A Study of Healthcare Delivery Disparities in Gujarat, India

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ABSTRACT

India is quickly emerging as a dominant economic force in the global arena. However, the country remains identified as a "developing" or third-world nation, due to widespread poverty. This paper focuses on the state of Gujarat in India, often labeled India's model state, and aims to examine Gujarat's health outcomes across its different districts. The following data brief involves a secondary data analysis of key health indicators in Gujarat's districts in relation to each district's varying proportions of scheduled caste, scheduled tribe, rural, literate, and educated populations. This analysis will shed insight on the possibility of health disparities and discrimination in healthcare delivery for underprivileged populations in Gujarat, India.

INTRODUCTION

"What do you do if someone is sick?" I asked the family seated on the dirt floor, under the shade of a hut made of cow dung and bamboo sticks. We had scooched away from the scorching sun, trying to escape as much of the arid, 100°F heat as possible. The ground was cracked and dry; farmers across India were anxiously waiting for the arrival of the monsoons.

"We treat them with nature," said a young man, smiling.

Confused, I asked the teacher who was travelling with me what he meant. "It's Ayurvedic medicine," he explained.

"I had kidney stones," an eighteen-year-old named Pawan told me. "If I had gone to the hospital, it would have taken me weeks to get cured. Anyways, we don't trust the government. So, I went to the village healer, and he gave me a mix of lemon juice with the root of a special plant. In two days, I was better." Pawan told me about how his village doesn't trust modern medicine, least of all the government. Pawan's village is part of the Chaudhari tribe, one of 29 tribes in Gujarat, according to India's 2001 Census. Like many other tribes in Gujarat, the Chaudhari tribe worships the elements of nature, and therein believes in their fundamental healing power.

A few days later, I interviewed Suresh, a health worker in the village of Arnai. He tells me that tribals often come to the health center where he works with infections from their natural treatments. He says the leaves and concoctions that the villagers use aren't necessarily contaminated, but the surfaces and methods of ingesting these natural cures are not hygienic. As a result, many tribals contract infections from using natural treatment. Intrigued by tribals' attachment to Ayurvedic medicine and how "natural" health choices could have unintended implications, I further examined the circumstances of tribals' health. I found that their health conditions are inextricably linked to the dire poverty that they have endured, due to India's long history of marginalizing tribes ([United Nations India](#)).

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For many generations, tribes were nomadic, and their "primitive" characterization didn't do them any favors. Ostracized from large villages and towns, who considered these migrating groups criminal and inferior, tribals gradually became cut off from India's

rapidly modernizing, urbanizing society (United Nations India). India's constitution labels this vulnerable population of around 115 million, or 8.6% of the country, the "Scheduled Tribes," and since independence, the government has taken efforts to uplift the status of this population. Along with the scheduled tribes, the government has identified another group that is heavily discriminated against, the "Scheduled Caste" population of around 222 million individuals, or 16.6% of Indians: they belong to the lowest caste in Hinduism, and are known as *Dalits,* or "Untouchables." According to United Nations India, "Scheduled Tribes (STs) and Scheduled Castes (SCs) are among the most disadvantaged socio-economic groups in India."

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The government has "enacted progressive legislation" such as the Land Acquisition Bill, the Resettlement and Rehabilitation Bill, and "special schemes to enable access to opportunities," to help secure these vulnerable populations' land and safeguard them from corporate manipulation and discrimination from villagers. Despite the government's interventions, however, Pawan tells me that when he attends college in Pune, Maharashtra, he doesn't divulge the fact that he is *Adivasi*, or tribal, to anyone, not even his friends. In May 2019,

Dr. Payal Tadvi, a young, Adivasi doctor at a private hospital in Mumbai, committed suicide because of the "repeated discrimination of her colleagues because she was from a lower caste" (Gupta). Dr. Tadvi's case is, sadly, not a singular occurrence; violence against members of scheduled castes and tribes are routine across India. Perceived as "low-born," these vulnerable populations are "not permitted to draw water from the same well or eat from the same plates or drink from the same glasses used by the upper castes" (Ghosh).

In light of the multiple factors that appear to play a role in tribals' health – their methods of natural healing and their long history of discrimination – I decided to take a closer look at the distribution of key health indicators across the districts in the state of Gujarat, known as the "model state" of India. The current Prime Minister of India, Narendra Modi, who was previously the Chief Minister of Gujarat, has touted Gujarat as the ideal Indian state (The Logical Indian). In this study, I will examine these health indicators in relation to each district's percent of vulnerable populations (STs and SCs), rural population, literacy rate, and attendance of educational institutions.

METHODS

This study entailed a secondary data analysis with raw data from the Indian government's website (data.gov.in), which provides extensive datasets from India's Census. Deriving data from the "Performance of Key Health Management Information Systems (HMIS) Indicators" 2017-2018 datasets for each of Gujarat's districts, I manually collected the data from each district into Excel. The health indicators included the percent of:

- Pregnant women who received 4 prenatal checkups out of the total

pregnant number of pregnant women registered for care
- Pregnant women receiving tetanus toxoid vaccine
- Safe deliveries out of total reported deliveries
- Public and private C-section deliveries out of total institutional deliveries
- C-sections conducted at public facilities out of the total number of deliveries at public facilities
- Pregnant women given 360 tablets of Calcium out of the total women registered for prenatal care
- Newborns given the Hepatitis B vaccine
- Infants who received the Measles and Rubella vaccine out of reported live births
- Children given Vitamin A out of reported live births
- Immunization sessions held out of the total number of immunization sessions planned
- Females screened for HIV out of total prenatal care registration
- Females HIV positive out of total females tested
- Total HIV positive from all men and women tested

These 13 health indicators represent a mix of health outcomes and care utilization. I utilized data from India's Census (censusindia.gov.in) and noted the scheduled tribe and caste population for each district, and within those vulnerable populations, the literacy and employment rates. Controlling for the variables of education and employment would potentially yield insight into factors that are associated with greater utilization and delivery of healthcare among the vulnerable populations.

The data I collected ultimately went beyond my initial motivation to examine the

potential correlation between the proportion of vulnerable populations and health indicators across Gujarat's districts. According to Save the Children, an Indian NGO, "most of the poor people in India are based in rural areas." I was curious if the rural population of a district had any association with a higher or lower utilization and delivery of healthcare.

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Fortunately, this data was also available on the India Census website from 2011. Additionally, I collected data on literacy rates and the percent of individuals who had attended educational institutions across each district; this data was also available on data.gov.in from 2001.

I used Python Pandas in Jupyter Notebook to complete linear regressions and visualize the data. The independent variables in this study are the proportions of the vulnerable group populations, rural population, literacy rates, and educational institution attendance. The dependent variables are the key health indicators, including both healthcare delivery and health outcomes. Thus, the regression code, an example of which is shown below in **Figure 1**, was run multiple times to account for each health indicator across each independent variable.

Figure 1: An example of the regression results between the independent variable of

the rural population of the districts and the dependent variable of the percentage of C-sections in public and private facilities.

```python
import statsmodels.api as sm # import statsmodels
X = all_data["Percentage Rural"]
y = all_data["Percent combined private and public C-sections"]
X = sm.add_constant(X)
model = sm.OLS(y, X).fit()
model.summary()
```

OLS Regression Results			
Dep. Variable:	Percent combined private and public C-sections	R-squared:	0.433
Model:	OLS	Adj. R-squared:	0.409
Method:	Least Squares	F-statistic:	18.33
Date:	Sat, 14 Dec 2019	Prob (F-statistic):	0.000258
Time:	22:57:26	Log-Likelihood:	-85.820
No. Observations:	26	AIC:	175.6
Df Residuals:	24	BIC:	178.2
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	33.5787	4.810	6.981	0.000	23.651	43.506
Percentage Rural	-0.2946	0.069	-4.281	0.000	-0.437	-0.153

Omnibus:	2.270	Durbin-Watson:	2.667
Prob(Omnibus):	0.321	Jarque-Bera (JB):	1.925
Skew:	0.557	Prob(JB):	0.382
Kurtosis:	2.267	Cond. No.	251.

Any results with a p-value over 0.05 or t-value below 2 are marked in the results matrix and not considered as a relevant finding. In summary, the methods used in this study are intended to determine if the delivery and utilization of healthcare across the districts of Gujarat was correlated to any of these factors.

RESULTS

(All data results and files are listed at the end of this paper in the appendix.)

Overall, there was no significant correlation between the percentage of scheduled caste and tribe populations and health indicators. Controlling for employment and literacy within the scheduled caste and tribal populations also did not yield any significant results (refer to the results matrix).Interestingly, there was one indicator that had a stronger correlation with the scheduled caste population: for everyone percentage point increase in the scheduled caste population, there was a 1.034 percentage point increase in pregnant women receiving the Tetanus Toxoid

vaccine (**Figure 2**). However, this association is weak, as seen below in the data plot.

Figure 2: Showing the correlation between the percent of a district that is scheduled caste and the percent of pregnant women receiving the Tetanus Toxoid vaccine in the district.
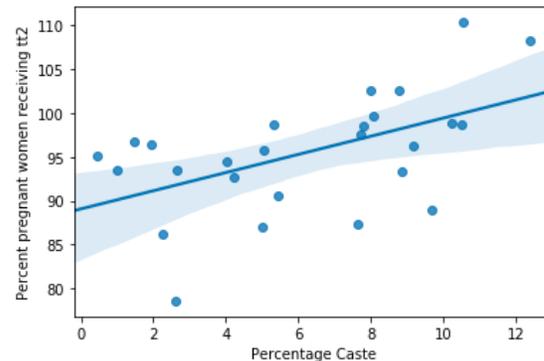
However, there were a few significant findings when the health indicators were compared to rural population. First, there was a moderately negative correlation between the rural population of a district and the percent of C-sections performed at both private and public facilities out of the total reported live births (**Figure 3**). Secondly, there was a stronger negative correlation between the rural population and the percent of C-sections performed at only public facilities (**Figure 4**).

Figure 3: A moderately negative correlation showing that for every 1 percentage point increase in percentage points of the rural population, there is a 0.295 percentage point decrease in the number of C-sections performed at both public and private facilities out the total number of reported live births.
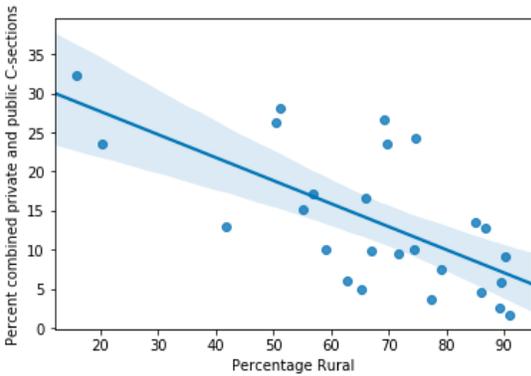
(Displayed above is **Figure 3**)

Linear regressions with the other health indicators in regard to the rural population did not demonstrate significant associations. There were also a couple interesting findings when analyzing the association between literacy rate and health indicators. For the same two health care delivery indicators above, a stronger-than-average correlation was shown, though not as significant:

Figure 5*: For every 1 percentage point increase in the literacy rate in a district, there is a 0.846 percentage point increase in the number of C-sections performed in private and public facilities out of the total number of reported live births.
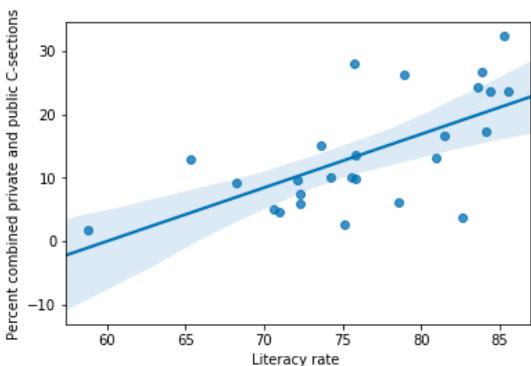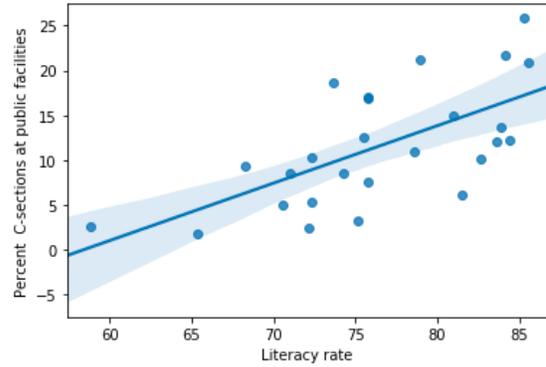

Figure 6: For every 1 percentage point increase in the literacy rate, there is a 0.640 percentage point increase in the number of C-sections performed at public facilities out of the total number of reported live births.

Apart from these interesting findings, there was no moderate or strong association between the proportion of vulnerable population, rural population, literacy rate, and attendance of educational institutions with the presence of key health outcomes and healthcare delivery indicators.

DISCUSSION

The overall lack of significant findings affirms the validity of the null hypothesis: districts in Gujarat with higher proportions of scheduled caste or tribe populations do not have lower healthcare utilization or poorer health outcomes than other districts. Additionally, with the exception of the few moderate associations shown above, the degree of the rural population, literacy rate, and attendance of educational institutions are also not positively or negatively associated with the health indicators.

However, the exceptions to this general analysis are fascinating to think about: why is that out of all 13 health outcomes and care delivery indicators, C-sections were the only indicator that had a stronger correlation with two of the independent variables? The most likely reason stems from the India's shortage of doctors and hospitals in rural areas (Cooper). Hospitals are more likely to be located in cities, and thus the greater rural population of a district may find it harder to travel to an urban area for a C-section—the cost of transportation, as well as the geographic uncertainty of not

knowing where to go, since rural India is often isolated from urban knowledge (Panagariya).

Furthermore, the more populous a rural region, the more that rural practices could be ingrained in village society; cultural practices and traditions play a critical role here. Indeed, rural villages in India often have a midwife or an informal healer, and a large rural population may defer to these family and community-oriented practices of healthcare, which are viewed as more culturally and spiritually intact, rather than adhering to urban, modernizing trends (Gramvaani).

> ## "Hospitals are more likely to be located in cities, and thus the greater rural population of a district may find it harder to travel to an urban area for a C-section…"

Next, regarding literacy rate, other health care delivery indicators, such as prenatal checkups, receiving vaccines, calcium tablets, and vitamins are much less expensive and resource-heavy than a C-section. Villagers who are not fluent or literate in the language communicated by the healthcare provider may not fully understand the premise of a C-section and may be more hesitant to undergo surgery. Additionally, many Indians speak a language other than Hindi, often times dialects that are exclusive to particular regions. Since it is more likely that hospitals are located in urban areas, where the language spoken is more likely Hindi or

even English, it is probable that many who do not live in centralized urban areas face a language barrier in accessing health care. Again, the influence of culture and tradition may cause Indians to be skeptical of an invasive and seemingly complex procedure, especially if the individual is unable to clearly communicate with the healthcare provider and understand the benefits of the surgery.

These findings suggest that there needs to be greater awareness and education on invasive medical procedures for maternal health in rural and illiterate areas. Indeed, preventative, simpler healthcare delivery indicators such as prenatal checkups and vaccines are not showing a correlation to the rural population or literacy rate, which suggests that the leap from preventative care to more intense, involved procedures can be both a logistical leap in terms of understanding and convenience for villagers. A 2013 study on inequity in maternal health care utilization in Gujarat finds similar results, showing that "structural determinants like caste group, wealth, and education were all significantly associated with…institutional deliveries" (Saxena & Vangani).

Despite these exceptions that point to some interesting findings, it is more important to discuss the more overarching finding— which is that there is no strong association between other variables. On the surface level, this rejection of the initial hypothesis can be interpreted positively, for it indicates that districts that are disproportionately more populated with vulnerable groups, rurally inhabited, literate, or educated do not experience a different level of healthcare delivery or health outcomes. It is indeed possible that the "model state" of India does live up to its superior developmental status. The policies that India has implemented at a federal level which are mentioned above, such as the laws that prevent against displacing vulnerable populations, may be

effective and successfully bridging the divide between marginalized groups and other Indians.

> *"These findings suggest that there needs to be greater awareness and education on invasive medical procedures for maternal health in rural and illiterate areas."*

However, given that there are still health disparities between these disadvantaged groups and the rest of Indians, it is important to consider other reasons for why no correlation was found, as well as the limitations of this data analysis (Poel & Speybroeck).

First, it is important to remember that grouping together *all* scheduled caste or scheduled tribes as one uniform, disadvantaged group is not necessarily accurate. There is significant variation among these groups, such as their level of modernization and socio-economic status. Thus, it is possible that the mere larger presence of scheduled caste or scheduled tribe groups in a district does not affect the health indicators, because there is much variation among these vulnerable populations.

Furthermore, it is also possible that the controls that I used for the vulnerable populations – literacy and employment – were not the most precise variables that I could have used. In fact, there is nuance to the question of whether one is literate or employed. From a developed-country perspective, we may assume that these questions are of a binary nature, but in

India, which has a massive informal labor market and a spectrum of literacy, this assumption cannot be made (Mysorekar). The types of jobs that mark respondents' status of employment are not always formal jobs. Informal jobs include paying a neighbor to take one's children to school or cooking some extra *rotis*, or bread, for a family member. Should these types of jobs constitute employment? Literacy also is not a binary quality—many poorer Indians can read and speak a very basic level of Hindi, not necessarily the level required to be able to understand how medical services or treatment work and why they are necessary. In this manner, the very definition of literacy and employment may not be specific enough to control for in this analysis. It may have been more significant to have a specific variable such as fluency in Hindi and English, or the income and time equivalent of the respondent's job. Unfortunately, that data does not exist yet.

One reason that there may not have been a correlation between the attendance of educational institutions and healthcare delivery is the quality of schools. Especially in rural areas, the quality of education is not always significant. Crowded classrooms and overwhelmed academic institutions often only have one or two teachers (Kohli). Furthermore, the data that I collected specifically refers to an overall attendance of educational institutions, at *any* point in the individual's life. The respondent may have only attended primary school, and dropped out early, as is characteristic for girls, for whom it is often more important to do household work; in this case, the few years of education would have little influence on the individual's decisions to utilize healthcare and enlist in receiving certain procedures or treatment.

Another possible reason that significant correlation was not found could be that the independent variables that I used weren't sufficient enough to illustrate a correlation—

other factors might have been more relevant, such as household income, distance from cities and more concentrated resources, or even environmental factors, such as water and air quality.

Another important characteristic of this study was the aspect of endogeneity. I assumed that the independent variables should be the characteristics of the population, and the dependent variable should be the health indicators; however, the study could also have worked with flipping the variables. In this sense, the health indicators are being examined as the variables explaining the trends in the health indicators. Expressing the data in this sense would lead to a very different set of underlying assumptions regarding the study overall.

CONCLUSIONS

Overall in Gujarat, the size of the scheduled tribe and scheduled caste population, rural population, literacy rate, and attendance of educational institutions do not correlate to the delivery of health care or health

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outcomes, with a few exceptions. Interestingly, literacy rate and rural population negatively correlate with the number of C-sections that are performed in both public and private facilities, as well as exclusively in public facilities. These findings suggest that the government should implement policy that devotes resources and incentivizes medical professionals to work in rural areas and explain to villagers about the need and purpose of invasive medical procedures, especially regarding maternal health.

In light of the realities of the health disparities that still exist between each of these independent variables and other Indians, there are two general explanations for why the results of this study do not negate the null hypothesis: either the different variables within the data, such as literacy and employment, are not defined with the specificity and depth that would be pertinent to the dependent variables, or other variables are more responsible for the health disparities

"…the government should implement policy that devotes resources and incentivizes medical professionals to work in rural areas and explain to villagers about the need and purpose of invasive medical procedures, especially regarding maternal health."

APPENDIX

Excel Spreadsheet with Relevant Data:
Showing the data that was used for statistical analysis.

Overall Results Matrix:
Showing the regression results for all the data analyses.

Results for Vulnerable Populations:
Visualizing the data and linear regression between the vulnerable populations of districts and their health outcome and delivery indicators. Additionally, regressions for controls of literacy and employment within the vulnerable population were performed.

Results for Rural Population:
Visualizing the data and linear regression between the rural population of districts and their health outcome and delivery indicators.

Results for Educated Population:
Visualizing the data and linear regression between the educated population of districts and their health outcome and delivery indicators.

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