



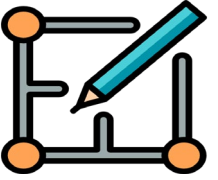
**Impact of Rotavirus Vaccine on
Malnutrition among Children aged
24-35 months:
*Evidence from National Family
Health Survey (NFHS) 2019-2021,
India***

Pretty Priyadarshini

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Outline



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Malnutrition & Diarrhea Crisis

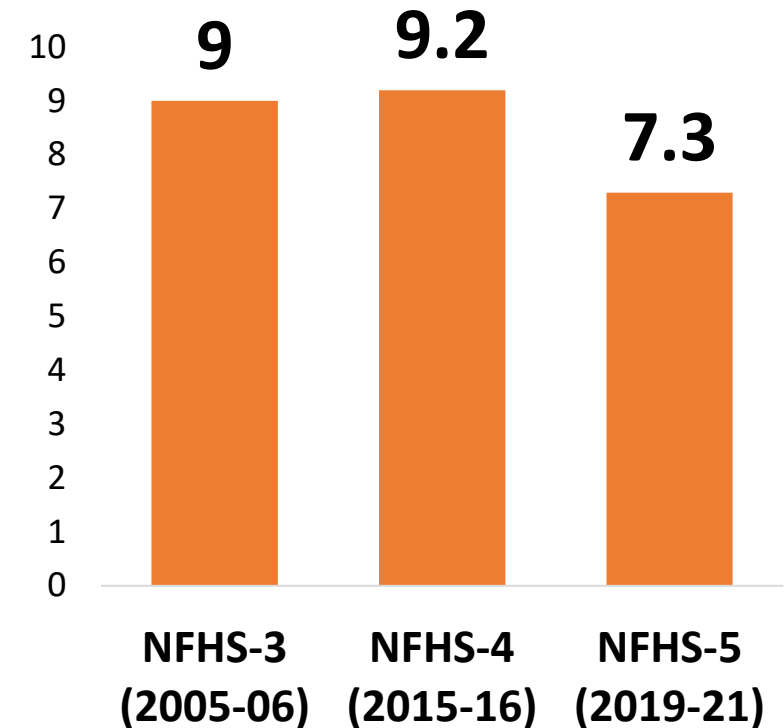


Stunting, Underweight, & Wasting – three key indicators measuring nutritional imbalances– *triple threat of malnutrition*

Stunting	Underweight	Wasting
<ul style="list-style-type: none">• 36% rate (NFHS-5)• Children under 5 with height-for-age below normal standards	<ul style="list-style-type: none">• 32%• Children with weight-for-age below normal standards	<ul style="list-style-type: none">• 19%• Children with weight-for-height indicating acute malnutrition

Despite gradual improvements from previous surveys, malnutrition remains a critical public health challenge affecting millions of children in India – **38%, 35%, and 21% respectively [NFHS-4; 2015-16]**

Diarrheal prevalence in children under five in India (in %)



- >90% of all Rotavirus-related deaths occurred in South Asia and sub-Saharan Africa
- India, 2011-13: 872,000 hospitalizations & 78,000 deaths associated with RVV

Rotavirus Vaccine in India's Universal Immunization Program



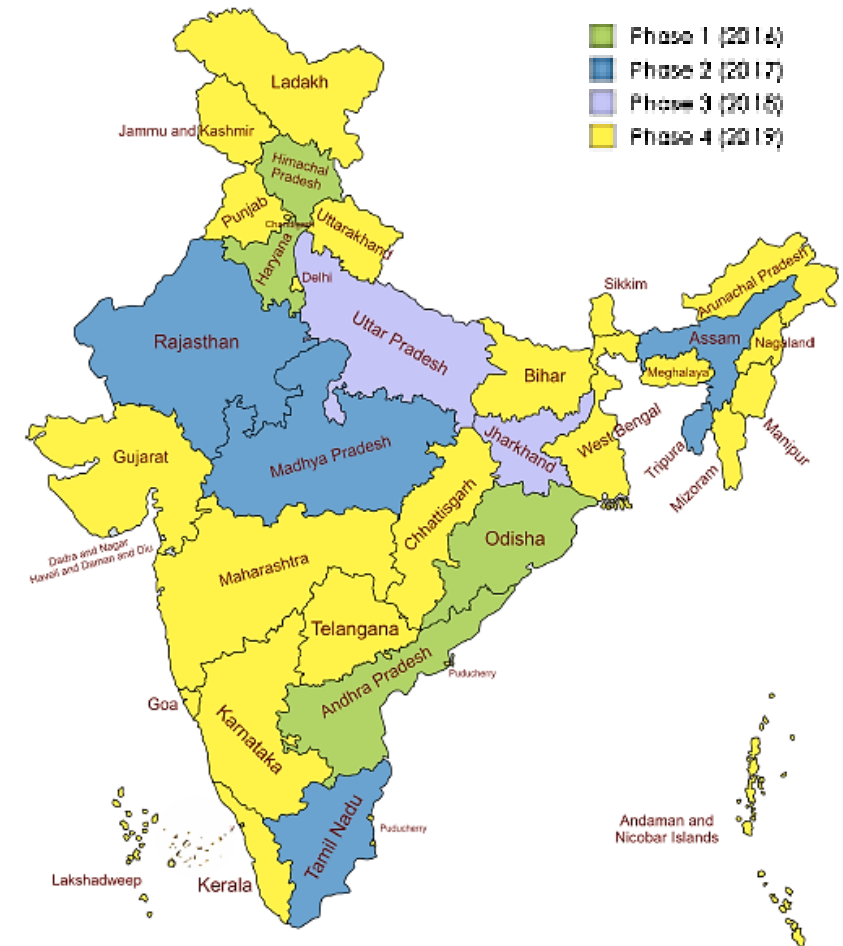
2013: India accounted for approximately 22% of all under-5 Rotavirus-induced deaths worldwide

2014: NTAGI recommendations; **2016:** India became the 1st country in South-east Asia region to introduce Rotavirus Vaccination (RVV) in UIP

Indigenously developed oral vaccines: ROTAVAC (Bharat Biotech), ROTASIIL (Serum Institute of India)

2018: 'POSHAN' – Prime Minister's Overarching Scheme for Holistic Nutrition launched: emphasizing nutrition and immunization integration

2019: Nationwide RVV rollout achieved through phased-expansion approach in 36 states



Phase	Year	No. of Children vaccinated	No. of states
1	2016	2.4 million	4
2	2017	5.6 million	5
3	2018	6.6 million	2
4	2019	12.1 million	25

References: Kumar, Pawan, et al. "Post-introduction evaluation (PIE) of rotavirus vaccine in India." *Vaccine: X* 19 (2024): 100526.; Dhalaria, Pritu, et al. "Potential impact of rotavirus vaccination on reduction of childhood diarrheal disease in India: an analysis of National Family Health Survey-5." *Vaccine: X* 14 (2023): 100319.

[Guidelines for Introduction of Rotasiil in UIP.pdf](https://nhm.gov.in/New_Updates_2018/NHM_Components/Immunization/Guidelines_for_immunization/Operational_Guidelines_for_Introduction_of_Rotasiil_in_UIP.pdf) https://nhm.gov.in/New_Updates_2018/NHM_Components/Immunization/Guidelines_for_immunization/Operational

Bidirectional Relationship



Relationship between nutrition and infection

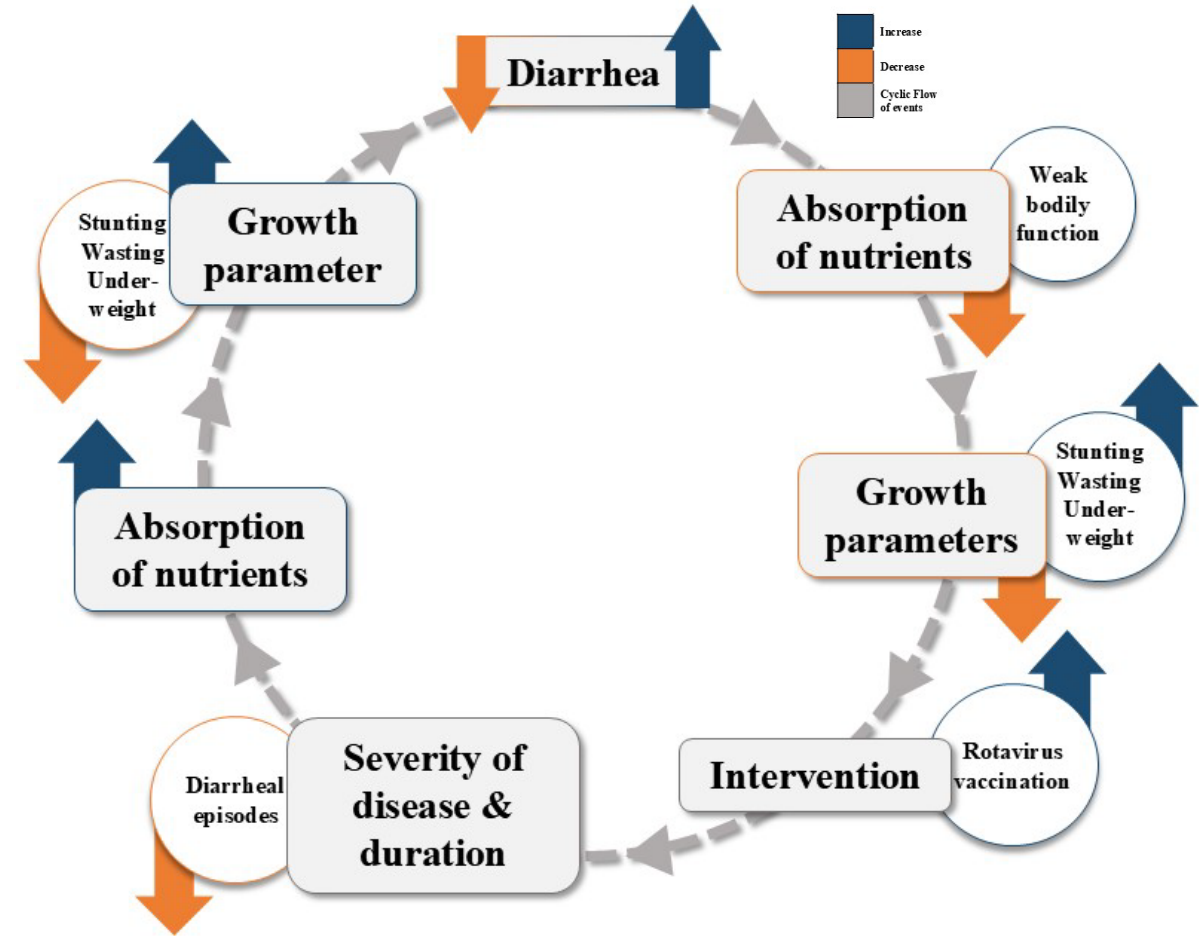
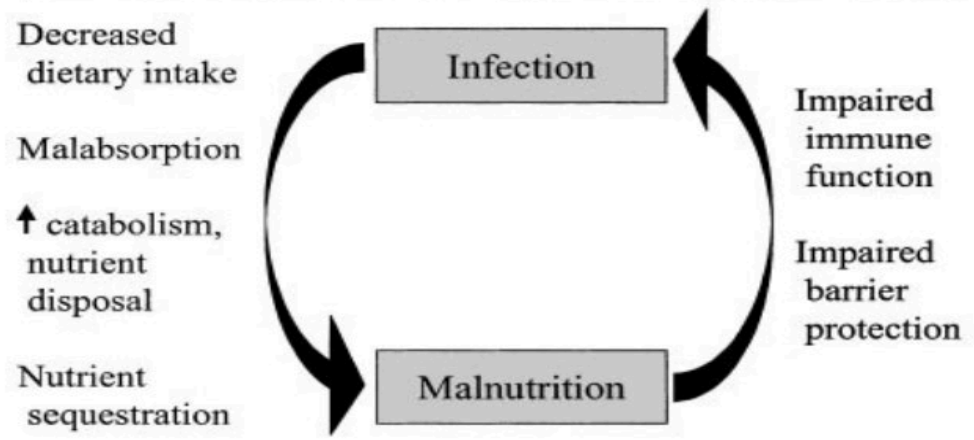


FIGURE 1 Relationship between nutrition and infection.

Source: Brown, K. H. (2003). Symposium: nutrition and infection, prologue and progress since 1968: diarrhea and malnutrition. *J Nutr*, 133(1), 328S-332S.

Malnutrition is both a cause and a consequence of diseases such as diarrhea

Malnutrition and diarrhea create a vicious cycle where each condition worsens the other.

Malnourished children are more susceptible to infections, while diarrheal episodes further compromise nutritional status through malabsorption and reduced intake.

Need for the Study

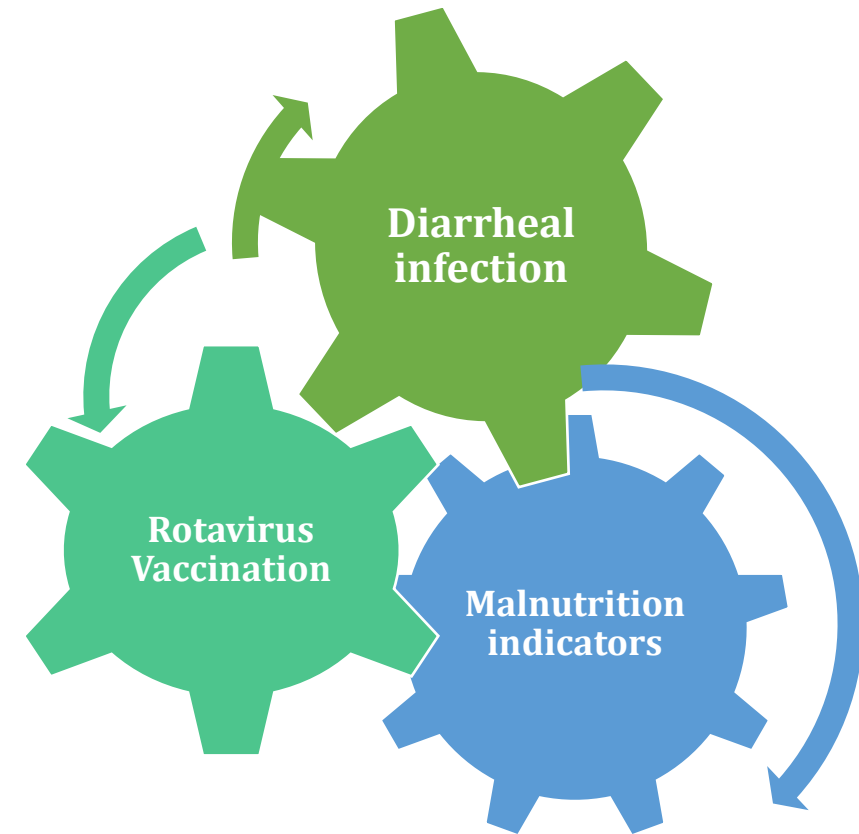


High prevalence of malnutrition and diarrhea indicated by NFHS-5 data

From the point of overall child health and development, countries must examine the impact of vaccination beyond the direct impact on the burden of disease:

Estimates suggest that by age five, almost all children, irrespective of country or socioeconomic status, will have had a rotavirus infection. It spares no one and infects everyone:

Democratic virus. (Bishop, 1996)



Novel

Rotavirus Vaccination Coverage was captured in NFHS 2019-2021; an opportunity to explore association between RVV and malnutrition parameters

Objective



Hypothesis: RVV reduces the risk of rotavirus-induced diarrhea, infectious diseases, & nutrient malabsorption, thereby contributing to improved anthropometric outcomes – height-for-age, weight-for-age, & weight-for-height metrics in vaccinated children compared to those who are unvaccinated.

Objective: The study aims to explore the relationship between RVV and the indicators of malnutrition–stunting, wasting, & underweight

Aim 1: Establish the secondary benefits of RVV beyond reducing diarrheal burden

Aim 2: Generate evidence that can further bridge immunization and nutrition policy efforts in India

Methodology



Analytical Software: Stata version 16.1



Data Source:
NFHS-5
(2019-21)-
67,969
children aged
24-35
months

Exposure/Independent Variables: Rotavirus vaccination status; Sociodemographic variables (child's age, sex, birth order, maternal education level, maternal boy mass index (BMI), religion, place of residence, social group, place of delivery (home/institutional), wealth quintile, toilet facilities)



Outcome/Dependent Variable: Wasting, stunting, and underweight among children aged 12-35 months

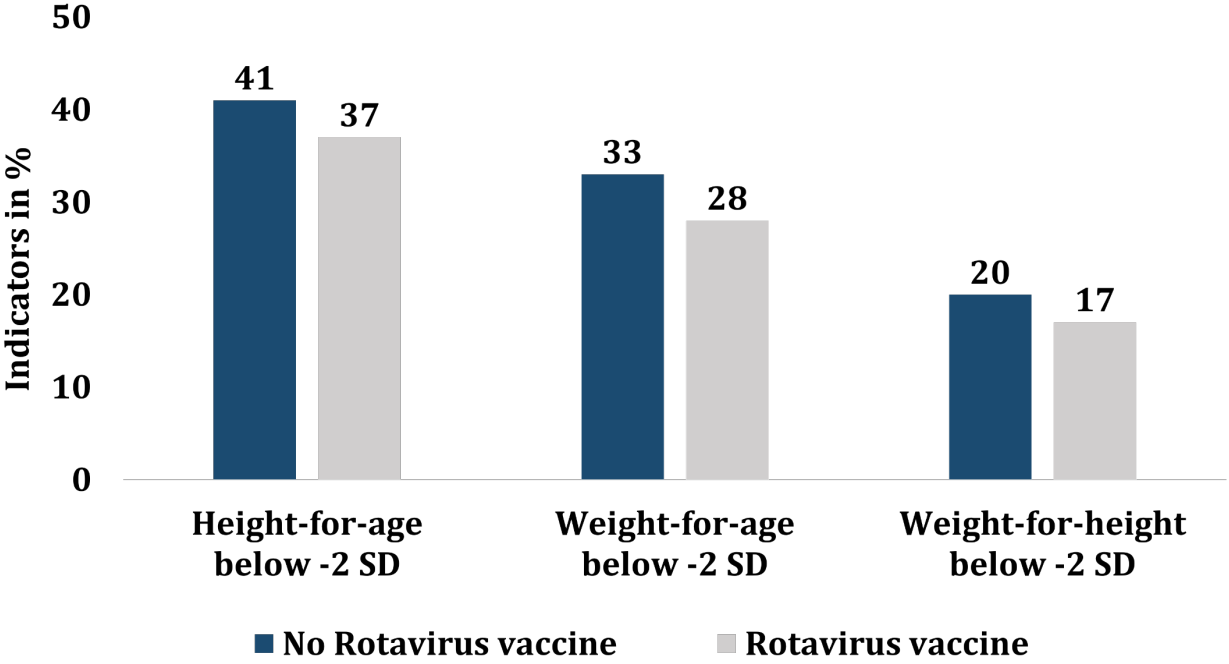


Methodology: bivariate analysis between RVV and stunting, wasting, and underweight in children aged 12-35 months; six multivariate regressions employed on anthropometric measures and RVV

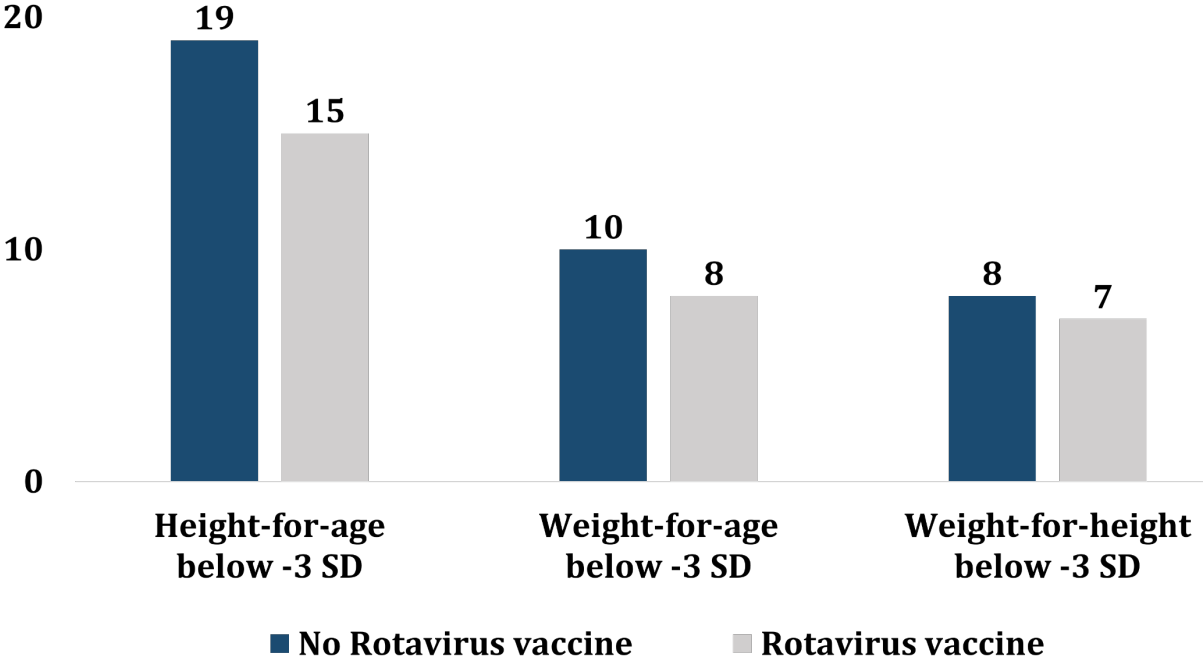
Socio-demographic variables – birth order of children, age of children (months), wealth quintile, gender of child, social group, religion, residence, mother's education (years), place of delivery, media exposure, delivery method, current status of residing with husband

Results: Prevalence of Malnutrition by RVV

Malnutrition among children of 12-35 months by Rotavirus vaccination status in India, 2019-21



Severe malnutrition by Rotavirus vaccine among children 12-35 months, India, 2019-21



Results: Regression Analysis of RVV & Malnutrition

Anthropometric outcomes	No RVV (aOR)	1 or 2 doses of RVV (aOR)	3 doses of RVV (aOR)
Height-for-age below -2 SD	1	0.94	0.88***
Weight-for-age below -2 SD	1	0.91**	0.86***
Weight-for-height below -2 SD	1	0.89**	0.85***
Height-for-age below -3 SD	1	0.99	0.86***
Weight-for-age below -3 SD	1	1.02	0.85***
Weight-for-height below -3 SD	1	0.95	0.82***

Inference: Children who received all three doses of rotavirus vaccines demonstrated a significant reduction in the odds of severe malnutrition across all three outcomes.

*Note: Significance: *P < 0.05; **P < 0.01; ***P < 0.001*

Results:

Regression Analysis of Malnutrition & RVV by Sociodemographic Variables

Socio-demographic variables; (lowest order of variable with OR 1)	Highest order of variable	Height for age below -2 SD/-3 SD (aOR)	Weight for age below -2 SD/-3 SD (aOR)	Weight for height below -2 SD/-3 SD (aOR)	Interpretation	Children from urban areas: relatively higher risk of becoming malnourished compared to those living in rural areas Maternal education and BMI: significant impact on child malnutrition Child's wealth status: strongly associated with nutritional status
Birth order (1 ^R)	4 or more birth order	1.47***/ 1.40***	1.40***/ 1.48***	0.99/0.96	Higher birth order associated with <i>poor anthropometric measures</i>	
Maternal education (No schooling ^R)	≥11 years complete	0.67***/ 0.57***	0.72***/ 0.63***	0.86***/ 0.85**	Higher education acts as a ' <i>protective factor</i> '	
Place of delivery (Institutional birth ^R)	Non-institutional	1.17***/ 1.17***	1.11***/ 1.23***	1.00/1.01	<i>Non-institutional deliveries</i> associated with <i>poor anthropometric measures</i>	
Maternal BMI (<18.5 kg/m ²) ^R	BMI 18.5 to 24.9 kg/m ²	0.73/0.80	0.61/0.65	0.79/0.92	Normal maternal BMI acts as a ' <i>protective factor</i> '	
Wealth quintile (poorest ^R)	Richest	0.54***/ 0.53	0.48***/ 0.47	0.73***/ 0.86	<i>Higher socioeconomic status</i> associated with <i>better anthropometric measures</i>	
Toilet facility (improved ^R)	Unimproved	1.09***/ 1.03	1.09***/ 1.10**	1.04/1.04	<i>Compromised WASH</i> is a <i>risk factor</i> for malnutrition	

Note: Significance: *P < 0.05; **P < 0.01; ***P < 0.001

Key Findings



Children aged 12–35 months who received **all three doses of RVV** showed a lower prevalence of stunting, wasting, and underweight.

All three doses significantly reduced the odds of **moderate and severe malnutrition**.

Children from **rural regions** had a lower risk of being malnourished, consistent with other studies, probably due to higher rates of exclusive breastfeeding practices and better access to Integrated Child Development Services (ICDS).

Relatively higher risk in **urban regions**: frequent migration rates, inadequate dietary requirements.

Social determinants: **Maternal education, maternal BMI, & socioeconomic status** were significantly associated with child's nutritional status.

Recommendations



Full 3-dose coverage is critical; Unvaccinated and partially vaccinated children are at greater risk of diarrhea and malnutrition.



Integrated maternal-child health strategies—high impact of maternal influence



Integration of immunization with nutrition & WASH interventions – synergistic impact



Calls for **deeper exploration of healthcare access & living conditions** in urban areas – equity lens (urban slums, peri-urban)



Data-driven insights informing **vaccine impact evaluations** and **strengthen advocacy for sustained vaccination programs**

Aligned with objectives of UIP and POSHAN scheme – reinforcement

Long-term service integration between immunization and child health services – 1000 days

Limitations



- Cross-sectional household survey data – limits our ability to establish temporal or causal relationships.
- Doesn't account for potential confounding factors: Use of Oral Rehydration Solutions (ORS), zinc supplementation, timely access to healthcare services
- This study provides suggestive associations between RVV and reduced malnutrition – more robust evidence from longitudinal data is required to validate findings further.
- Future research, such as prospective cohorts or RCTs, is needed to establish causal inference.

Acknowledgements

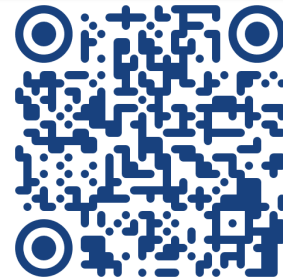


सत्यमेव जयते

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