

Serum retinol concentration varies spatially: a secondary analysis of data from three states from the Indian 2016 cross-sectional Comprehensive National Nutrition Survey (CNNS)

Rupinder Sahota¹, Fanny Sandalinas¹, Christopher Chagumaira², Robert Johnston³, Louise Ander², Arindam Das⁴, Edward Joy^{1*}

¹ Department of Population Health, London School of Hygiene & Tropical Medicine, UK; ²School of Biosciences, University of Nottingham, UK; ³UNICEF, New Delhi, India; ⁴Indian Institute of Health Management Research, Jaipur, India

rupinder.sahota@lshtm.ac.uk

Background

- **Vitamin A deficiency (VAD)** is a public health problem in India.
- As per **Comprehensive National Nutrition Survey (CNNS) 2016-2018** report (1) – **Highest prevalence** of VAD in adolescents was in **Bihar, Chhattisgarh** and **Jharkhand** - **higher than 20%**.
- **Spatial information** about the variations in **retinol concentration** can help **targeting efforts**. (2)
- Spatial information can also help to understand the **aetiology** of **VAD**.
- Geospatial analysis paves the way for further work to answer important questions about the effect of **seasonality bias** in **survey designs and interpretations**. (3)

Methods

- Secondary data analysis of the CNNS data was conducted in the states having highest prevalence of VAD.
- Serum retinol was analyzed for adolescents as it was less affected by inflammation

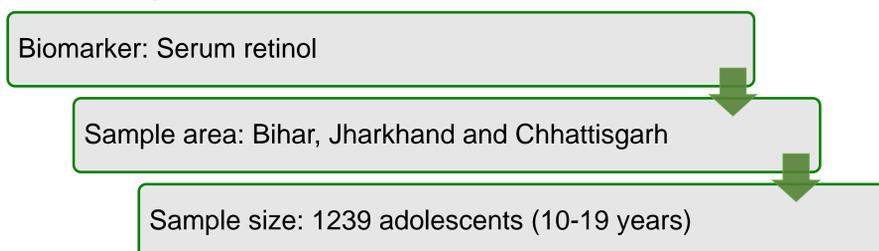


Fig 1. Sample of serum retinol analysis

- Geostatistical methods were used to reveal spatial dependence of retinol concentration in the states.
- Ordinary kriging predictions were made on aggregated mean values for each primary sampling unit.
- The predictions and their uncertainties [expressed in terms of the probability that the true value does not exceed 0.7 $\mu\text{mol/L}$, which is widely used to indicate VAD (4)] were presented as maps (Fig 4).

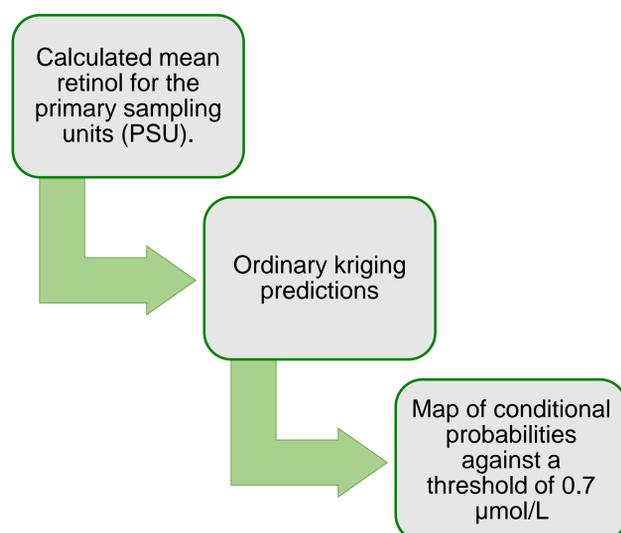


Fig 3. Steps in geostatistical analysis



Funding: This work was supported by the Bill & Melinda Gates Foundation (INV-002855) through the Micronutrient Action Policy Support (MAPS) project

Results

A marked **spatial dependence** in **retinol concentration** was observed in the study area (Fig 4)

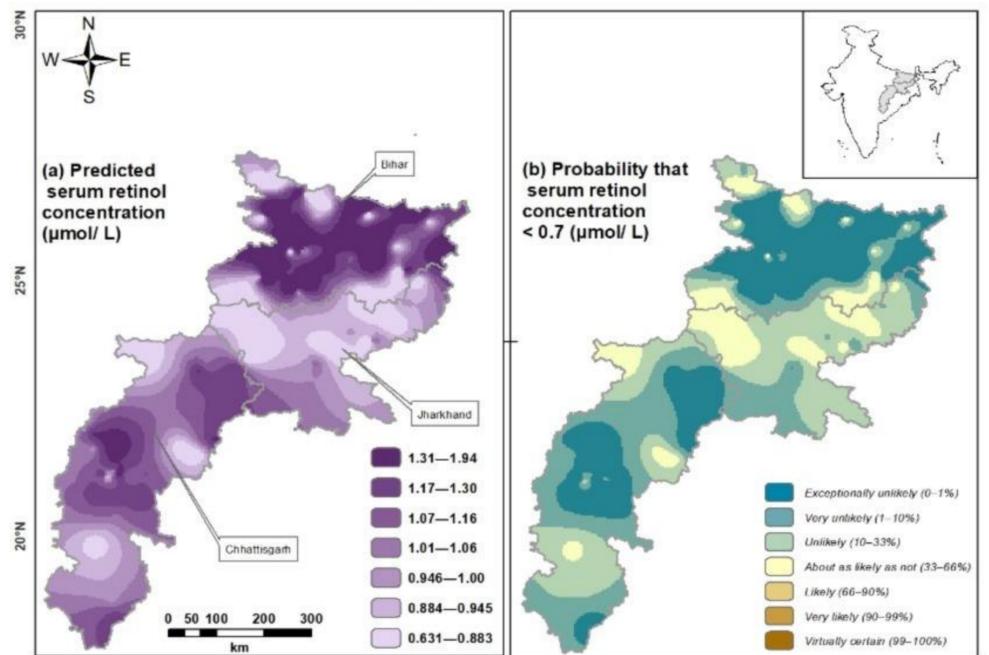


Fig 4. (a) Spatial prediction of concentration of serum retinol in adolescents, (b) probability that retinol concentration does not exceed 0.7 $\mu\text{mol/L}$ in adolescents of the study area

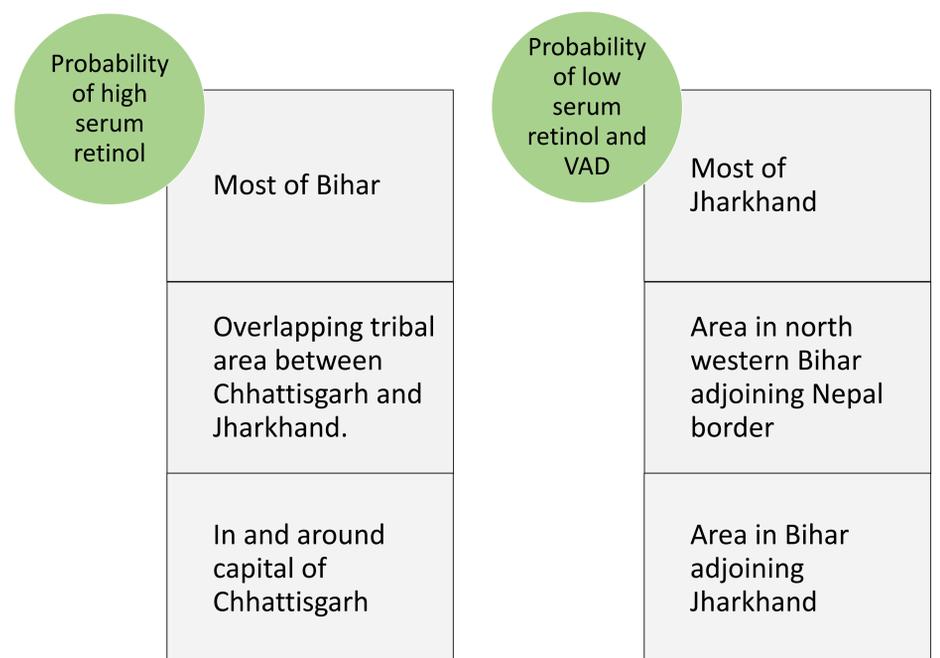


Fig 5 Description of areas with probability of high and low serum retinol and VAD in adolescents

Conclusion

- **Single values** of **deficiency** prevalence estimates at state level can **mask substantial variation within the state**.
- **Large uncertainties** in VAD prevalence estimates **outside the state capitals** can be used to inform the **design of subsequent surveys**.
- **VAD exists but spatial predictions** can help design **targeted approaches for focus areas within the states**.

References

1. Ministry of Health and Family Welfare (MoHFW), Government of India, UNICEF and Population Council. 2019. Comprehensive National Nutrition Survey (CNNS) National Report. New Delhi
2. Bora K. BMJ Glob Health. 2022;7:e007972.
3. Johnston R, et al. PLOS ONE. 2021;16(11):e0260301.
4. Arroyave G et al. Methodologies for monitoring and evaluating Vitamin A deficiency intervention programs : A report of the International Vitamin A Consultative Group (IVACG). 1989