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# Ecological Associations between Surgical Rates and Surgeon Densities across India's District Hospitals

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### Introduction

- India: Unmet need of **49 million** surgeries • annually [1]. Scaling up surgical volumes needs adequate workforce.
- **District Hospitals (DHs):** public hospitals • that provide subsidized surgical care.
- Aim: To investigate association between • surgical workforce availability and surgeries conducted across DHs.

# Materials & Methods

**Design:** Cross-sectional secondary data analysis of 629 DHs in 2018-19

**Data Source:** NITI Aayog [2]

Model: Zero-inflated negative binomial mixed effects regression, gives incident rate ratio (IRR)

	Variable	Median (IQR)
Outcome	Major Surgery	522 (97, 1225)
Exposure	General Doctors & Specialist Surgeons	35 (23, 54)
Covariates	Nursing & Paramedical Staff	115 (67, 189)
	Beds	175 (100, 300)
	Service Coverage (%)	76.19 (66.67, 83.33)
Offset	Population	1253938 (669919, 2034763)

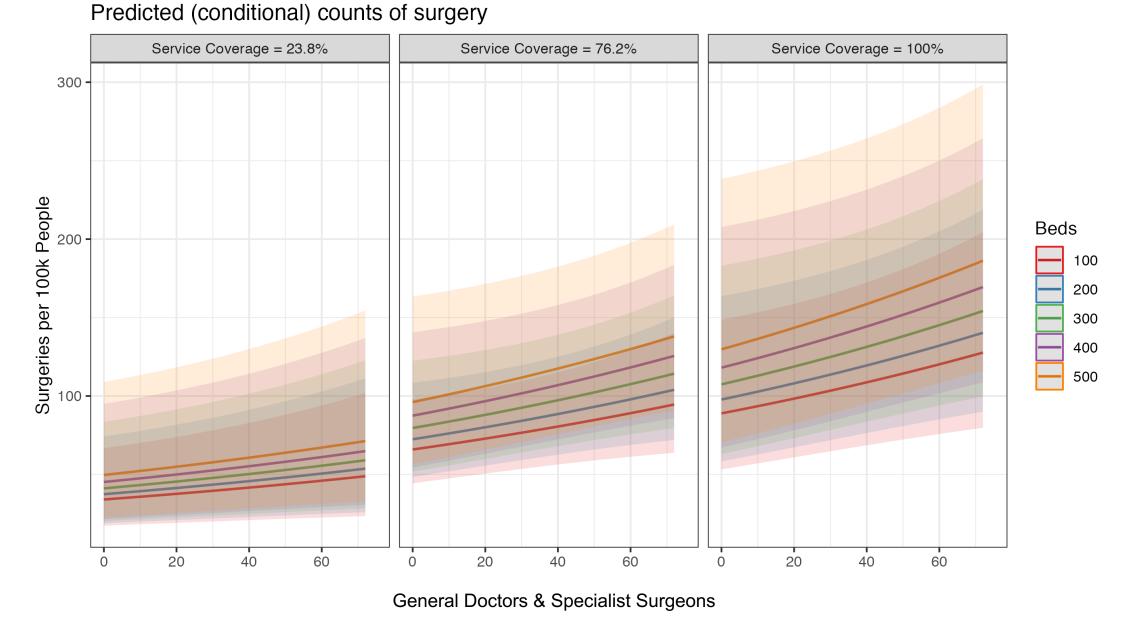
# **Discussion & Conclusions**

- This novel pan-India analysis found surgical workforce is **significantly associated** with surgical rates per 100,000 people at Indian District Hospitals, after adjusting for covariates.
- Surgical workforce scale-up should be accompanied with improved coverage of **core**, diagnostic, and support services for better surgical rates.

# Results

Variable	IRR (95% CI)		
Negative Binomial Conditional Model - Fixed Effects			
Intercept	0.00022 (9.13e-05, 0.000545)		
General Doctors &	1.00		
Specialist Surgeons	(1.00, 1.01)		
Nursing & Paramedical	1.00		
Staff	(0.99, 1.00)		
Beds	1.00		
Deus	(1.00, 1.00)		
Service Coverage	1.00		
Service coverage	(1.00, 1.02)		
Zero-inflation model			
Intercept	7.00 (2.33, 21.2)		
General Doctors &	0.83		
Specialist Surgeons	(0.78, 0.89)		
Negative Binomial Conditional Model - Random			
Effects			
States (SD)	0.95 (0.72, 1.26)		

**Random effects:** 36 states & union territories **Zero-inflation:** Modeled as dependent on General Doctors & Specialist Surgeons **Statistical significance:** p-value < 0.05, in bold Analysis platform: R



#### **References:**

1. Zadey, S et al. Int. J. Surg. , doi:10.1097/JS9.0000000000001024 (2024), PMID: 38181119. 2. Sarwal, R et al., doi:10.31219/osf.io/y79bg (2021).