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AN EXPLORATION OF STATE-BASED VARIATIONS IN HEALTH OUTCOMES BETWEEN DALITS AND OTHER CASTES IN INDIA

Dissertation submitted by

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Abstract

This thesis examines variations in health outcomes between Dalits (formerly untouchables) and non-Dalits in select states of India. Although significant strides have been made in achieving better health outcomes in India, the country's most marginalized communities face persistent health inequities on the basis of caste. This research attempts to understand why state-based differences exist in health outcomes between different caste groups. The theoretical framework of the research uses a combination of the Social Determinants of Health Framework by Solar and Irwin (2010) and the Structural Violence Theory by Galtung (1969) to identify key social determinants, caste interactions with structural factors using a mixed methods approach. The quantitative analysis uses India Human Development Survey (IHDS-II) a nationally representative sample survey to uncover underlying causes of these disparities. Findings reveal that Dalits have a higher disease burden, longer medical waiting times and lower treatment satisfaction when compared to Upper Caste communities. The thesis examines the structural violence underlying in the Indian Public Health System that perpetuates a host of health inequities and advocates for blanket policy reforms to tackle these issues.

Key words: Caste System, Health Inequities, India, Social Determinants of Health, Public Health, Healthcare Access, Structural Violence, Policy Interventions

Introduction

A 3000-year-old social tradition forms the basis of Hindu society: the caste system. Caste influences everything from occupation to who comprises one's social circle and, most importantly, influences the focus of this thesis: a person's health outcomes. Found on the last rung of this ancient hierarchy is that group known as the Dalits, or untouchables, who are also beset with social and economic disadvantages, including discrimination in the healthcare field. Despite economic progress in India, wide health gaps exist, and health inequities persist, especially along the lines of caste (Balarajan et al., 2011). This thesis attempts to understand the state-based variations in health outcomes of Dalits versus non-Dalits and why these differences exist, with similar population size and percentages of Dalit population but different socio-economic indicators.

Kumar (2010) notes that lower caste populations are surrounded by a host of adversities comprising untouchability, violence, and discrimination at the hands of historical, social, and economic factors that blight them and seriously impact their access to basic resources and rights. Incidents of physical violence, sexual harassment, and even killings are much too common. According to Vengateshwaran and Velusamy (2017), the caste mindsets of people towards Dalits remain as it was, and atrocity incidents against Dalits are increasing in an incremental manner for every year. Such vicious circles of violence bring about not only direct physical harm but also long-term psychological injuries, adding to the intergenerational trauma of Dalit communities. As Misra (2022) poignantly describes, “It is about us and the powerful nature of intergenerational trauma. It is about how trauma passes

from mother to daughter and manifests as aches, sores, and memories in the body and how the collective systems of patriarchy, caste, and motherhood produce and facilitate individually abusive mothers, who suffocate their children and prevent them from speaking up and breaking the silence of narcissistic parental abuse" (p. 37).

An undeniably inhumane practice, manual scavenging, continues through the manual cleaning of human excreta, which is almost exclusively done by Dalits, leading to extreme health risks and social stigmatization. According to Kurian and Singh (2017), targeted legislation and schemes meant to uplift them have not been effective due to higher castes using their economic and political influence to undermine these programs. Discrimination against Dalits, justified by caste, physically and socially isolates and excludes them from society. Severe caste prejudices prevent Dalits from accessing opportunities and resources, leading to their entrenched marginalized status.

Land is an important source of social status and economic security in rural areas. Landlessness increases the vulnerability and dependence of the Dalits (Pankaj, 2016). The Agricultural Census 2015-16 reports that Dalits own a meager 9% of the agricultural land in India. Recent data from the Census of India reveals the staggering fact that 71% of Dalits are landless laborers, working on land they do not own. Additionally, 58.4% of Dalit households in rural areas do not have any land at all (Yendge, 2019). By failing to effectively carry out land reform, increasing numbers of people have become increasingly susceptible to economic distress, contributing to the growth of militancy. In Bihar, Dalits enthusiastically support the activities of the guerrillas due to the appalling poverty of many of them (Bhatia,

2005). Economic liberalization in India has also influenced the Dalits. Privatization has decreased jobs in the public sector, which limits the effectiveness of affirmative action based reservations of job opportunities for lower caste communities.

Police brutality against Dalits has been on the rise; custodial deaths and excessive force have alarmingly increased as well, especially during protests against discrimination and violence. Caste pride and superiority of caste Hindus often lead to such crimes, with the police mostly complicit in these (Kochar, 2022). The generational trauma that results for the Dalits shows up in mental health problems, substance abuse, and an increase in hopelessness (Capella et al., 2020). Based on the review of existing research and theoretical approaches, the following research questions and hypotheses are proposed for the current study:

Research Questions

How do social determinants of health contribute to caste-based disparities in healthcare access in different Indian states?

This question will be explored through quantitative analysis, examining the impact of socioeconomic status, education, employment, physical environment, social support networks, and access to healthcare on health outcomes among Dalits and non-Dalits.

How does structural violence perpetuate health inequities between Dalits and non-Dalits?

This question will combine quantitative analysis with policy analysis to understand how systemic discrimination and exclusion impact health disparities among Dalits. The analysis will focus on identifying the institutional practices and social norms that perpetuate structural violence and exacerbate health inequities.

Hypothesis 1: Socioeconomic and educational disparities significantly contribute to healthcare access inequalities between Dalits in different states across India.

The SDOH framework suggests that socioeconomic status and education are critical determinants of health. Therefore, disparities in these areas are likely to contribute significantly to healthcare access inequalities among Dalits.

Hypothesis 2: Structural violence, manifested through systemic discrimination and exclusion, exacerbates health disparities among Dalit populations.

Structural Violence Theory posits that social structures and institutions systematically harm certain populations. Thus, systemic discrimination and exclusion are expected to exacerbate health disparities among Dalits.

Context: The Indian Caste System.

The traditional caste system consists of four principal varnas: Brahmins (priests and teachers), Kshatriyas (rulers and soldiers), Vaisyas (merchants and traders), and Shudras (laborers and artisans). Below these varnas are the Dalits, or "untouchables," who do work deemed too polluting to be included in the traditional varna system. While Article 17 of the

Indian constitution may have abolished "untouchability," the Dalits are still facing massive social and economic harm, thereby being exposed to several forms of deprivation of resources and life chances. Within these principal castes, there are thousands of sub-castes, known as jatis, which are further divided on the basis of occupation, region, and language. Dalits are considered to be outside the caste system and are considered inferior and polluting. Even among Dalits, there are further subdivisions reflecting a complex and deeply entrenched social structure that continues to influence the socio-economic and religious status of an individual.

These ancient caste classifications were recodified and hardened during British colonial rule in the 19th century. The British codified certain Brahman-Sanskrit texts, for instance the Manusmriti, as canon, branding them ex post facto as the source of caste divisions (Chakravorty, 2019). They enshrined this idealized conception within the census and made lists of the vastly heterogeneous population of India under strict compartments.

The census revealed the complexity and fluidity of social identities, which did not fit into the clear categories imposed by the British. The British still persisted in simplification and definition, creating a stiff system that had not existed in quite a concrete form before this date. Susan Bayly (2001), an anthropologist, opined that "until the colonial period, the operation of caste distinctions was very limited: social identities were mutable in a high degree through occupation, marriage, or migration" (p. 3–4)

The British had just simplified the case-based categorization in an attempt to make one governable society under a common law. This had also introduced new categorizations

and hierarchies, combining incompatible groups and hardening flexible boundaries. As a result of these actions, British colonial rule reinforced and redefined the caste system to be rigid and all-pervading (Chakravorty, 2019).

The implications of such a colonial reshuffling remain profound, as the fixed categories became tagged to social and economic rights that had a substantive consequence on human lives, further fortified through religion-based electorates in British India and caste-based reservations in independent India that influenced the access to resources and opportunities. That is not to say that the British created the caste system in India, but their simplified caste system survives to this day and defines the nature of Indian society. The so-called modern caste system has the following categories:

1. **Forward/General caste:** The communities that were traditionally Brahmin and other high castes make up this group.
2. **Scheduled Castes (SC)**: As per Article 366 (24) of the Constitution of India, the Scheduled Castes is defined as such castes, races, or tribes, or parts or groups within such castes, races, or tribes as are deemed under Article 341 to be Scheduled Castes for the purpose of this constitution (Constitution of India, 1950).
3. **Scheduled Tribes (ST)**: According to Article 366 (25) of the Constitution of India, this group is defined as such tribes or tribal communities, or parts or groups within such tribes or tribal communities as are deemed under Article 342 to be Scheduled Tribes for the purposes of this constitution (Constitution of India, 1950).

4. **Other Backward Class (OBC**) is a collective term used by the Government of India to classify communities that are educationally or socially backward (Constitution of India, 1950).

For the purpose of this thesis we will use the term ***'Dalit'*** interchangeably for both ST and SC populations. Dalit communities live in ghetto areas and are often prohibited from public places like temples, schools, or places to draw drinking water, this kind of social exclusion is a basic human rights violation that starts with a vicious cycle of poverty and marginalization (Human Rights Watch, 1999).

Literature Review

Research on health disparities among Dalits is quite critical. Previous works have explored a lot of such disparities such as mortality rates, maternal and child health, nutrition, and mental health. The complete lack of a comprehensive caste census makes it difficult to make accurate measurements of Dalit health outcomes while building a reliance on sample surveys rather than precise data for policy and interventions. Dalits have significantly higher mortality rates than higher caste groups, reflecting profound health disparities. According to Kumari and Mohanty (2020), life expectancy at birth is lower for Dalits, with higher infant and child mortality rates. These disparities are due to poorer healthcare access, lower socioeconomic status, and greater environmental risks. Indirect outcomes analyzed from the National Family Health Survey (NFHS-5) have concluded that Dalit children are more likely to have higher rates of neonatal and post-neonatal mortality than higher caste children (Tripathi et al., 2023).

Maternal and child health indicators are particularly concerning among Dalit populations. Studies show that Dalit women have higher rates of maternal mortality, low birth weight infants, and under-five mortality (Retnakumar & Krishnakumar, 2020). Limited access to maternal healthcare services, including antenatal care, skilled birth attendance, and postnatal care, contributes to these poor health outcomes (Namasivayam et al., 2017). According to the NFHS-5, Dalit women are less likely to receive full antenatal care and are more likely to deliver at home compared to women from higher caste groups (Algur et al., 2023). Social discrimination and economic barriers exacerbate disparities in maternal health services, hindering Dalit women's access to quality healthcare. Children belonging to lower castes are more likely to suffer from stunting, wasting, and being underweight compared to children from higher caste groups (Nandy et al., 2005). Food insecurity, in general, inadequate dietary intake, and poor living conditions contribute to high levels of malnutrition among Dalits. Nutritional disparities are further worsened by social exclusion and discrimination in accessing food and nutrition programs (Mamgain & Diwakar, 2012). A study by Pradhan and Rao (2018) found that Dalit households have lower access to public distribution systems (PDS) for food grains, resulting in poorer nutritional status.

The cycle of violence and social exclusion that is experienced by Dalits result in higher rates of psychological stress and mental health disorders (Gupta & Coffey, 2020). And this is not addressed through any access to mental health services or any availability of culturally sensitive mental health services. Previous research into disease burdens have revealed that lower caste communities are likely to have a higher burden of cardiovascular

diseases and diabetes (Joshi et al., 2006). Systemic discrimination adds another level of difficulty in accessing any healthcare service be it primary, secondary or tertiary healthcare. In a study by Reddy et al. (2011), it was found that Dalit individuals have higher chances of living with hypertension and diabetes when compared with Upper Caste individuals, mostly due to stressful lifestyle factors and lower access to healthcare services.

The Impact of the Lack of Caste Census

The absence of a comprehensive caste census in the country complicates any research on healthcare access that factors caste in. The decennial census collects some data on Scheduled Castes (SCs) and Scheduled Tribes (STs), but the collection is very limited and does not go into other caste groups and sub-caste groups namely *jatis* (Sahgal & Starr, 2021). The lack of any granular data hampers the researcher's ability to say for certainty that the full extent of health disparities have been uncovered or to develop any meaningful interventions. The exclusion of caste data from the Census has become an issue of contention amongst scholars and politicians. Those critical of the move argue that it is incredibly difficult to monitor the progress of affirmative action policies or to design policies that target Dalit communities (Kumar, 2010). The absence of caste data also hinders the evaluation of health programs aimed at improving outcomes for Dalits, as it prevents a clear understanding of which interventions are most effective for different sub-groups within the Dalit population (Thapa et al., 2021).

The Indian government has affirmative action policies that have been designed to improve the economic conditions of Dalits. These are colloquially referred to as "Reservations". These reservations stipulate that a certain percentage of jobs and roles in any public institution must be reserved for candidates from Scheduled Caste, Scheduled Tribes and Other Backward Classes. A debate that centers around this policy is its effectiveness in improving socio-economic outcomes for Dalits. Thorat (2016) argues that reservation policies have indeed increased access to education and employment for Dalits although their impact on health outcomes remain questionable. Scholars argue that such policies treat caste as simply an economic backwardness and do not acknowledge the discrimination and other social determinants of health that inflict such disparities (Kumar, 2010). Previous research has shown that discrimination done by healthcare workers becomes a significant barrier between healthcare access and Dalits (Acharya, 2022).

Critics argue that these policies do not address the underlying social determinants of health, such as discrimination and economic inequality, which continue to perpetuate health disparities (Kumar, 2020). Another critical debate focuses on the role of healthcare providers in perpetuating caste-based discrimination. Research has shown that discrimination by healthcare providers is a significant barrier to accessing quality care for Dalits (Acharya, 2010). Studies by Armstrong & Davenport (2010) and Acharya (2010) document numerous instances of Dalits being denied entry to healthcare facilities or receiving substandard treatment due to their caste. Addressing this issue requires not only policy interventions but also efforts to change attitudes and behaviors within the healthcare system. The interplay

between economic liberalization and caste-based health disparities is also a topic of ongoing debate. Economic liberalization and privatization have made it difficult for Dalits to find jobs due to reduced public sector jobs and increased economic vulnerability (Das, 2021). There is a presence of literature that details how reservations have decreased India's economic potential but the author's caste background comes into play with this because a lot of those who question such affirmative actions belong to Upper Caste such as Mehta (2004). India's economic liberalization policies that were first implemented in the 90s have opened up new opportunities for economic advancement of Indian citizens but some argue that this has exacerbated existing inequalities and created a bigger gap between the wealthy and the poor (Thorat et al., 2016)

Social Determinants of Health (SDOH) Framework

The SDOH framework has been designed to understand the influence of social, economic and environmental factors on health (Solar & Irwin, 2010). Such determinants encompass a broad range of indicators such as socioeconomic status, physical environment , employment, education in addition to access to healthcare. Within this framework the socioeconomic status (SES) of an individual becomes a critical determinant of health. SES tends to include income, education and occupation. A lower SES status usually indicates poor health outcomes because a person with low SES is likely to have inadequate access to healthcare and have unhealthy living conditions (McMaughan et al., 2020). This proves to be a good measure for our research as Dalits are more prone to socio-economic disadvantages. Barik & Thorat (2015) have found that Dalits have lower levels of education

attainment, worse housing conditions in turn, poorer access to healthcare. Educational disparities are deeply rooted in social exclusion and discrimination, further limiting Dalits' opportunities for economic advancement and access to health services (Sreekumar, 2023). The National Family Health Sample Survey (NFHS-4) has data on literacy rates among Dalits which are significantly lower than those of higher castes, which directly impacts their health literacy and ability to navigate the healthcare system effectively (IIPS, 2017).

The second measure in the framework pertains to physical environments such as housing conditions, sanitation and access to clean water.

The physical environment, including housing conditions, sanitation, and access to clean water, plays a crucial role in determining health outcomes. Dalits often endure life in poverty conditions with inadequate sanitation and limited access to clean water, making them more susceptible to infectious illnesses and other health problems (Dutta et al., 2018). Thorat and Lee (Thorat & Lee, 2005), found that Dalit homes are more likely to lack basic facilities like toilets and clean drinking water, all of which are necessary for good health. Poor living conditions lead to mental health issues such as stress, anxiety, and depression, especially among segregated and marginalized Dalit groups (Evans, 2003). The Indian Human Development Survey (IHDS)- 1 supports these findings, revealing a large disparity in access to basic utilities between Dalits and upper castes (Desai & Dubey, 2012).

Employment stability is linked to maintaining health and well-being. But even at this juncture, Dalits face discriminatory practices while accessing the labor market because employers display stigma towards them. Dalits are still largely confined to low-paying jobs

with poor conditions such as manual sewer cleaners and so on which adversely affect their health outcomes (Das, 2021). The report by the National Sample Survey office (NSSO) finds that Scheduled Castes and Scheduled Tribes are disproportionately represented in the informal, unorganized labor sector with no job security or insurance for health (Hazra, 2023).

Another link established in the framework is access to social support networks with having family and friends who can provide emotional support to cope with stress (Drageset, 2021). Social exclusion and discrimination makes it difficult for Dalits to access a social support system. Civil society organizations have come up in the recent past that advocate for the rights of Dalits but their reach is limited. Such a support system is crucial for maintaining mental and physical wellbeing. Jiwani et al. (2022), have shown that social cohesion and collective efficacy are lower in Dalit communities, impacting their ability to mobilize resources and advocate for their health needs. The SDOH framework stipulates that healthcare is a fundamental determinant of health (Solar & Irwin, 2010). Healthcare inequity can occur due to various factors such as infrastructure, discrimination and financial resources. Dalits have such barriers due to a historic lack of economic mobility and discrimination by healthcare providers (Acharya, 2022). Such barriers can cause treatment delays, and substandard quality of care eventually resulting in higher disease burdens. Some research has revealed that lower castes in the country have lower rates of institutional deliveries and antenatal care which are particularly concerning for Dalit women (Ali et al., 2023).

Structural Violence Theory

Structural Violence Theory, developed by Galtung (1969) in essence, stipulates that social structures and institutions can systematically reduce the ability of communities and groups to meet basic human needs. The notion of 'violence' becomes ingrained into a person's everyday life when factors such as class, ethnicity, race and religion bring about a lack of realized potential at the same time those factors increase it for some others (Page-Reeves et al., 2013). Such violence can put marginalized communities in the poorest position. Farmer, et al. (2006) expand on Galtung to say,"are structural because they are embedded in the political and economic organization of our social world; they are violent because they cause injury to people (typically, not those responsible for perpetuating such inequalities)" (p. 1686). In the context of using this theory in public health, outbreaks of violence also pertain to the limitation of options or the lack of options in situations where there is already a lack of options. This kind of violence is invisible and ingrained in the social fabric and makes itself known through policies, economic systems and social hierarchies.

In India, the structural violence framework is appropriate to study the health outcomes of Dalits due to the nature of the caste system and how invisibilized it is in daily life. The caste system is intangible from exploitation, social discrimination and disadvancement of Dalits. The system perpetuates economic and social exploitation which in turn results in health inequalities. A more direct form of structural violence is also witnessed in the way Dalits are often neglected, and verbally and physically abused in the healthcare system (Devkota, 2017). The rigidity of caste cannot be understood without understanding its colonial legacy. The codified and institutionalized caste distinctions were the first time that the Brahmin text

Manusmriti gained canonical status. These rigid hierarchies are still followed to this day. O'Hanlon (2017) argues that this colonial codification of caste has created an even more rigid and pervasive system of social stratification in the country. Before this, some lower caste individuals could escape their social distinction by attaining economic and social mobility but in today's day a person's caste status is codified in their government-issued identifications.

Methodology

Theoretical Framework

The theoretical framework of the thesis is a combination of the two primary theoretical frameworks discussed in the literature review, namely the Social Determinants of Health (SDOH) framework developed by Solar and Irwin (2010) and Galtung's Structural Violence Theory (1969). The SDOH framework dictates that health is influenced by a multitude of social, economic and environmental factors such as income, education, employment and access to healthcare. This framework gives us a broad ground to analyze some socio-economic and healthcare outcomes between Dalits and Upper Castes. The framework will be used to compare income, education and health variables to see if Dalits have a lower outcome than Upper Castes. It would also be interesting to see the differences between Upper Caste, Dalits and Other Backward Classes (OBC) since the latter have been known to attain better economic outcomes. These comparisons will give us a good estimate of Caste-wise economic stability, education and health outcomes. Structural Violence Theory as outlined in the review defines violence as the difference between known or unknown

potential and the actual realization of one's personal capabilities when constrained by society. This violence makes people perform and realize below their actual potential affecting their ability to meet their basic needs. This is extended to include not just physical harm but systemic discrimination and social structures that seek to exclude disadvantaged people. This theory is crucial to understanding why social determinants of health, if found to be poor, are worse for Dalit. The theory will allow us to identify caste-based discrimination in healthcare practices and exclusion that is being perpetuated against the Dalits. With this theory, the research aims to uncover policies that favor Upper Castes or perpetuate social norms that could limit lower-caste individuals from accessing essential services.

Research Design

The research is going to analyze health outcomes between different caste groups in three chosen states namely, Uttar Pradesh, Bihar and Maharashtra. These states have been chosen because they currently house an estimated 35% of India's total population amounting to over 400 million individuals. They are also the most populous states in India with relatively similar estimated caste ratios. These three states were also chosen because they have vastly different Gross State Domestic Product (GSDP) on purpose to see if state GSDPs have major effects on the people's outcomes.

Table A: GSDP by State

	GSDP at Current Prices (2011-2012) (in crores)
Bihar	247,144
Maharashtra	1,280,369
Uttar Pradesh	7,24,050

(Ministry of Statistics and Programme Implementation, 2022)

The quantitative analysis is conducted through separate regressions for states that have been chosen based on certain parameters with each of the identified dependent variables. This approach avoids the complexities of interaction terms and allows for a clearer interpretation of the results. The dependent variables are major morbidity, healthcare access, treatment satisfaction, and wait times for medical treatment.

Qualitative Component

The qualitative analysis involves examining state-level health policies that affect health outcomes for different caste groups. This component provides a deeper understanding of the local implementation of health policies and their impact on Dalit communities.

Data Sources

The primary data for this analysis come from the India Human Development Survey - II (IHDS-II) which was conducted in 2011-12. The survey is nationally representative with

multiple topics pertaining to the daily lives of people living in diverse Indian households. The survey has 42,152 households that span across 1,420 villages and 1,042 urban neighbourhoods in all of India. The survey was designed and implemented by the National Council of Applied Economic Research (NCAER) in New Delhi in collaboration with the University of Maryland and is made publicly available. The IHDS-II survey has a large repository of several datasets, each capturing different dimensions of human development such as Individual Education and Health, Eligible Women's Education and Health, Medical Facilities Medical Facility**,** Wage and Salary Income & Social Capital and Village. These datasets provide a somewhat detailed view of health, education, employment, economic status, marriage, fertility, gender relations, social capital, village infrastructure, wage levels, and panchayat composition

The key variables used in the regression models are:

- **Caste:** Categorized into four groups: Upper Caste, Lower Caste (OBC), Dalit, and Other. OBCs are coded as a separate category due to the upward economic mobility that is displayed by individuals of this caste.
- **Income:** Measured as household income, adjusted for inflation and regional cost differences.
- **Education:** Highest education level attained within the household, categorized into primary, secondary (Upto Grade 10), and tertiary levels.
- **State Identifier:** Used to control for regional differences and enable state-level comparisons.

- **Weights:** Applied to ensure the representativeness of the survey data and correct for potential biases due to the sampling design.
- **Age:** Continuous variable indicating the age of individuals.
- **Health Provider Type:** Categorical variable indicating the type of healthcare provider consulted.

To handle missing data and ensure the robustness of the results, multiple imputation via Predictive Mean Matching (PMM) with the mice package in R was employed. This approach involves the following steps: All character variables were converted to factors to facilitate the imputation process. Multiple imputations were performed with 5 iterations using predictive mean matching. This method helps to reduce bias and increase the robustness of the results. Post-imputation steps included converting relevant columns back to factors and scaling numeric variables for model convergence and interpretability. The dataset was subsetted to include only the relevant variables and observations necessary for the analysis. This step involved filtering out incomplete or irrelevant records to improve the efficiency and focus of the study.

Model 1: Confidence in Public/Private Healthcare.

With this model we aim to analyze the effect of caste on major morbidity among individuals through logistic regression since it is appropriate for binary outcome variables which in our case is the presence or absence of major morbidity. The dependent variable Major Morbidity (binary) has been derived by merging major morbidity prevalence for all available data such as diabetes, heart disease, major mental illness, epilepsy and so on. The

independent variables were Caste Group, State, Age, Types of Treatments, Education level and Income. The equation for the model is are follows:

$$log(\frac{P(Major\ Morbidity)}{1-P(Major\ Morbidity)}) = \beta0 + \beta1(Caste\ Group) + \beta2(State) + \beta3(Types\ of\ Treatments) + \beta4(Age) + \beta5(Education) + \beta6(Income) + \epsilon$$

Model 2: Medical Treatment Wait Times.

The second model is a linear regression that examines the influence of caste, income, education, and other factors on the waiting time for medical treatment. The dependent variable of the model is Medical Treatment Wait Time which is measured in minutes. The independent variables are Caste Group, State, Income, Education, Age, and Health Provider Type (Public/Private). The equation for the model is given below:

$$Wait\ Time = \beta0 + \beta1(Caste\ Group) + \beta2(State) + \beta3(Income) + \beta4(Education) + \beta5(Age) + \beta6(Health\ Provider\ Type) + \epsilon$$

Model 3: Treatment Satisfaction.

The final model of the paper uses linear regression to evaluate how caste, income, education, and healthcare provider characteristics impact the perceived quality of medical treatment. The model consists of Treatment Satisfaction as the dependent variable with Caste Group, State, Income, Education, Age, Health Provider Type being the independent variables. The regression equation for this is given below:

$$Treatment\ Satisfaction = \beta 0 + \beta 1(Caste\ Group) + \beta 2(State) + \beta 3(Income) + \beta 4(Education) + \beta 5(Age) + \beta 6(Health\ Provider\ Type) + \epsilon$$

Limitations

The primary data source used is a sample survey with largely self-reported data. This could make the data have biases which could make the results questionable. It could be possible in cases where individuals could report healthier statuses due to stigma and intimidation. We have tried to handle this by controlling for major determinants that could support our initial assumptions. The data has information about the broader categories of Castes that are based on current government regulations but as established before, intra-caste variations exist within jatis (sub-castes). Although this thesis does not delve into jatis, it does make a distinction between Dalits and Other Backward Classes (OBC) which often get grouped but differ vastly in their social and economic outcomes. Due to the scope of the thesis being Central India, it will not be able to capture health outcomes for the entire country where health outcomes could look vastly different. This geographical limit is addressed by selecting states in the region that have varied economic outcomes to show a clearer picture of the region that houses nearly 35% of India's entire population. Ideally, this research could have been enhanced by adding a qualitative component that has descriptive testimonies from members of the Dalit community whose experiences with the Indian Public Health system, would have enriched the findings of the quantitative research. The author's positionality as a Non-Dalit would make such interactions sensitive to reinforcing power imbalance.

Findings & Empirical Discussion

Model 1: Effect of Caste on Major Morbidity Using Logistic Regression

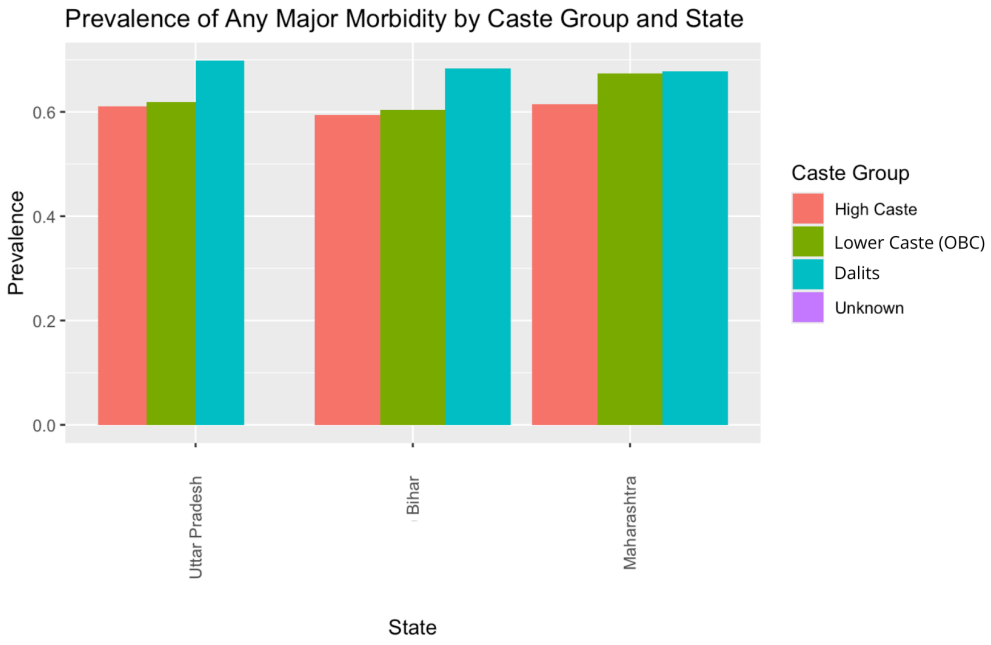
The dataset contains a range of variables capturing demographic, socioeconomic, and health-related information. The data was balanced by sampling weights rendering an approximately equal distribution of major morbidity (0.4997)

Table 1.1 Descriptive Statistics for Model 1

Variable	Min	1st Qu.	Median	Mean	3rd Qu.	Max
Major Morbidity (Yes or No)	0.00000	0.00000	0.00000	0.08853	0.00000	1.00000
Weight	154.1	2952.3	4585.3	5926.0	7214.3	156647.5
Age	0.00	13.00	26.00	29.82	45.00	99.00
Income	-1037040	45000	83480	143971	162800	11360000

The average age of the respondents is about 29.82 years. About 8.85 of the individuals from the dataset report having had or presently have a major morbidity. The average annual income is 143,971 INR (USD 2,732.68 in 2011). There is a notable variation in incomes which ranges from -1,037,040 INR (USD -19,684) to 11,360,000 INR (USD 215,621). Since the data is national representative it contains data from all 33 States and Union Territories of the country.

Figure 1.1: Prevalence of Major Morbidity in Selected States



The caste variable was categorized into four groups namely: **Dalits** (Scheduled Castes and Scheduled Tribes), **Lower Caste** (OBCs), **Upper Caste** (Forward castes including Brahmins) and **Others**. The variable for treatment type sought for a major morbidity includes

categories of the following treatments, Antibiotics, Other Allopathic, Ayurvedic, Homeopathy, Home/Herbal Remedy and Surgery. From the education variable, we note that most individuals report no formal education attained followed by primary and secondary (Grade 10) education levels. The family member with morbidity reports that about 50% of respondents report having a family member with a major morbidity.

Findings from Model 1:

The log-odds of Dalits reporting prevalence of major morbidity is significantly high across all three states confirming our initial assumption that Dalits would probably have lower outcomes. The difference between the prevalence of major morbidity between lower castes and Dalits is not much different (Estimate = 0.164, SE = 0.127, z = 1.294, p = 0.196). Although, this is not the case in Maharashtra where low-caste respondents have a significantly higher likelihood of reporting major morbidity when compared to Dalits (Estimate = 0.459, SE = 0.133, z = 3.447, $p < 0.001$). On the other hand, in Uttar Pradesh low castes are much less likely to have a major morbidity when compared to Dalits (Estimate = -0.168, SE = 0.071, z = -2.377, $p < 0.05$). This is an interesting observation as this indicates that perhaps there is more social mobility for OBCs in Uttar Pradesh when compared to Maharashtra. Having a family member with a major morbidity is not statistically significant in Maharashtra and Uttar Pradesh but not in Bihar where it is significantly associated with the likelihood of reporting a major morbidity (Estimate = -0.315, SE = 0.101, z = -3.124, $p < 0.01$). As is often reported, older respondents are more likely to report a major morbidity across all three states. In Bihar, we have some perplexing

findings in relation to education where individuals with secondary school upwards to postgraduates are significantly more likely to report a major morbidity. Higher education is often associated with better health outcomes but in Bihar's case, it is the opposite. A possible explanation for this could be that educated individuals in Bihar are more proactive in reporting their illness. A more controversial explanation is the reflection of the pressure and stress that is associated with attaining any level of education in Bihar which affects their health adversely.

In Maharashtra, people with primary school education and secondary school education are significantly associated with reporting a major morbidity (Estimate = 0.349, SE = 0.171, z = 2.039, p = 0.041434 & (Estimate = 0.843, SE = 0.176, z = 4.78, $p < 0.001$). This holds true for undergraduates as well ((Estimate = 1.105, SE = 0.246, z = 4.486, $p < 0.001$). In Uttar Pradesh people with any level of education are significantly less likely to report a major morbidity which could indicate social stigma and a culture of silence around acknowledging health difficulties, especially amongst the educated communities who may fear professional repercussions. The results for income are predictable with higher income being associated with people reporting lower numbers of major morbidities. Morbidity treatment types were generally not significant across the three states except Surgery which is associated with a lower likelihood of reporting a major morbidity in Bihar and Maharashtra which could indicate. However, since surgery is not significantly associated with lower major morbidity in Uttar Pradesh it could point to a lower healthcare burden or a lower quality of surgical care in the state.

Table 1: Effect of Caste on Major Morbidity

	Bihar				Maharashtra				Uttar Pradesh			
Term	*Estimate*	*SE*	*z value*	*Pr(>|z|)*	*Estimate*	*SE*	*z value*	*Pr(>|z|)*	*Estimate*	*SE*	*z value*	*Pr(>|z|)*
Intercept	3.61E+00	7.33E-01	4.928	8.31e-07 ***	2.636	0.313	8.415	2e-16 ***	3.601	0.461	7.818	5.35e-15 ***
Low Caste	1.64E-01	1.27E-01	1.294	0.19558	0.459	0.133	3.447	0.000566 ***	-0.168	0.071	-2.377	0.017 *
Upper Caste	3.33E-02	1.62E-01	0.206	0.8367	-0.55	0.145	-3.796	0.000147 ***	-0.049	0.083	-0.592	0.554
Family Member with Morbidity	-3.15E-01	1.01E-01	-3.124	0.00179 **	-0.074	0.103	-0.724	0.469346	0.093	0.06	1.568	0.117
Morbidity Treatment: Antibiotic	-5.25E-01	7.65E-01	-0.687	0.4921	0.332	0.368	0.902	0.36691	0.299	0.484	0.617	0.537
Morbidity Treatment: Other Allopathic	-7.49E-01	7.31E-01	-1.024	0.30583	-0.19	0.28	-0.676	0.498936	0.277	0.458	0.604	0.546
Morbidity Treatment: Ayurvedic	-1.56E+00	8.88E-01	-1.754	0.07949 .	1.069	1.036	1.033	0.301778	-0.43	0.646	-0.665	0.506
Morbidity Treatment: Homeopathy	2.93E-01	1.01E+00	0.29	0.77217	0.467	0.455	1.026	0.305045	0.419	0.639	0.656	0.512
Morbidity Treatment: Home/Herbal remedy	9.95E+00	4.41E+02	0.023	0.98202	-0.368	1.042	-0.353	0.724174	11.42	139.43	0.082	0.935
Morbidity Treatment: Surgery	-3.64E+00	9.17E-01	-3.968	7.26e-05 ***	-1.523	0.338	-4.514	6.36e-06 ***	0.06	1.107	0.054	0.957
Other Major Morbidity	-2.66E+00	1.04E+00	-2.562	0.01041 *	-0.071	1.042	-0.068	0.945526	0.029	0.847	0.034	0.973
Morbidity Unknown	-7.66E+00	7.28E-01	-10.519	< 2e-16 ***	-8.073	0.264	-30.607	2e-16 ***	-6.95	0.454	-15.322	2e-16 ***
Age	3.87E-02	2.27E-03	17.018	< 2e-16 ***	0.027	0.003	10.336	2e-16 ***	0.029	0.001	21.809	2e-16 ***
Education 1-4 years	-2.59E-02	1.66E-01	-0.156	0.87636	0.349	0.171	2.039	0.041434 *	-0.421	0.101	-4.174	3.00e-05 ***
Primary School	1.93E-03	2.09E-01	0.009	0.99266	1	0	2	0.074761 .	-0.235	0.105	-2.242	0.025 *
Educated till 8th Grade	-1.90E-01	1.52E-01	-1.252	0.2106	1	0	7	8.34e-12 ***	-0.257	0.082	-3.146	0.002 **
Education 10th Grade	-1.01E+00	2.15E-01	-4.71	2.48e-06 ***	0.843	0.176	4.78	1.75e-06 ***	-0.268	0.124	-2.169	0.030 *
Education 12th Grade	8.22E-01	2.01E-01	4.099	4.15e-05 ***	0.322	0.218	1.481	0.138643	-0.486	0.142	-3.432	0.001 ***
Undergraduate	6.76E-01	2.71E-01	2.494	0.01263 *	1.105	0.246	4.486	7.27e-06 ***	-0.568	0.179	-3.178	0.001 **
Some Post-Graduate	1.67E+00	3.15E-01	5.307	1.11e-07 ***	-0.317	0.469	-0.675	0.499563	-1	0.246	-2.895	0.004 **
Education Unknown	-1.10E+01	2.43E+02	-0.045	0.96377	-10	2	0	1	-1.33	1.056	-1.255	0.21
Income	-3.85E-06	6.08E-07	-6.328	2.49e-10 ***	0.00	0.00	-4.69	2.80e-06 ***	0.00	0.00000016	-7.772	7.75e-15 ***
Weight	-3.03E-06	5.88E-06	-0.515	0.60656	0.00	0.00	1.57	0.12	0.00	0.00000322	-0.5	0.617

This model sums up the diverse experiences witnessed amongst high caste and OBCs, who have varied levels of morbidity by state. However, what remains constant is that Dalits have consistently higher reports of major morbidity across the states.

Model 2: Caste-Based Differences on Confidence in Public/Private Healthcare

Table 2.1. Descriptive Statistics for Model 2

Variable	**Min**	**1st Qu.**	**Median**	**Mean**	**3rd Qu.**	**Max**
Medical Wait Time (in minutes)	0.00	5.28	20.00	28.11	50.94	760.00
Confidence: Private hospitals/ Doctors	1.00	0.95	1.00	1.32	1.69	3.00
Confidence: Government hospitals/docto	1.00	1.10	1.00	1.56	2.02	3.00

rs						
Consult for minor illnesses	1.00	1.10	1.00	1.56	2.02	3.00
Income	-1037040	45000	83480	143971	162800	11360000
Education (in years)	0.00	2.15	5.00	5.37	8.59	16.00
Age	0.00	16.08	26.00	29.82	43.56	99.00
Income	-1037040	45000	83480	143971	162800	11360000

The minimum waiting time noted for all patients is 0 minutes while the maximum waiting time is 760 minutes which indicates the presence of outliers in the dataset. The minimum education is 0 years which tells us that some people surveyed have no formal education. The average education is also 5.37 years. This indicates a very low education rate overall in our dataset.

Findings from Model 2

There are quite a few significant disparities in medical treatment waiting times amongst the different caste groups in each of the states. In Uttar Pradesh, Dalits experience significantly longer waiting times when compared to the Upper Caste (Estimate: -0.1833, $p = 0.0203$). In Bihar too, Dalit face longer waiting times than both Upper Castes (Estimate: -0.3404, $p < 0.0001$) and OBCs (lower castes) (0.2183, $p = 0.031$). In Maharashtra, Dalits once again experience longer wait times and very significantly lower wait times are reported by Other Castes (Estimate: 0.0703, $p < 0.0001$). Additionally, higher education and income significantly reduce waiting times in the state which alludes to socio-economic mobility playing a role in healthcare access in the state.

Table 2.1: Effect of Caste on Confidence in Public/Private Healthcare

		Uttar Pradesh				Bihar				Maharashtra			
		Estimate	*SE*	*t value*	*p value*	*Estimate*	*SE*	*t value*	*p value*	*Estimate*	*SE*	*t value*	*p value*
Waiting Time	Intercept	0.3627	0.0615	5.89	0	0.1475	0.0209	7.06	0	-0.3764	0.0076	-49.26	0
	Upper Caste	-0.1833	0.079	-2.32	0.0203	-0.3404	0.0448	-7.6	0	-0.0018	0.0132	-0.13	0.8936
	Lower Caste	0.2183	0.1014	2.15	0.0314	-0.1147	0.2332	-0.49	0.6229	-0.1963	0.3099	-0.63	0.5266
	Other Caste	0.055	0.0666	0.83	0.409	-0.1151	0.0267	-4.31	0	0.0703	0.0112	6.27	0
	Income	0.0173	0.0295	0.58	0.5588	-0.0041	0.0179	-0.23	0.8179	0.0248	0.0055	4.47	0
	Education	-0.0343	0.0199	-1.72	0.085	0.0003	0.0127	0.03	0.9782	-0.0137	0.005	-2.75	0.006
	Age	-0.0019	0.0213	-0.09	0.928	0.0042	0.0117	0.36	0.7185	-0.003	0.0048	-0.63	0.529

		Estimate	SE	t value	p value	Estimate	SE	t value	p value	Estimate	SE	t value	p value
Income	Intercept	0.0176	0.0326	0.54	0.5897	-0.1543	0.0142	-10.83	0	-0.0856	0.017	-5.05	0
	Upper Caste	0.0351	0.0417	0.84	0.4	0.0264	0.0308	0.85	0.3927	0.0421	0.0259	1.63	0.104
	Lower Caste	0.2589	0.0534	4.85	0	-0.1125	0.1599	-0.7	0.4819	0.4628	0.6071	0.76	0.446
	Other Caste	0.1072	0.0351	3.05	0.0023	0.1294	0.0183	7.08	0	0.3697	0.0216	17.08	0
	Treatment waiting time	0.0048	0.0082	0.58	0.5588	-0.0019	0.0084	-0.23	0.8179	0.0951	0.0213	4.47	0
	Education	0.1345	0.0103	13.05	0	0.1029	0.0086	11.95	0	0.0971	0.0097	9.98	0
	Age	0.0369	0.0113	3.28	0.0011	0.0306	0.008	3.82	0.0001	0.0197	0.0094	2.1	0.0356

		Estimate	SE	t value	p value	Estimate	SE	t value	p value	Estimate	SE	t value	p value
Confidence in Government Hospitals	Intercept	-0.0613	0.0485	-1.26	0.2061	-0.3204	0.0193	-16.61	0	-0.1314	0.0187	-7.02	0
	Upper Caste	0.017	0.062	0.27	0.7839	0.2224	0.0414	5.37	0	0.0678	0.0286	2.37	0.0176
	Lower Caste	0.1362	0.0796	1.71	0.0873	-0.3293	0.2146	-1.53	0.125	-0.5824	0.6694	-0.87	0.3843
	Other Caste	0.1951	0.0523	3.73	0.0002	0.0699	0.0246	2.84	0.0046	0.2256	0.0243	9.29	0
	Income	0.1028	0.0232	4.44	0	-0.0081	0.0165	-0.49	0.6218	0.0053	0.012	0.44	0.6577
	Treatment waiting time	0.0876	0.0122	7.16	0	-0.0018	0.0113	-0.16	0.8732	0.1268	0.0235	5.39	0
	Education					0.0048	0.0117	0.41	0.6818	0.0457	0.0108	4.24	0
	Age					0.0035	0.0108	0.33	0.7426	0.0114	0.0104	1.1	0.2719

		Estimate	SE	t value	p value	Estimate	SE	t value	p value	Estimate	SE	t value	p value
Confidence in Private Hospitals	Intercept	-0.3088	0.0442	-6.98	0	0.3663	0.024	15.29	0	-0.2392	0.0138	-17.34	0
	Upper Caste	0.2048	0.0565	3.62	0.0003	-0.265	0.0514	-5.15	0	-0.0485	0.0211	-2.31	0.0212
	Lower Caste	0.1154	0.0726	1.59	0.112	0.0937	0.2665	0.35	0.7253	-0.3265	0.4933	-0.66	0.5081
	Other Caste	0.2665	0.0477	5.59	0	-0.003	0.0306	-0.1	0.9211	-0.1462	0.0179	-8.17	0
	Income	-0.0926	0.0211	-4.39	0	0.0302	0.0205	1.47	0.1411	0.0601	0.0088	6.8	0
	Waiting Time	0.0224	0.0112	2.01	0.0442	-0.0184	0.0141	-1.31	0.1919	-0.0226	0.0173	-1.3	0.1928
	Education	-0.0114	0.0143	-0.8	0.4222	-0.0407	0.0145	-2.8	0.005	0.0279	0.008	3.51	0.0004
	Age	-0.0165	0.0153	-1.08	0.2801	0.0114	0.0134	0.85	0.3941	0.0191	0.0076	2.5	0.0124

		Estimate	SE	t value	p value	Estimate	SE	t value	p value	Estimate	SE	t value	p value
Consultation for Minor Illnesses (QC2)	(Intercept)	-0.3123	0.0491	-6.37	0	-0.6284	0.0239	-26.28	0	0.4013	0.011	36.58	0
	Upper Caste	-0.4545	0.0627	-7.24	0	0.0572	0.0513	1.11	0.265	0.045	0.0167	2.69	0.0071
	Lower Caste	-0.2478	0.0806	-3.08	0.0021	0.8652	0.2661	3.25	0.0012	0.1079	0.3922	0.28	0.7832
	Other Caste	-0.2936	0.0529	-5.55	0	0.2273	0.0305	7.44	0	0.045	0.0142	3.16	0.0016
	Income	0.0206	0.0234	0.88	0.3787	0.0935	0.0205	4.57	0	-0.0231	0.007	-3.28	0.001
	Waiting Time	-0.1039	0.0124	-8.4	0	-0.2047	0.014	-14.58	0	-0.1727	0.0138	-12.53	0
	Education	0.0957	0.0158	6.05	0	-0.0083	0.0145	-0.57	0.5685	-0.0071	0.0063	-1.13	0.2602
	Age	0.0233	0.0169	1.37	0.1697	-0.0042	0.0134	-0.31	0.7537	0.0003	0.0061	0.05	0.9631

Economic discrepancies are more or less consistent across the three states. In the state of Uttar Pradesh Dalits have much lower incomes compared to Upper Castes (Estimate 0.2589, $p < 0.0001$) and Other Castes (Estimate: 0.1072, $p = 0.0023$). Although education has a very strong positive effect on income (0.1345, $p < 0.0001$) , this effect is lower for Dalits when compared to other castes. In Bihar too Dalits have lower incomes than Upper Castes (Estimate: 0.1294, $p < 0.0001$). As is the case with Uttar Pradesh, education (0.1029, $p < 0.0001$) and age (0.0306, $p < 0.0001$) have the positive effect of increasing income levels. Similar patterns are witnessed in Maharashtra as well.

In Uttar Pradesh Dalits have lower confidence in the performance of government hospitals to treat illnesses effectively while Upper Castes (Estimate: 0.1951, $p = 0.0002$) and Other Castes (Estimate: 0.1362, $p = 0.0873$) have a lot more confidence than the reference group. A higher income (Estimate: 0.1028, $p < 0.0001$) and shorter wait times (0.0876, $p < 0.0001$) increase the confidence levels in government hospitals which could be associated with receiving better treatment due to higher income. Similar outcomes are witnessed in Maharashtra where Dalits have lower confidence in the facilities than Upper Caste (Estimate: 0.2256, $p < 0.0001$). Here too, income and shorter wait times result in better opinions about public healthcare services. In Bihar, Dalits have low confidence in government hospitals when compared to Upper Caste (Estimate: 0.2224, $p < 0.0001$). But unlike Uttar Pradesh, income, education and age do not influence people's trust in Bihar's public health services. In Maharashtra, Dalits have lower confidence in government hospitals, whereas Upper Castes exhibit higher confidence (Estimate: 0.2256, $p < 0.0001$). Both income and shorter

wait times positively influence confidence in government hospitals, suggesting that better economic status and timely healthcare improve perceptions of public healthcare services.

Interestingly, Dalits have a lower confidence in private hospitals across the three states. In Uttar Pradesh, higher income negatively affects confidence in the private healthcare practices (Estimate: -0.0926, $p < 0.0001$) which shows that neither the Dalits or Upper Castes have confidence in either public or private healthcare institutions. The same is witnessed in Bihar where higher income negatively affects people's confidence in private hospitals. This could indicate that high-income individuals prefer public hospitals over private ones in Bihar. Conversely, in Maharashtra Upper Castes have a higher confidence in private hospitals.

Dalits are overall less likely to consult any doctors or nurses for the treatment of minor illnesses. In Uttar Pradesh Upper Castes (Estimate: -0.4545, $p < 0.0001$) and Other Castes (Estimate: -0.2478, $p = 0.0021$) are more likely to consult government doctors. Longer wait times are negatively associated with consultation whereas higher education(Estimate: 0.0957, $p < 0.0001$) increases it. Similar outcomes are witnessed in Maharashtra where Upper Castes are more likely to visit a doctor than Dalits. Higher-income in the state is also associated with consulting government doctors (Estimate: -0.0231, $p = 0.0010$).

Model 3: Caste-Based Differences in Perceived Treatment Quality and Waiting Time in Selected States

The key variables in this model are Health provider sex, Treatment satisfaction (whether the healthcare provider treats them nicely, somewhat nicely and not nicely), Medical treatment wait time (minutes), Caste group, Household income, Weight of the individual and the State identifier. The dependent variable is treatment satisfaction and medical waiting time. We have used medical waiting time as a dependent variable once again because it could influence treatment satisfaction and vice versa.

Table 3.1: Descriptive Statistics for Model 3

Variable	**Min**	**1st Qu.**	**Median**	**Mean**	**3rd Qu.**	**Max**
Health provider sex	1.00	2.00	2.00	1.97	2.50	3.00
Treatment Satisfaction	1.00	1.00	1.00	1.14	1.50	3.00
Medical Wait Time	0.00	5.28	20.00	28.11	50.94	760.00
Weight	519.2	1239.0	2066.6	2962.6	3916.4	47220.7

Income	-1037040	45000	83480	143971	162800	11360000

The health provider's sex indicates that nearly 70.1% of the providers have been reported to be male. Since health provider sex and treatment satisfaction were coded in series of 1,2 or 3 we converted the numeric values into meaningful factors. Predictive mean matching was also used with five iterations followed by scaling of the numeric variables to ensure that the model converges.

Findings from Model 3

Consistent with our findings in models 1 and 2, Lower Caste groups have significantly higher treatment satisfaction than Dalits in Uttar Pradesh (Estimate = 0.2885, $p < 2e\text{-}16$). The other caste groups also report higher treatment satisfaction in the state. The same holds true for Maharashtra as well where Dalits report significantly lower satisfaction compared to all other caste groups. In contrast, Lower Caste respondents from Bihar report a significantly lower treatment satisfaction rate (Estimate = -0.3544, $p < 5.72e\text{-}15$). Upper castes in Bihar also report lower treatment satisfaction (Estimate = -0.3544, $p < 5.72e\text{-}15$). This could suggest a lower overall satisfaction with Bihar's healthcare infrastructure amongst diverse castes. While higher income increases treatment satisfaction in Uttar Pradesh (Estimate = 0.0359, p = 7.35e-05) and Maharashtra (Estimate = 0.0053, p = 0.0156), it does not do so in Bihar (Estimate = -0.0025, p = 0.8910). Health Provider's sex does not significantly affect treatment satisfaction in any other state apart from Uttar Pradesh where male healthcare workers are associated with higher satisfaction (Estimate = 0.2202, p <

2e-16). This could indicate a possibility of gender bias in assessing healthcare workers. However in Maharashtra, male health providers are associated with shorter waiting times (Estimate = -0.0860, p = 7.45e-06). Income positively influences treatment satisfaction in Uttar Pradesh and Maharashtra which is in line with our other findings that wealthier individuals perceive better healthcare quality. However, this trend is not observed in Bihar, pointing once again to regional differences in how economic status affects healthcare perceptions.

Table 3.2: Caste-Based Differences in Perceived Treatment Quality

		Uttar Pradesh				Bihar				Maharashtra			
		Estimate	SE	t value	Pr(>|t|)	Estimate	SE	t value	Pr(>|t|)	Estimate	SE	t value	Pr(>|t|)
Treatment Satisfaction	Intercept	0.6692	0.0299	22.4	< 2e-16	0.2283	0.0522	4.38	1.22E-05	1.0101	0.0155	65.32	< 2e-16
	Upper Caste	0.2885	0.0248	11.64	< 2e-16	-0.3544	0.0453	-7.83	5.72E-15	0.0184	0.0052	3.51	0.0005
	Lower Caste	-0.0551	0.0318	-1.74	0.0829	-0.1213	0.2361	-0.51	0.6074	-0.0163	0.1235	-0.13	0.8947
	Other Caste	0.1114	0.0209	5.32	1.09E-07	-0.1187	0.027	-4.4	1.08E-05	0.0204	0.0044	4.68	2.88E-06
	INCOME.	0.0359	0.009	3.97	7.35E-05	-0.0025	0.018	-0.14	0.891	0.0053	0.0022	2.42	0.0156
	Health provider Sex	0.2202	0.012	18.37	< 2e-16	-0.0381	0.0229	-1.66	0.0965	0.005	0.0078	0.64	0.5243
	Age	0.0047	0.0067	0.7	0.4835	0.0017	0.0118	0.14	0.887	-0.0042	0.0019	-2.19	0.0283
		Estimate	SE	t value	Pr(>|t|)	Estimate	SE	t value	p value	Estimate	SE	t value	Pr(>|t|)
Medical Treatment Wait Time	Intercept	0.2375	0.096	2.48	0.0134	0.2283	0.0522	4.38	0	-0.1988	0.038	-5.23	1.75E-07
	Upper Caste	-0.1794	0.0796	-2.25	0.0242	-0.3544	0.0453	-7.83	0	-0.0077	0.0129	-0.6	0.552
	Lower Caste	0.2166	0.102	2.12	0.0337	-0.1213	0.2361	-0.51	0.6074	-0.1846	0.3038	-0.61	0.543
	Other Caste	0.0692	0.0672	1.03	0.3032	-0.1187	0.027	-4.4	0	0.0539	0.0107	5.02	5.31E-07
	Income	-0.0057	0.0291	-0.2	0.8442	-0.0025	0.018	-0.14	0.891	0.0227	0.0054	4.19	2.82E-05
	Health provider Sex	0.0567	0.0385	1.47	0.1411	-0.0381	0.0229	-1.66	0.0965	-0.086	0.0192	-4.48	7.45E-06
	Age	-0.0076	0.0214	-0.35	0.7231	0.0017	0.0118	0.14	0.887	-0.0024	0.0047	-0.5	0.614

Policy Analysis

The central and state healthcare policies that pertain to our chosen states cover over 400 million individuals. Even though we cannot account for individual experiences with healthcare practices in the region, this section will attempt to encapsulate major initiatives taken by the states, central healthcare policies and the deeply entrenched structural violence in the Indian healthcare system. The federal characteristics of India are very apparent in public health. Healthcare is a State subject making the states responsible for the implementation and delivery of healthcare services. Due to variations in GSDP and other factors, states are often unable to raise enough revenue which results in grants and loans from the center. Despite not being at the forefront of implementation, the central government releases national policy guidelines which adopt a one-size-fits-all approach. The Centre has periodically released the National Health Policy (NHP) in 1983, 2002 and 2017 respectively. The first NHP was designed to emphasize achieving primary healthcare for all through establishing referral networks and free publicly available primary healthcare for all. The second NHM which was released in 2002 built upon the previous mission of expanding healthcare to all by establishing new infrastructure and increasing funding for healthcare initiatives. It focused on supporting the National Population Policy of 2000 to stabilize the booming population of the country. Interestingly, for the first time, the Centre put a focus on developing traditional medicine systems such as Ayurveda, Unani and Homeopathy to reach remote populations in a way as a substitute for scientific medical centres. It emphasized increasing public health expenditure to 2% of GDP by 2010 in contributions from both state

and central governments. The third NHP was released in 2017 and it built on its predecessors for the most part. An even bigger emphasis has been put on the promotion of alternative medical practice to make healthcare equitable and accessible to all. The NHP 2017 outlined even more conservative financial resources for healthcare expenditure intending to increase public health expenditure to a mere 2.5% of GDP by 2025. The total government expenditure on healthcare stands at about 3% (National Health Accounts 2019-2020) This increase can perhaps be attributed to the COVID-19 pandemic during which India suffered a catastrophic loss of lives due to the complete collapse of public and private healthcare systems in multiple states of India. These numbers still make India one of the worst performers in GDP expenditure for public health.

A key programme that began in 2005 was the National Rural Health Mission (NRHM), as a recognition of challenges faced by rural populations to access medical care. The mission aimed to reduce the Infant Mortality Rate (IMR) to 30 per 1000 live births by 2012. It sought to involve Panchayati Raj institutions and community health workers like Accredited Social Health Activists (ASHAs) to manage health programs and infrastructure at the ground level. According to World Bank data, India's Infant Mortality Rate was 43 per 1000 live births in 2012. ASHA workers were at the frontline of the COVID-19 pandemic and have been periodically striking for months at a time due to huge workloads and meagre payments (Mohiuddin et al., 2023).

The implementation of NHM and NRHM in Maharashtra has yielded mixed results. Since their implementation in 2002 and 2005 respectively the state's population growth rate

reduced from 22.57% in 2001 to 15.99% in 2011. Overall sex ratio marginally increased from 922 females per 1000 men in 2001 to 925 females per 1000 men. The child sex ratio witnessed a dramatic decrease from 913 to 883 girls per 1000 boys. The findings from our research show consistently higher morbidity rates (12.4%) when compared to non-Dalits. Dalits face longer waiting times at all healthcare facilities. Higher education and income are associated with better health outcomes, shorter waiting times and even more faith in the healthcare system as a whole. This falls in line with the SDOH framework which emphasizes upon increasing a person's health outcomes through literacy and financial liberty.

Bihar is the third most populous state in India and has long faced socio-economic deficiencies in comparison to the likes of states like Maharashtra. Bihar currently spends INR 1,588 (USD 18,96) per capita on health expenditure. Despite being so populated, the total health expenditure by the Central government in Bihar remains to be INR 701 (8,42 USD) in 2023 and has been low over the years. According to government financial reports, the central government spends about INR 2,273 (27,14 USD) per capita on health expenditure in Uttarakhand, a state which already spends INR 3,678 (43,91 USD) and has better overall health outcomes than Bihar (National Health Systems Resource Centre, 2023). There is no rational rationale to the Central government's healthcare spending within states. The government of Bihar has had successful programmes such as Janani Suraksha Yojana aimed at maternal and child mortality in addition to implementing the directives of NHM and NRHM. But our findings indicate that Dalits have higher morbidity rates (15.6%) compared to non-Dalits (10.1%). The treatment satisfaction in Bihar was overall lower than in the other

states both for public and private healthcare facilities. The more highly educated an individual is in Bihar the more likely they are to have a major morbidity. This is a reflection of Bihar's healthcare system which is inadequate. Dalits in Bihar wait 1.5 times longer than non-Dalits to receive treatment. Dalits neither have faith in the government nor private healthcare in the state. The lack of an adequate healthcare system is more likely to affect those with socio-economic difficulties and in Bihar we see this manifest for lower caste communities. Uttar Pradesh is the most populous state in India with an incredibly diverse population. It also happens to be the 'Hindi heartland' where a large majority of the population speaks in Hindi. Uttar Pradesh is not as economically advanced as Maharashtra but has about INR 3,721 (USD 44,43) per capita for its healthcare. Interestingly, the central government spends about INR 951 (USD 11,35) which is more than Bihar (National Health Systems Resource Centre, 2023). Even though the Bihar government's state funding capacity is limited, the Central government's funds are directed towards states with better health outcomes. This could also be a reflection of political party lines as Bihar is historically ruled by state-level parties whereas Uttar Pradesh and Maharashtra have been the Bharatiya Janata Party's (the ruling party at the Centre) strongholds. Lower Castes/Other Backward Classes have largely better treatment satisfaction and higher incomes in the state. Yet the morbidity rates for Dalits are higher than non-Dalits. There is also an indication of gender bias concerning the preference of male or female healthcare providers. However, income, age and education do improve people's perception of treatment. These issues make it clear that structural violence is deeply embedded in India's healthcare system. Dalits consistently face the worst health outcomes in the states we examined, despite similar population sizes but

vastly different GDPs. The healthcare policies meant to serve over 400 million people fail to address the needs of Dalits, who are marginalized by entrenched discrimination, resulting in persistently poor health outcomes.

Across Bihar, Maharashtra, and Uttar Pradesh, Dalits report low satisfaction with their healthcare and lack trust in both public and private healthcare facilities. This distrust drives many to seek alternative healthcare options like Ayurvedic and Homeopathic medicine. The central government of India promotes these traditional practices as equivalent to scientific medicine, aiming to 'decolonize' healthcare through initiatives like the National Health Missions (NHM) 2 and 3, which emphasize expanding Ayurvedic clinics in remote areas.

This policy agenda is likely to have a significant impact on Dalits who as per our findings have a higher disease burden and are less likely to have trust in public and private hospitals. Even for minor illnesses, this research shows that Dalits are much less likely to consult a doctor. Currently, the Centre plans on opening 12,500 Ayush Health and Wellness Centres (AHWCs) to cater Ayurvedic and Homeopathic treatments to citizens (Naraharisetty, 2023). These ‘herbal’ products are being marketed globally as medical alternatives. However, numerous studies have found dangerous chemicals in these products. For example, research by Marek A. Mikulski found lead in 65% of 252 Ayurvedic medicine samples, with mercury and arsenic present in 38% and 32% of samples. The Department of Health in Minnesota has issued a warning for using Ayurvedic medicines as there were numerous reports in the state of heavy metal poisoning found in children of Indian communities

(Minnesota, Department of Health, 2023). These products are usually purchased online and shipped from India.

Ayurveda, Unani and Siddha practices are being promoted as a means to 'decolonize' Indian healthcare and to revive ancient (Hindu) practices in the country. This puts not only Dalits but the general population of India at risk. Dalits, who have been systemically pushed to the periphery seem to be at the forefront of this disaster-in-waiting.

Conclusion

This thesis has explored the deeply entrenched caste-based disparities in the healthcare system of India through two hypotheses namely:

- ***Hypothesis 1: Socioeconomic and educational disparities significantly contribute to healthcare access inequalities between Dalits in different states across India.***
- ***Hypothesis 2: Structural violence, manifested through systemic discrimination and exclusion, exacerbates health disparities among Dalit populations.***

Through the statistical analysis conducted on the IHDS sample survey, Hypothesis 1 **finds support** as we found that Dalits have significantly lower health utilization which is correlated to lower income and education levels. We also found evidence of the lower economic status of Dalits through our literature review. Findings from our statistical analysis on treatment waiting times and confidence in public and private hospitals **support** Hypothesis 2. The lack of focused policy and historic discrimination has resulted in structural

violence against Dalits resulting in lower health outcomes for them across the three states we have analyzed.

Within public health, such social determinants of health and structural violence remain evident and perpetuate such inequalities. The focus of the research was the state of Bihar, Maharashtra and Uttar Pradesh where we have results that show the multifaceted nature of caste and expose the systemic limitations of the healthcare policies which are failing at every stage to protect the most vulnerable. The hypotheses developed proposed that socioeconomic disparities create unequal access for Dalits in healthcare which is exacerbated by deeply entrenched structural violence. The findings from the empirical findings support our hypotheses to a major extent. The logistic regression on the effect of Caste on Major Morbidity unveils our initial intuition that Dalits report higher rates of major morbidity across all three states we analyzed. This indicates to us that caste-based disparities in Indian healthcare are all-pervasive regardless of how economically developed or underdeveloped a state is. Other factors such as lower socioeconomic status, and lower education levels are very significantly associated with the disparity. However, in Bihar, higher education is paradoxically associated with higher morbidity rates, especially among Dalits. Dalits are facing significantly longer waiting times at medical clinics of all kinds compared to Upper Caste communities. The findings are very visible in Bihar and Uttar Pradesh, an indication of structural violence and discrimination. The social determinants of health such as higher income and education are indeed associated with shorter wait times but this mobility is much less accessible to Dalits.

One of our most important findings from this research is that Dalits have consistently reported much lower satisfaction with both public and private medical facilities despite having higher morbidity rates. This lack of trust in available healthcare providers is more than likely to push them to seek alternative medical practices that have no scientific backing. These results display a systematic failure of conventional health facilities to address the needs of marginalized communities. The healthcare policies at the center and state have been failing to address the needs of Dalits. The very fragmented nature of the healthcare system in the country has led to significant disparities in the delivery of healthcare services. The conservative goals set by the National Health Policies (NHP) of 1983, 2002 and 2017 have set the bar low to achieve meaningful change. The NHPs have progressively tried to expand access to healthcare but with a very heavy emphasis on alternative medicines as a means of replacement for modern medicine. These national healthcare policies are adopting a uniform approach to healthcare that not only overlooks the inter-state differences but systematically excludes minorities and their needs. Other programmes such as the National Rural Health Mission (NRHM) have been shown to be improving certain outcomes such as reductions in infant mortality but fail to make a distinction between those who are economically weak and those who are Dalits. The major reliance on community healthcare workers (ASHAs) is beneficial but is incredibly insufficient to overcome the structural violence and erasure that limits any healthcare access for Dalits.

The Indian government's refusal to conduct a Caste Census perpetuates a cycle of structural violence as there are no mechanisms in the country to understand the real numbers

of not only health outcomes between different castes but their socioeconomic disparities as well. Without mapping such inequalities, researchers will always be forced to look at indirect measures of health outcomes which can be robust but not enough to create targeted interventions. The country currently lacks vital data that is necessary to map inequalities accurately. Aggregated data can show us the general trends in the health outcomes of communities but without a disaggregation by caste, it is impossible to identify in which areas are lower caste populations the most at risk. The government continues to have reserved seats for SC, ST and OBC communities at every public institution. Election battles are fought on the basis of caste. But this is done arbitrarily without having any real data on structural barriers like healthcare, education, employment and living conditions neither at the country level nor at the state level. The indifference towards conducting a Caste Census could be seen largely as a political decision to ambiguously deny the structural violence and the real effect of caste on the Indian population. The lack of a caste census makes it difficult for civil society organizations and human rights activists to hold the government accountable as without concrete evidence it becomes incredibly hard to advocate for a change based on just qualitative testimonies. In addition to acknowledging Caste with real data, making policy changes to improve their conditions must first address the social determinants of health as well as making a systemic change in the existing structures. Healthcare policies must acknowledge caste as a determinant of health outcomes. This recognition will enable policymakers to design policies that cater to the unique challenges faced by Dalits that go beyond economic conditions. The mass promotion of alternative medicines needs to be met with strict regulations on their contents to ensure that it is safe and has real efficacy. The

findings of this thesis reveal uneven trust in the public healthcare system in the three states analyses. While these results are not generalizable to the entire population of the country, it does make structural violence that seeks to mask integral identities of those who are marginalized fairly evident.

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Annexe I

Figure 1.2: State-Wise Clinics per 100,000 people

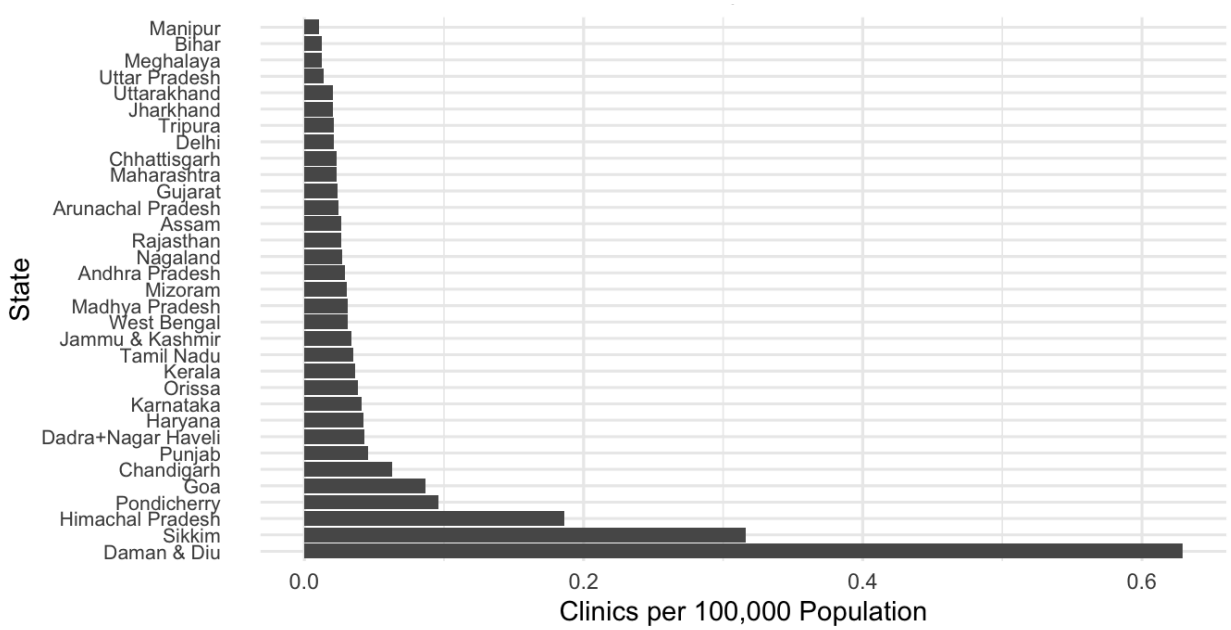
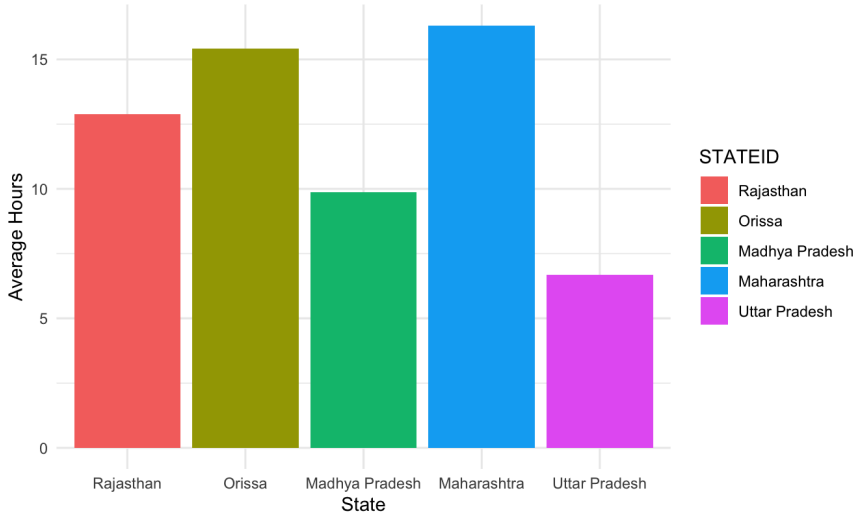


Figure 1.3: Average Availability of Electricity (Hours) in Medical Facilities in Select States



```
# Model 2

library(dplyr)

library(data.table)

library(readr)

original_data <- fread("individual.csv")

major_morbidities <- c("MB4", "MB5", "MB6", "MB8", "MB9", "MB10",

                       "MB11", "MB12", "MB13", "MB14", "MB15",

                       "MB16", "MB17")

relevant_data <- original_data %>%

  select(ID13, all_of(major_morbidities), IDPERSON, STATEID, FM1, MB23, WT, RO5,

EDUC7, INCOME)

extract_numeric <- function(x) {

  as.numeric(sub(".*\\((\\d+)\\).*", "\\1", x))

}

relevant_data[, (major_morbidities) := lapply(.SD, extract_numeric), .SDcols =

major_morbidities]

relevant_data <- relevant_data %>%

  mutate(

    major_morbidity = if_else(MB4 == 2 | MB5 == 2 | MB6 == 2 | MB8 == 2 | MB9 == 2 |

MB10 == 2 |

                              MB11 == 2 | MB12 == 2 | MB13 == 2 | MB14 == 2 | MB15 == 2 |
```

```
                        MB16 == 2 | MB17 == 2, 1, 0)
  )
inspection_data <- relevant_data %>%
  select(STATEID, ID13, FM1, major_morbidity, MB23, WT, RO5, EDUC7, INCOME,
IDPERSON)
write.csv(inspection_data, "majormordibitywork_with_controls.csv", row.names =
FALSE)


library(dplyr)
library(data.table)
library(readr)
relevant_data <- fread("majormordibitywork_with_controls.csv")


relevant_data$WT[is.na(relevant_data$WT)] <- mean(relevant_data$WT, na.rm = TRUE)
relevant_data$MB23[is.na(relevant_data$MB23)] <- "Unknown"
relevant_data$RO5[is.na(relevant_data$RO5)] <- mean(relevant_data$RO5, na.rm =
TRUE)
relevant_data$EDUC7[is.na(relevant_data$EDUC7)] <- "Unknown"
relevant_data$INCOME[is.na(relevant_data$INCOME)] <-
mean(relevant_data$INCOME, na.rm = TRUE)
relevant_data <- relevant_data %>%
```

```
  mutate(caste_group = case_when(
    ID13 == "(1) Brahmin 1" ~ "Upper Caste",
    ID13 == "(2) Forward/General (except Brahmin) 2" ~ "Upper Caste",
    ID13 == "(3) Other Backward Castes (OBC) 3" ~ "Lower Caste",
    ID13 == "(4) Scheduled Castes (SC) 4" ~ "Dalit",
    ID13 == "(5) Scheduled Tribes (ST) 5" ~ "Dalit",
    ID13 == "(6) Others 6" ~ "Other",
    TRUE ~ "Other"
  ))


relevant_data$MB23 <- as.factor(relevant_data$MB23)
relevant_data$EDUC7 <- as.factor(relevant_data$EDUC7)
relevant_data$caste_group <- as.factor(relevant_data$caste_group)
relevant_data$FM1 <- as.factor(relevant_data$FM1)
relevant_data$STATEID <- as.factor(relevant_data$STATEID)
relevant_data$IDPERSON <- as.factor(relevant_data$IDPERSON)


cat("Data Types After Transformation:\n")
str(relevant_data)
set.seed(123) # For reproducibility
balanced_data <- ovun.sample(major_morbidity ~ caste_group + FM1 + STATEID +
```

```
MB23 + RO5 + EDUC7 + INCOME + IDPERSON,
                    data = relevant_data, method = "both",
                    N = 2 * max(table(relevant_data$major_morbidity)))$data

# Summary of the balanced dataset to check if IDPERSON is present
cat("Summary of the balanced dataset:\n")
summary(balanced_data)

# Check if IDPERSON is present in balanced_data
if (!"IDPERSON" %in% colnames(balanced_data)) {
  stop("The column 'IDPERSON' is missing from the balanced_data.")
}

unique_wt_data <- relevant_data %>%
  select(IDPERSON, WT) %>%
  distinct()
if ("IDPERSON" %in% colnames(balanced_data) && "IDPERSON" %in%
colnames(unique_wt_data)) {
  balanced_data <- merge(balanced_data, unique_wt_data, by = "IDPERSON", all.x =
TRUE)
} else {
```

```
  stop("The column 'IDPERSON' is missing from either balanced_data or
unique_wt_data.")
}

selected_states <- c("(09) Uttar Pradesh 09", "(10) Bihar 10", "(27) Maharashtra 27")  #
State codes for Bihar, Maharashtra, and Uttar Pradesh

filtered_data <- balanced_data %>%
  filter(STATEID %in% selected_states)

run_state_regression <- function(state_code) {
  state_data <- filtered_data %>% filter(STATEID == state_code)
  state_data$STATEID <- as.character(state_data$STATEID)
  factor_cols <- c("caste_group", "FM1", "MB23", "EDUC7")
  for (col in factor_cols) {
    if (length(unique(state_data[[col]])) < 2) {
      stop(paste("Factor", col, "in state", state_code, "does not have at least two levels."))
    }
  }

  logistic_model <- glm(major_morbidity ~ caste_group + FM1 + MB23 + RO5 + EDUC7
```

```
+ INCOME + WT,
                    data = state_data, family = binomial(link = "logit"))
  return(summary(logistic_model))
}

bihar_model <- tryCatch(run_state_regression("(10) Bihar 10"), error = function(e)
print(e))
maharashtra_model <- tryCatch(run_state_regression("(27) Maharashtra 27"), error =
function(e) print(e))
uttar_pradesh_model <- tryCatch(run_state_regression("(09) Uttar Pradesh 09"), error =
function(e) print(e))

print("Bihar Model:")
print(bihar_model)

print("Maharashtra Model:")
print(maharashtra_model)

print("Uttar Pradesh Model:")
print(uttar_pradesh_model)
```

```
#Morbidity Prevalence
library(dplyr)
library(data.table)
library(readr)
library(tidyr)
state_caste_prevalence <- relevant_data %>%
  group_by(STATEID, caste_group) %>%
  summarize(
    total = n(),
    morbidity_cases = sum(major_morbidity),
    prevalence = (morbidity_cases / total) * 100,
    .groups = 'drop'
  ) %>%
  filter(caste_group %in% c("Upper Caste", "Dalit"))
state_caste_prevalence_wide <- state_caste_prevalence %>%
  pivot_wider(names_from = caste_group, values_from = c(total, morbidity_cases,
prevalence))
state_caste_prevalence_wide <- state_caste_prevalence_wide %>%
  mutate(
    prevalence_difference = `prevalence_Upper Caste` - `prevalence_Dalit`
  )
```

```
print(state_caste_prevalence_wide)
write.csv(state_caste_prevalence_wide, "state_caste_prevalence_difference.csv",
row.names = FALSE)

cat("Summary Statistics for Numerical Variables:\n")
summary(select_if(relevant_data, is.numeric))

# Descriptive statistics for categorical variables
cat("Summary Statistics for Categorical Variables:\n")
summary(select_if(relevant_data, is.factor))

summary(balanced_data)
```

```
#Model 2
library(dplyr)
library(data.table)
library(ggplot2)
library(mice)
```

```
merged_data <- fread("merged_individual_household.csv")
char_vars <- names(merged_data)[sapply(merged_data, is.character)]
merged_data[, (char_vars) := lapply(.SD, factor), .SDcols = char_vars]
relevant_columns <- c("QC8", "ID13.x", "INCOME.x", "WT.x", "STATEID", "EDUC7",
"RO5", "CI9", "CI10", "QC2")
merged_data_subset <- merged_data[, ..relevant_columns]
if (!all(relevant_columns %in% colnames(merged_data))) {
  relevant_columns <- c("QC8", "ID13.y", "INCOME.y", "WT.y", "STATEID", "EDUC7",
"RO5", "CI9", "CI10", "QC2")
  merged_data_subset <- merged_data[, ..relevant_columns]
}
merged_data_subset <- merged_data_subset %>%
  mutate(caste_group = case_when(
    ID13.x %in% c("(4) Scheduled Castes (SC) 4", "(5) Scheduled Tribes (ST) 5") ~ "Dalit",
    ID13.x %in% c("(1) Brahmin 1", "(2) Forward/General (except Brahmin) 2") ~ "Upper
Caste",
    ID13.x %in% c("(3) Other Backward Castes (OBC) 3") ~ "Lower Caste",
    TRUE ~ "Other"
  ))
merged_data_subset$caste_group <- factor(merged_data_subset$caste_group)
merged_data_subset_for_imputation <- merged_data_subset %>%
```

```
  mutate(across(where(is.factor), as.numeric))


imputed_data <- mice(merged_data_subset_for_imputation, m = 5, method = 'pmm', seed
= 500)
imputed_data_set <- complete(imputed_data, 1)
imputed_data_set <- imputed_data_set %>%
  mutate(across(c("ID13.x", "STATEID", "caste_group"), ~ as.factor(.)))
imputed_data_set <- imputed_data_set %>%
  mutate(across(c(QC8, INCOME.x, EDUC7, RO5, CI9, CI10, QC2), ~ scale(.) %>%
as.numeric))


summary_stats <- imputed_data_set %>%
  summarize(
    QC8_mean = mean(QC8, na.rm = TRUE),
    QC8_sd = sd(QC8, na.rm = TRUE),
    INCOME_mean = mean(INCOME.x, na.rm = TRUE),
    INCOME_sd = sd(INCOME.x, na.rm = TRUE),
    EDUC7_mean = mean(EDUC7, na.rm = TRUE),
    EDUC7_sd = sd(EDUC7, na.rm = TRUE),
    RO5_mean = mean(RO5, na.rm = TRUE),
    RO5_sd = sd(RO5, na.rm = TRUE),
```

```
    CI9_mean = mean(CI9, na.rm = TRUE),
    CI9_sd = sd(CI9, na.rm = TRUE),
    CI10_mean = mean(CI10, na.rm = TRUE),
    CI10_sd = sd(CI10, na.rm = TRUE),
    QC2_mean = mean(QC2, na.rm = TRUE),
    QC2_sd = sd(QC2, na.rm = TRUE)
  )

print(summary_stats)
statewise_analysis <- imputed_data_set %>%
  group_by(STATEID) %>%
  summarize(
    QC8_mean = mean(QC8, na.rm = TRUE),
    QC8_sd = sd(QC8, na.rm = TRUE),
    INCOME_mean = mean(INCOME.x, na.rm = TRUE),
    INCOME_sd = sd(INCOME.x, na.rm = TRUE),
    EDUC7_mean = mean(EDUC7, na.rm = TRUE),
    EDUC7_sd = sd(EDUC7, na.rm = TRUE),
    RO5_mean = mean(RO5, na.rm = TRUE),
    RO5_sd = sd(RO5, na.rm = TRUE),
    CI9_mean = mean(CI9, na.rm = TRUE),
```

```
    CI9_sd = sd(CI9, na.rm = TRUE),
    CI10_mean = mean(CI10, na.rm = TRUE),
    CI10_sd = sd(CI10, na.rm = TRUE),
    QC2_mean = mean(QC2, na.rm = TRUE),
    QC2_sd = sd(QC2, na.rm = TRUE)
  )

print(statewise_analysis)

# Correct state IDs to their actual values
imputed_data_set <- imputed_data_set %>%
  mutate(STATEID = case_when(
    STATEID == 1 ~ "09",
    STATEID == 2 ~ "10",
    STATEID == 3 ~ "27",
    TRUE ~ as.character(STATEID)
  ))
selected_states <- c("09", "10", "27")
filtered_data <- imputed_data_set %>%
  filter(STATEID %in% selected_states)
```

```
str(filtered_data)

summary(filtered_data)

results <- list()

for(state in selected_states) {

  state_data <- filtered_data %>% filter(STATEID == state)

  if (nrow(state_data) > 0) {

    model_qc8 <- lm(QC8 ~ caste_group + INCOME.x + EDUC7 + RO5, data = state_data)

    model_income <- lm(INCOME.x ~ caste_group + QC8 + EDUC7 + RO5, data =
state_data)

    model_ci9 <- lm(CI9 ~ caste_group + INCOME.x + QC8 + EDUC7 + RO5, data =
state_data)

    model_ci10 <- lm(CI10 ~ caste_group + INCOME.x + QC8 + EDUC7 + RO5, data =
state_data)

    model_qc2 <- lm(QC2 ~ caste_group + INCOME.x + QC8 + EDUC7 + RO5, data =
state_data)

    results[[state]] <- list(

      model_qc8_summary = summary(model_qc8),

      model_income_summary = summary(model_income),

      model_ci9_summary = summary(model_ci9),

      model_ci10_summary = summary(model_ci10),

      model_qc2_summary = summary(model_qc2)
```

```
  )
 } else {
  results[[state]] <- list(
   model_qc8_summary = NULL,
   model_income_summary = NULL,
   model_ci9_summary = NULL,
   model_ci10_summary = NULL,
   model_qc2_summary = NULL
  )
 }
}
for(state in selected_states) {
 cat("\nState:", state, "\n")
 if (!is.null(results[[state]]$model_qc8_summary)) {
  print(results[[state]]$model_qc8_summary)
 } else {
  cat("No data for state", state, "\n")
 }
 if (!is.null(results[[state]]$model_income_summary)) {
  print(results[[state]]$model_income_summary)
 } else {
```

```
    cat("No data for state", state, "\n")
  }
  if (!is.null(results[[state]]$model_ci9_summary)) {
    print(results[[state]]$model_ci9_summary)
  } else {
    cat("No data for state", state, "\n")
  }
  if (!is.null(results[[state]]$model_ci10_summary)) {
    print(results[[state]]$model_ci10_summary)
  } else {
    cat("No data for state", state, "\n")
  }
  if (!is.null(results[[state]]$model_qc2_summary)) {
    print(results[[state]]$model_qc2_summary)
  } else {
    cat("No data for state", state, "\n")
  }
}
```