



Eureka Project Title & ID: Impact of Medical Guidelines Adherence on Maternal Mortality Reduction, 2425BUS1001			
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Introduction

Our research focused on exploring how various factors impact maternal outcomes, with the aim of providing data-backed suggestions for healthcare operations improvements to the state government of Tamil Nadu, India. Through exploring and analyzing data related to patient outcomes, medical staff and patient surveys, as well as government led assessments of different medical facilities, we were able to draw conclusions regarding suggested key areas of focus

Method

We first started by conducting Ordinary Least Squares (OLS) regression to show the relationship between key independent variables and our selected dependent variable, maternal mortality rate, and later facility performance scores. While OLS provides a natural starting point for estimating linear relationships between our dependent variable and its potential determinants, it relies on strict assumptions which are typically violated in our dataset, where observations may be nested within health facilities or districts. In our explored dataset’s case, OLS standard errors become inconsistent, and resulting estimates may be under omitted variable bias due to unobserved group-level effects.

Regularized regression through ridge and lasso regressions prevented overfitting and dropped insignificant independent variables, leading to more reliable results compared to OLS regression in causation analysis. Using a double machine learning (DoubleML) approach helped us to get around biases caused by irrelevant variables. Through this approach, we were able to derive statistically significant results and conclude the impact direction and magnitude different variables had on patient experience. In particular, budget allocation towards staff training, higher staff allocation rate to maternity wards, and focusing funding towards facilities with higher maternal mortality rates were found to be key drivers of patient experience. However, these approaches are predictive in nature, and the final goal of policy implementation to improve operations would need causation-driven results. Thus, the DoubleML & Ridge-Lasso approaches were supported by econometrics based approaches below, including fixed effects (FE), random effects (RE), and clustering.

Comparison of Variable Significance Under Different Methods

The results have been summarized in the table below: Highlighted variables were found to be statistically significant to patient outcomes across the different methods used.

Method	Simple OLS	Econometrics			Partially OLS		Mechine Learning
Technique	OLS	Clustered OLS	FE	RE	Ridge	Lasso	Double ML
Variables With Statistically Significant Positive Effect on Patient Satisfaction Score, Ranked by Coefficien							
1		Knowledge Assessment Test Score	Total Operating Theatre Assessment Score		Maternal Death Rate	Maternal Death Rate	Number of Staff Nurses in Maternal Ward per shift
2		Labour Room Assessment Score	Inborn Referral Deaths		Caste	Caste	Number of Staff Nurses in CEMONC Functions
3		Travel Distance to Facility	Number of Inborn Referrals		Educational Qualification Level	Travel Distance to Facility	Labour Room Assessment Score
4		Number of Staff Nurses in CEMONC Functions			Age	Age	Knowledge Assessment Test Score
5					Travel Distance to Facility		Number of Staff Nurses in Labour Ward per shift
6					Average Employee Satisfaction Survey Score		
7					Total Operating Theatre Assessment Score		
Variables With Statistically Significant Negative Effect on Patient Satisfaction Score, Ranked by Coefficien							
1	Percentage of Staff Nurses in CEMONC Functions Number of Sanitary Workers in CEMONC Functions	MaternaL_Death_Rate	Knowledge Assessment Test Score	Delivery Type	Number of Children Expired	Number of Children Expired	Clinical_services
2		Inputs	Inputs	Travel Time to Facility	Delivery Type	Delivery Type	Delivery Type
3		Clinical_services	Clinical_services		Knowledge Assessment Test Score	Knowledge Assessment Test Score	Travel Time to Facility
4		Travel Time to Facility	Travel Time to Facility		Occupation	Occupation	Inborn Referral Deaths
5		Number of Staff Nurses in Maternal Ward per shift	Number of Sanitary Workers in CEMONC Functions		Travel Time to Facility	Travel Time to Facility	Outborn Referral Deaths
6		Avg_OSCE_Score	Number of Staff Nurses in Maternal Ward per shift		Hospital Stay Length	Hospital Stay Length	
7		Inborn Referral Deaths			Labour Room Assessment Score	Labour Room Assessment Score	
8		Delivery Type			Religion	Number of Beds in Facility	
9					Number of Beds in Facility		

Conclusion

In summary, each model used contributed different insights: The clustered OLS model highlights broad correlational patterns; the DoubleML model is predictive instead of causative in nature. the FE model strengthens causal inference by controlling for unobserved heterogeneity; and the RE model enables policy translation across units. Limitations include potential measurement error in facility-level indicators and unbalanced panels across districts. By investing the government budget into improving the highlighted variables above, the Tamil Nadu state government can optimize healthcare operations to improve maternal patient outcomes.