages in rural areas and Census Enumeration Blocks (CEBs) in urban areas. PSUs with fewer than forty households were linked to the nearest PSU. Within each rural stratum, villages were selected from the sampling frame with Probability Proportional to Size (PPS). In each stratum, six approximately equal substrata were created by crossing three substrata, each created based on the

estimated number of households in each village, with two substrata, each created based on the percentage of the population belonging to SCs and STs. Within each explicit sampling stratum, PSUs were sorted according to the literacy rate of females aged six years or older. The final sample PSUs were selected with PPS.

Table 1 tabulates the summary statistics for our main sample. My primary analytical interest is the Infant Mortality Rate (IMR) and the Neonatal Mortality Rate (NMR), defined respectively as the number of deaths among children less than one year old and less than one month old, scaled per 1,000 live births. Throughout the paper, I organize the analysis at the level of the individual child, constructing mortality rates from birth history information on around 54,000 SC and ST children.

Table 1 shows that infant mortality is 11 percent higher for SCs as compared to STs. Analysis of neonatal mortality shows a similar pattern, with an 11 percent survival deficit. Conversely, SCs are found to have higher educational attainment and wealth, measured in the survey by the possession of various technology and other assets.

Table 1. Summary Statistics: Scheduled Caste (SCs) and Scheduled Tribes (STs) in NFHS-4

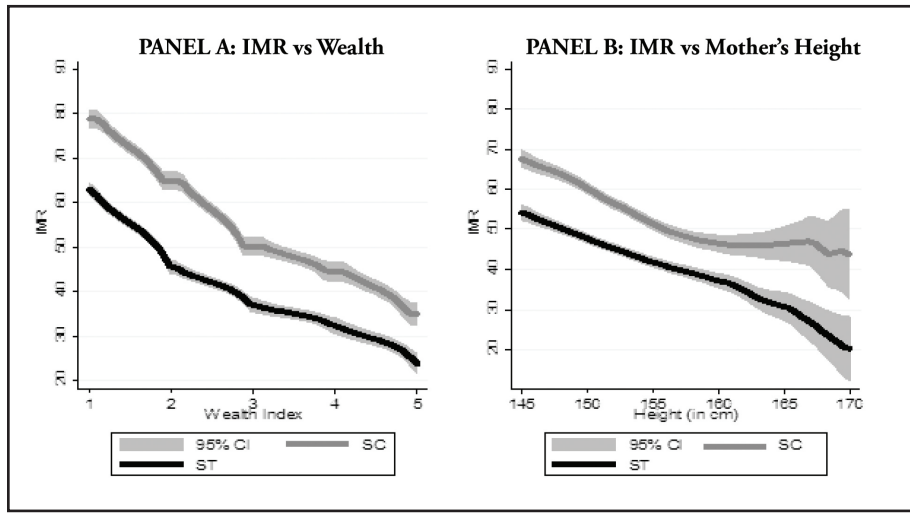
	SC Subsample		ST Subsample	
	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)
Infant Mortality (IMR), year 1	57.094	0.77	51.357	0.929
Neonatal Mortality (NMR), month 1	39.011	0.614	35.018	0.74
Household Open Defecation	0.535	0.005	0.546	0.007
Local (PSU) open defecation	0.534	0.005	0.547	0.007
Household has electricity	0.977	0.005	0.95	0.007
Household has piped water	0.135	0.003	0.102	0.004
Household is urban	0.255	0.007	0.18	0.007
Household has radio	0.225	0.005	0.197	0.006
Household has TV	0.748	0.006	0.6	0.008
Household has refrigerator	0.345	0.006	0.262	0.007
Household has bicycle	0.755	0.006	0.649	0.007
Household has motorcycle	0.436	0.006	0.381	0.007
Household has car	0.179	0.005	0.16	0.006

Table 1. continued	SC Subsample		ST Subsample	
	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)
Mother's height	157.715	10.258	157.97	6.312
Mother no education	0.532	0.004	0.55	0.005
Mother completed primary	0.389	0.003	0.353	0.004
Child's birth order	2.316	0.007	2.289	0.009
Child's female	0.476	0.001	0.479	0.002
Observations (live births)	246513		298428	

Notes: The table displays summary statistics for my main analysis. Neonatal and infant mortality are defined, respectively, as the number of deaths among children less than one month old and less than one year old, scaled per 1,000 live births. Observations are children (live births).

The Puzzle

Figure 1. Infant Mortality Rate (IMR) for Scheduled Castes (SC) and Scheduled Tribes (ST) by Wealth and Mother's Height



Notes: The figure plots local regressions of infant mortality on measures of economic well-being. The dependent variable is an indicator for death in the first year of life × 1,000. Panel A plots mortality against asset wealth rank, constructed as described in the text. Panel B plots mortality against mother's height. Observations are children (live births). The grey area in the figure correspond to 95 percent confidence intervals that are not adjusted for clustering.

Figure 1 demonstrates the mortality puzzle. At all levels of socio-economic status, mortality is higher among SC infants than ST infants. The figure plots IMR, separated by the two groups, against two alternative summary measures of household economic well-being. The NFHS, like all DHS surveys, does not measure income or consumption. Therefore, in Panel A of Figure 1, I follow the literature (see, for example, Filmer and Pritchett 2001)[9] in using asset ownership as a proxy for wealth. I use the wealth index that is measured by the NFHS itself as a proxy for assets in the household, which gives the horizontal axis clear rank interpretation. As an alternative measure of parental endowment, I use mother's height along the horizontal axis in Panel B of Figure 1. Maternal adult height predicts maternal adult health and reflects maternal economic well-being earlier in the mother's life.[10] Figure 1 shows that IMR is steeply decreasing in both measures, which is consistent with the variables' (asset ownership and mother's height) ability to capture meaningful variation in endowments that correlates with child survival. The SC disadvantage is apparent in the large and statistically significant mortality differences at any fixed level for either measure of well-being.

Empirical Strategy

I run the following linear regression to try and understand patterns in society:

$$1.\ Mortality_{ij} = \alpha + \beta Caste_{ij} + \mu_j + f(X_i) + \varepsilon_{ij}$$

where i indexes live births and j indexes PSUs. $Mortality_{ij}$ is an individual-level mortality indicator for infant and neonatal mortality. It is scaled such that coefficients reflect deaths per 1,000 births. $Caste_{ij}$ is the regressor of interest. It takes the value 0 if the mother of the child belongs to ST and 1 if the mother belongs to SC. The PSU is represented by μ_j (the main model has PSU-fixed effects). X_i are controls for a set of demographic and socio-economic characteristics that determine early-life health in India according to literature. They include gender of child (1 if female, 0 if otherwise), and mother's height, wealth index, education level of mother, religion of child, birth order, and whether the household has piped water (1 if yes, 0 if no). I chose these covariates because considerable evidence suggests that variables capturing economic status and education level predict child development outcomes, likely in part because they are correlated with the quality and quantity of food and other health inputs that young children need to grow.[11] I also control for high caste fraction. Coffey et al. (2019)

find that since SCs live in the vicinity of General caste people, their social rank orders are enforced against them, making them feel discriminated against.[12] This discrimination causes a lot of stress and anxiety in Scheduled Castes children, manifesting into physical health impacts like lower child height. However, since STs stay in regions mostly secluded from other castes, they are not discriminated against, despite being the poorest caste in India. Robust standard errors are clustered at the PSU level. I also run treatment by covariate interactions. However, the results do not change– instead, they show the same story.

A. Results

Table 2. Regression Output

Dependent Variable	IMR	IMR	IMR	IMR	NMR	NMR	NMR	NMR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Scheduled Caste	5.737*** (1.19)	6.243*** (1.28)	1.210 (1.99)	1.264 (2.03)	3.994*** (0.95)	4.126*** (1.04)	1.184 (1.64)	1.470 (1.70)
Mom's Height	No	-1.284*** (0.09)	No	-1.096*** (0.10)	No	-1.022*** (0.08)	No	-0.878*** (0.08)
Wealth Index	No	-6.674*** (0.55)	No	-5.257*** (0.71)	No	-4.403*** (0.46)	No	-3.127*** (0.58)
Education Level	No	-1.695*** (0.14)	No	-1.308*** (0.16)	No	-1.212*** (0.11)	No	-1.090*** (0.13)
Female	No	-9.606*** (0.94)	No	-9.500*** (0.98)	No	-10.208*** (0.77)	No	-10.183*** (0.80)
Piped Water	No	-4.472** (1.68)	No	-2.544 (2.24)	No	-3.687** (1.37)	No	-1.190 (1.76)
High Caste Fraction	No	4.356* (2.02)	No	0.000 (.)	No	4.643** (1.64)	No	0.000 (.)
Birth Order Dummy	No	Yes	No	Yes	No	Yes	No	Yes
Religion Dummy	No	Yes	No	Yes	No	Yes	No	Yes
PSU fixed Effects	No	No	Yes	Yes	No		Yes	Yes
Observations	524938	524938	524938	524938	520406	520406	520406	520406

"* p<0.05 ** p<0.01 *** p<0.001"

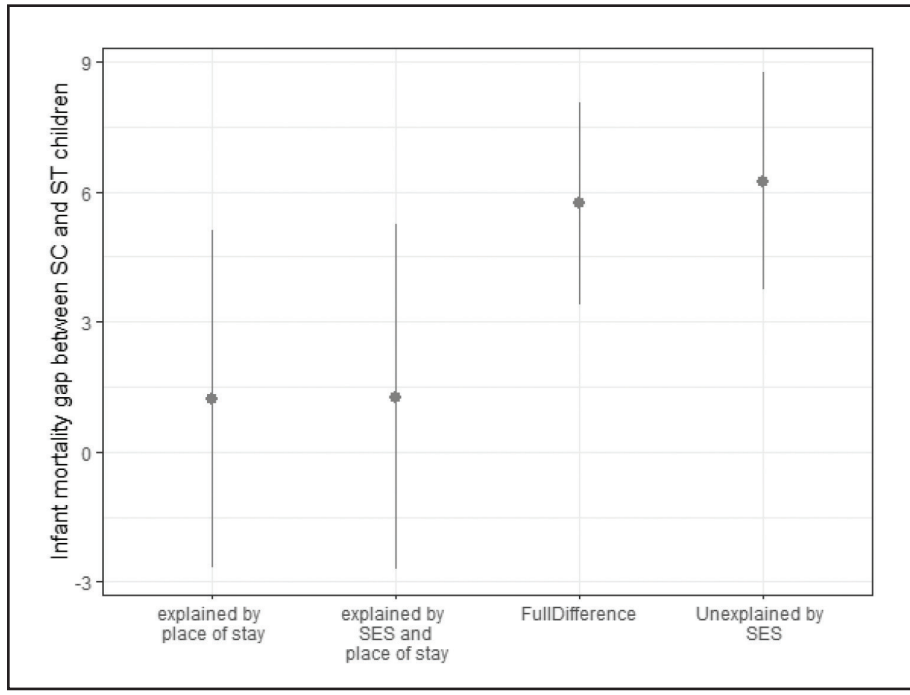
The table reports results from OLS regressions. The dependent variable in columns 1 through 4 is infant mortality (year1). The dependent variable in columns 5 through 8 is neonatal mortality (month1). Mortality

variables are scaled as described in the text to generate coefficients that indicate impacts on rates × 1,000 (deaths per 1,000) children. Columns 1 and 5 do not control for SES variables or PSU fixed effects. Columns 2 and 6 control for SES variables, The SES variables are a set of controls including mother's height, mother's educational attainment, household wealth, birth order, an indicator for child's sex, an indicator for piped water and high caste fraction (Coffey et al., 2019).13 Columns 3 and 7 only have PSU fixed effects. Columns 4 and 8 control for SES variables, and I add PSU fixed effects. Observations are children (live births). Probability weights are given to regression. Standard errors are clustered at the PSU level.

In Table 2, Model 1 (the naïve estimate) tells us that on average, six out of 1,000 more SC children are likely to die as compared to ST children before their first birthday. These results are significant at the 95 percent confidence interval. When socioeconomic status controls are added to Columns 2 and 6, we see that more SC children are likely to die before their first birthday and reaching one month of age. These results are also significant at the 95 percent confidence interval. However, we should clarify that these columns only state that SCs fare better in comparison to STs in relation to socioeconomic status.

In Columns (3) and (7), I add PSU fixed effects. Models (3) and (7) tell us that, when accounting for PSU fixed effects and urban/rural goodness, SCs are more likely to stay in areas that are more likely to have unfavorable conditions for infant and neonatal mortality as compared to the STs. In the main Models, Model (4) and (8), I add socioeconomic-demographic covariates and PSU fixed effects. When comparing live births in the same PSUs and matched on observably similar socioeconomic status, SC children are more likely to die than ST children. However, the results are insignificant at the 95 percent confidence interval. These models show that when we add PSU fixed effects, being a Scheduled Caste or Scheduled Tribe is unlikely to determine infant and neonatal mortality. Controlling for PSU fixed effects, with or without the SES controls, renders the coefficient on caste insignificant.

Figure 2. Infant Mortality Gap between SC and ST Children by Place of Stay



Notes: Figure 2 graphically depicts the regression output in table. One thing to notice is that the infant mortality puzzle could be explained by the child's "place of stay," as our confidence intervals overlap with zero. That provides an alternative hypothesis that could probably explain the anomaly.

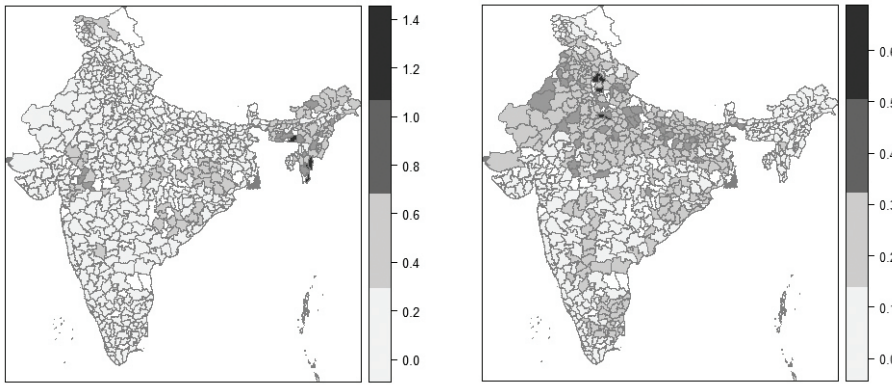
CONCLUSIONS AND SCOPE FOR FURTHER RESEARCH

I have laid out the puzzle above stating that even though SCs in India are better off than STs in terms of health, wealth and educational status, SC children are more likely to die than ST children before their first birthday. This is a puzzle because all the main causes of mortality listed in health and demography literature seem to be working in the opposite direction. I specifically look at two confounding variables from the literature—Open Defecation and High Caste Fraction—that might lead to increased IMR and NMR among SCs. My control for "open defecation" is based on a recent paper by Geruso and Spears. The SC population in India is mostly Hindu, while STs belong to either the Muslim or Christian religion. Geruso and Spears find that Hindus have a higher infant mortality rate than Muslims, despite having higher wealth, health and education indicators, because of the Hindu practice of defecating in the open. This practice

leads to increased rate of infection among young rural children, causing higher deaths. [14] However, when I control for open defecation, I do not find that open defecation is the cause behind the SC/ST mortality puzzle.

When I add PSU fixed effects, I see that it is where SCs live is what matters for infant and neonatal mortality. Trying to explore as to what specifically about "where SCs/STs stay" could lead to this puzzle, I graph a map as to the geographical location of where STs and SCs stay. Figure 3 shows that while SCs are spread throughout the country, STs are clustered together in certain parts of the country and almost non-existent in the others.

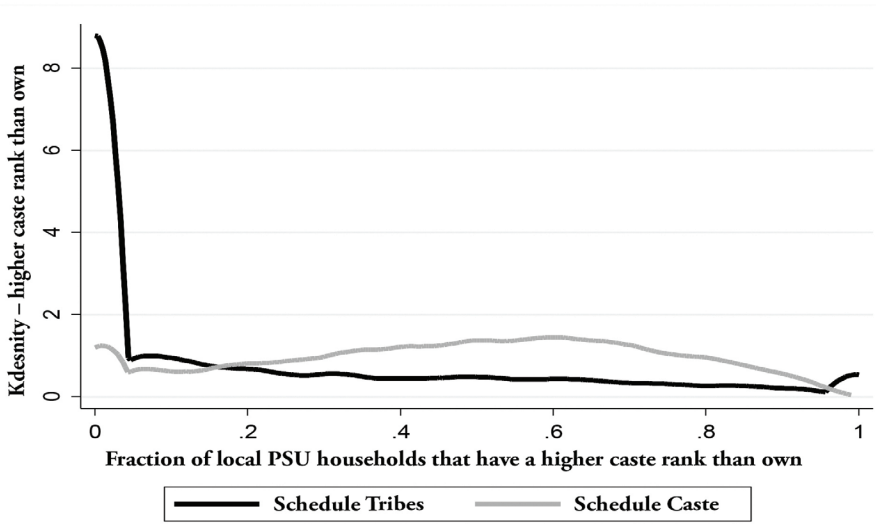
Figure 3. ST and SC Population Proportions



Notes: The left map shows the proportion of SC population of the total ST and SC population. The right map shows the proportion of ST populations of the total ST and SC population. The scales on the two maps are different because STs are less in number as compared to SCs. The figure shows that while SCs are spread throughout the country, STs are clustered together in certain parts of the country and almost non-existent in the others.

Then, based on a recent paper, I control for High Caste Fraction – controlling for "whether General castes live in surrounding areas," causing SCs to be discriminated against, and hence causing higher infant mortality among SCs. I find that SCs tend to stay in regions with General Caste groups and STs do not.

Figure 4. High Caste Fraction among PSU Households



However, when I control for it in my regression (methodologically similar to Coffey et al. 2019), I do not find that "high caste fraction" (proxy for discrimination) is the causal mechanism behind the puzzle.

I also find that overall, these regions where STs stay are poorer regions with less access to health facilities. Therefore, the question remains: what about the PSUs leads to this difference? This is an extremely important question for policy makers. Until we do not know the cause, specifics of where SCs or STs stay that leads to higher infant and neonatal mortality among the SCs, we will not be able to make policies to reduce the mortality rate. The health of a child is extremely important not just via the instrumentalist approach– that we need healthy children for economic development—but also for the equity argument. We need healthy children because they *deserve* to be healthy. To be healthy, we need to know what causes mortality, and research in this area can lead to important health policy to reduce infant and neonatal mortality in India. ***f***

ENDNOTES

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