

# Double burden of malnutrition Prospective studies in Pune, India



**Prof C.S. Yajnik** MD,FRCP  
KEM HOSPITAL, PUNE, INDIA  
MRC LEU, Southampton, UK  
University of Exeter, UK  
IISER, Pune  
SDU, Odense, DK  
STIAS, Stellenbosch, SA  
[www.kemdiabetes.org](http://www.kemdiabetes.org)



PERSPECTIVE

Crystal Ball Series

# Confessions of a thin-fat Indian

Chittaranjan S. Yajnik<sup>1</sup>

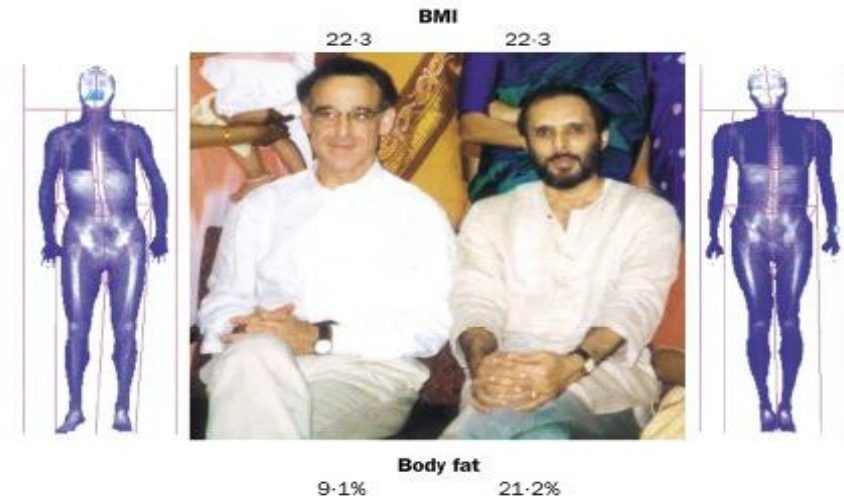
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**\*Fat = Body fat % (adiposity)  
Not Obesity**

## Clinical picture

### The Y-Y paradox

Chittaranjan S Yajnik, John S Yudkin

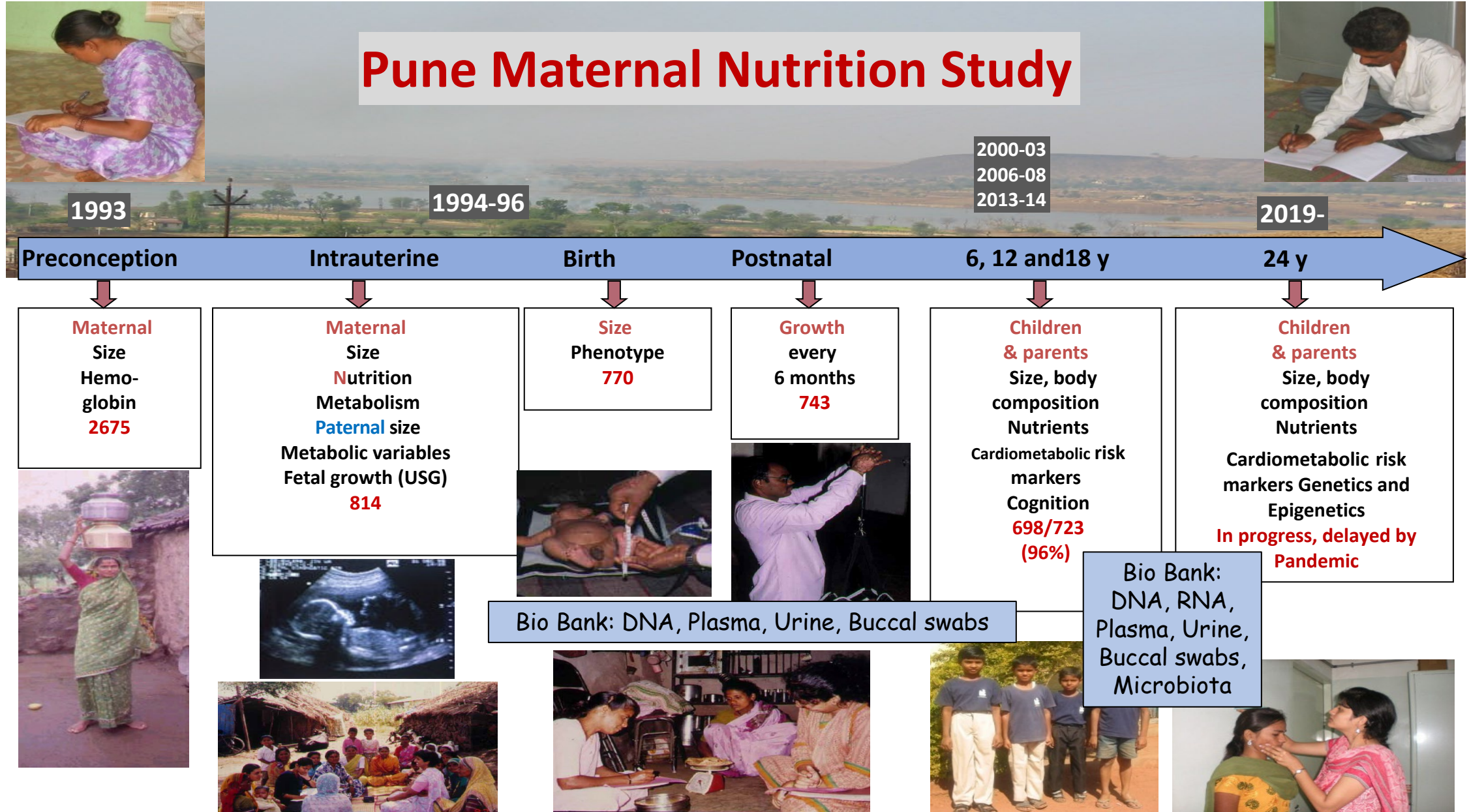


The two authors share a near identical body-mass index (BMI), but as dual X-ray absorptiometry imagery shows that is where the similarity ends. The first author (figure, right) has substantially more body fat than the second author (figure, left). Lifestyle may be relevant: the second author runs marathons whereas the first author's main exercise is running to beat the closing doors of the

elevator in the hospital every morning. The contribution of genes to such adiposity is yet to be determined, although the possible relevance of intrauterine under-nutrition is supported by the first author's low birthweight. The image is a useful reminder of the limitations of BMI as a measure of adiposity across populations.

Diabetes Unit, KEM Hospital Research Centre, Rasta Peth, Pune 411011, India (C S Yajnik MD); International Health and Medical Education Centre, University College London, UK (J S Yudkin FRCP)

- Determinants of fetal growth and body composition
- Lifecourse evolution of phenotypes



# Social and Nutritional Transition in the study area in six villages near Pune, India

**1993**

- **Population: 220,995**
- **Electricity <30%**
- **Predominantly subsistence farming**
- **Drought prone**
- **Piped water supply <20%**
- **Few gadgets, basic transport**
- **Illiteracy common**
- **Low SES**
- **Minimum fast foods**

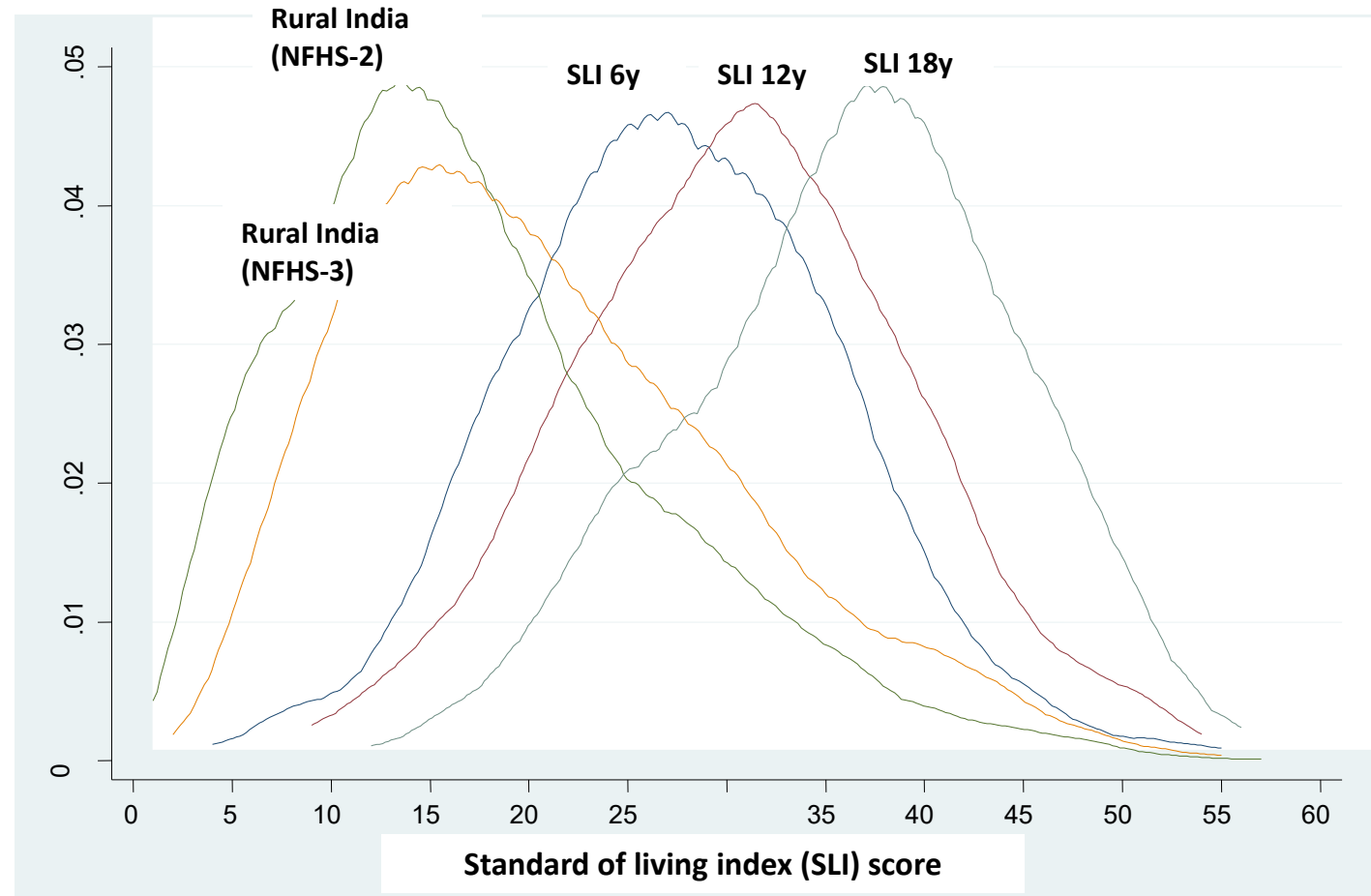
**2022**

- **Population: 431,896**
- **Electricity >90%**
- **Cash crop farming + wage workers**
- **Regular supply from a dam**
- **Piped water supply >80%**
- **Mobiles, fridges, 2- and 4-wheelers**
- **Graduates and professionals**
- **Improved SES**
- **Fast foods common**



# Distribution of Standard of Living Index (SLI) over 18 years in study area of National Family Health Survey (NFHS) compared to national statistics in India

\*National Family Health Survey (NFHS)



**Study area has observed rapid socioeconomic development over 20 years**

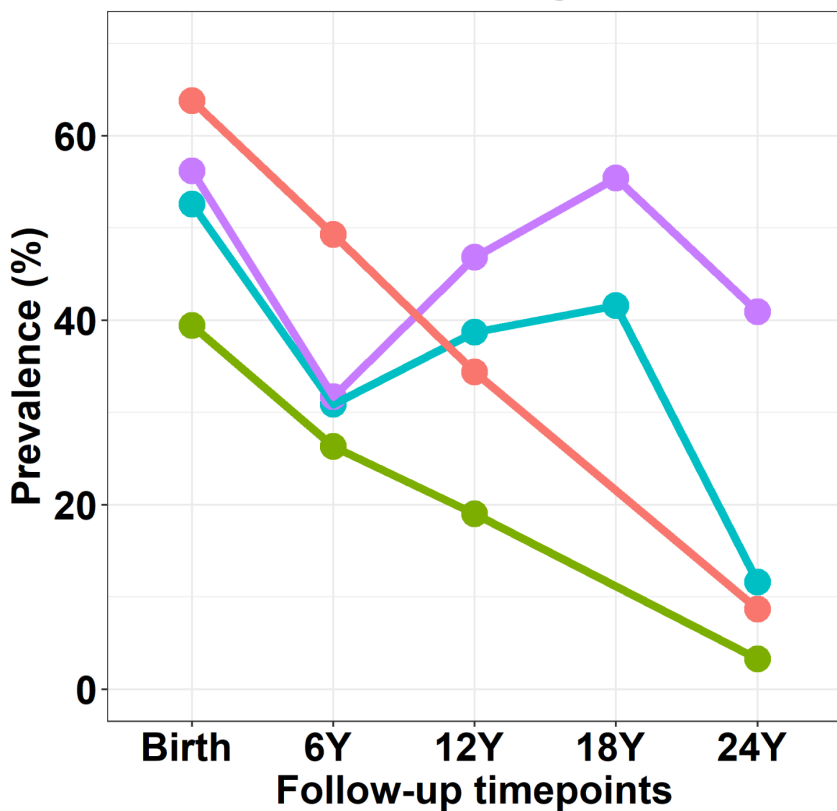
# Double Burden of Malnutrition - Body Size measurements

## The Pune Maternal Nutrition Study (1993-2022)

● Mother ● Father ● Boys ● Girls

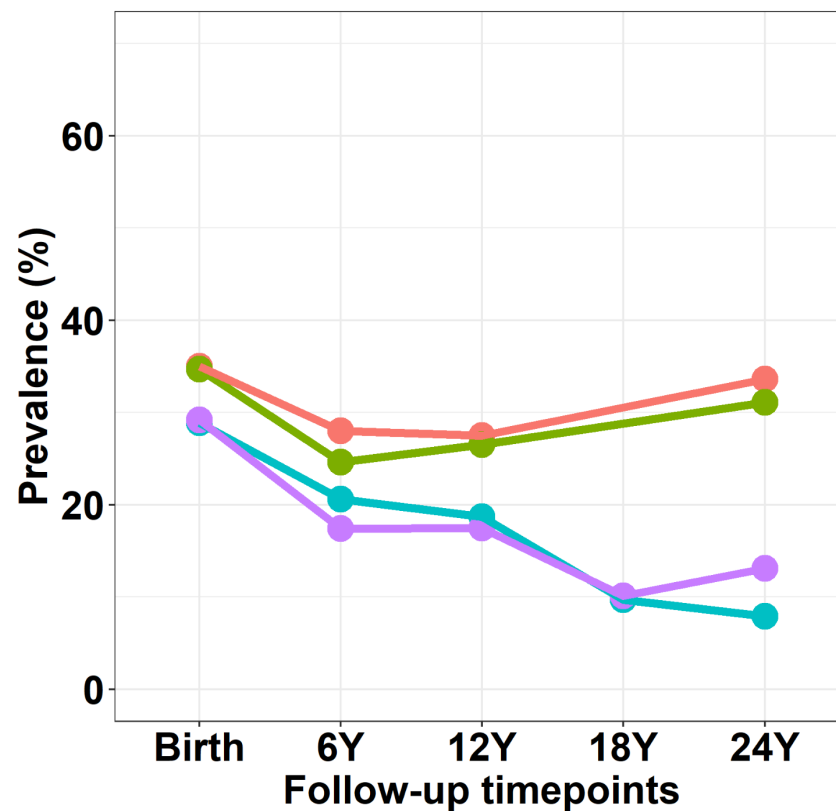
A

### Underweight



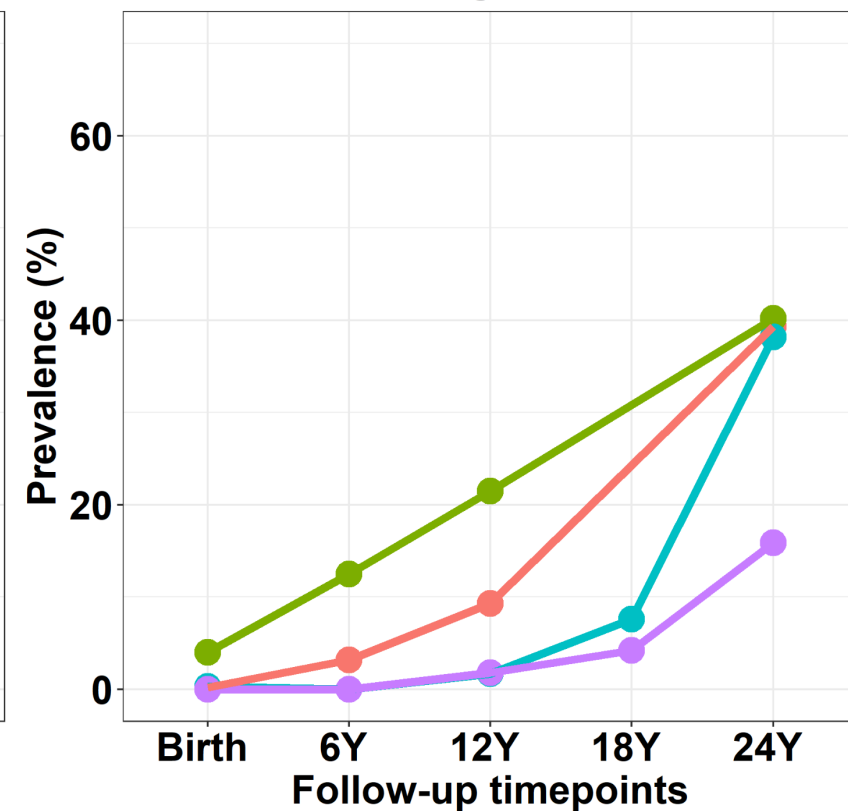
B

### Stunted



C

### Overweight/Obese



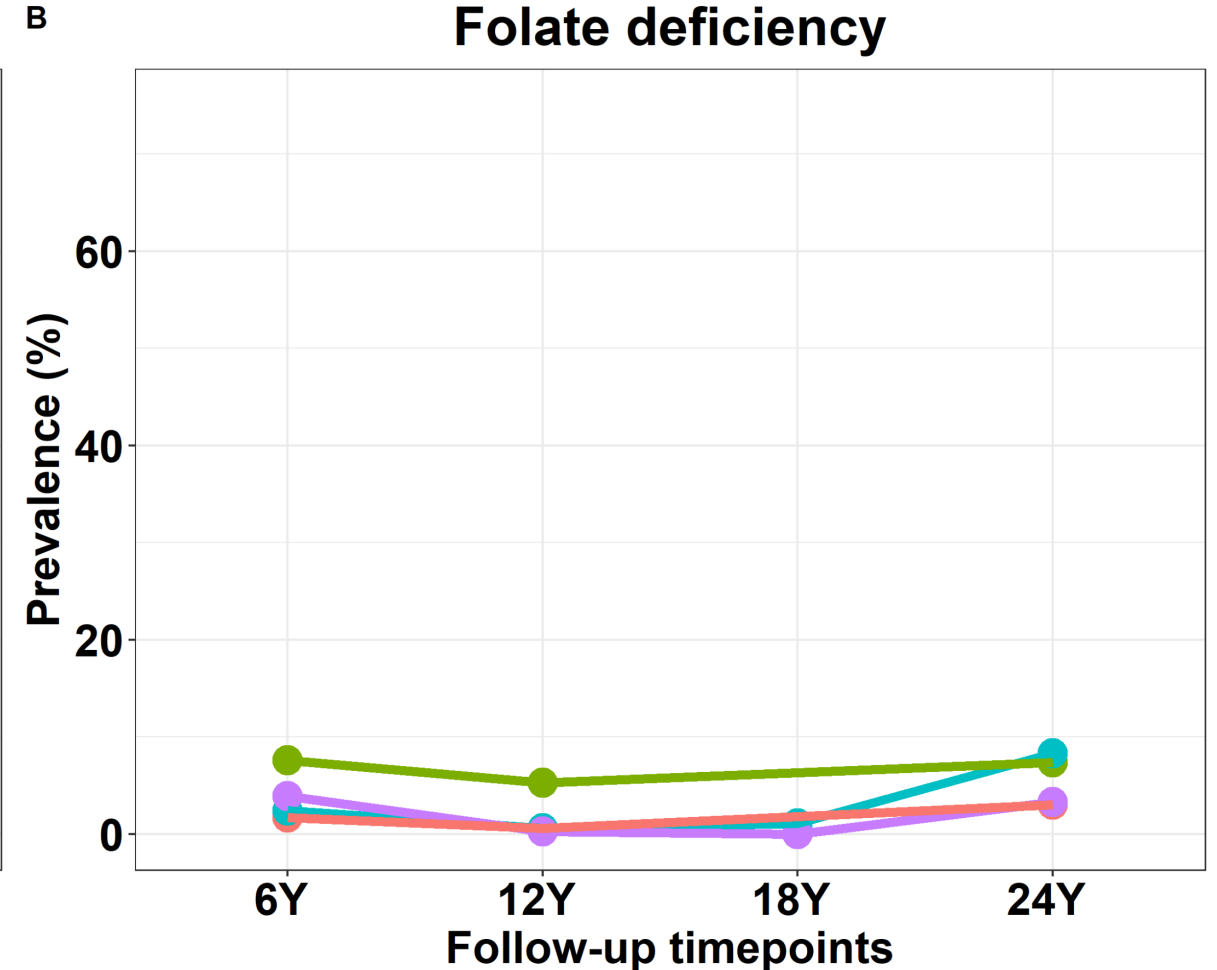
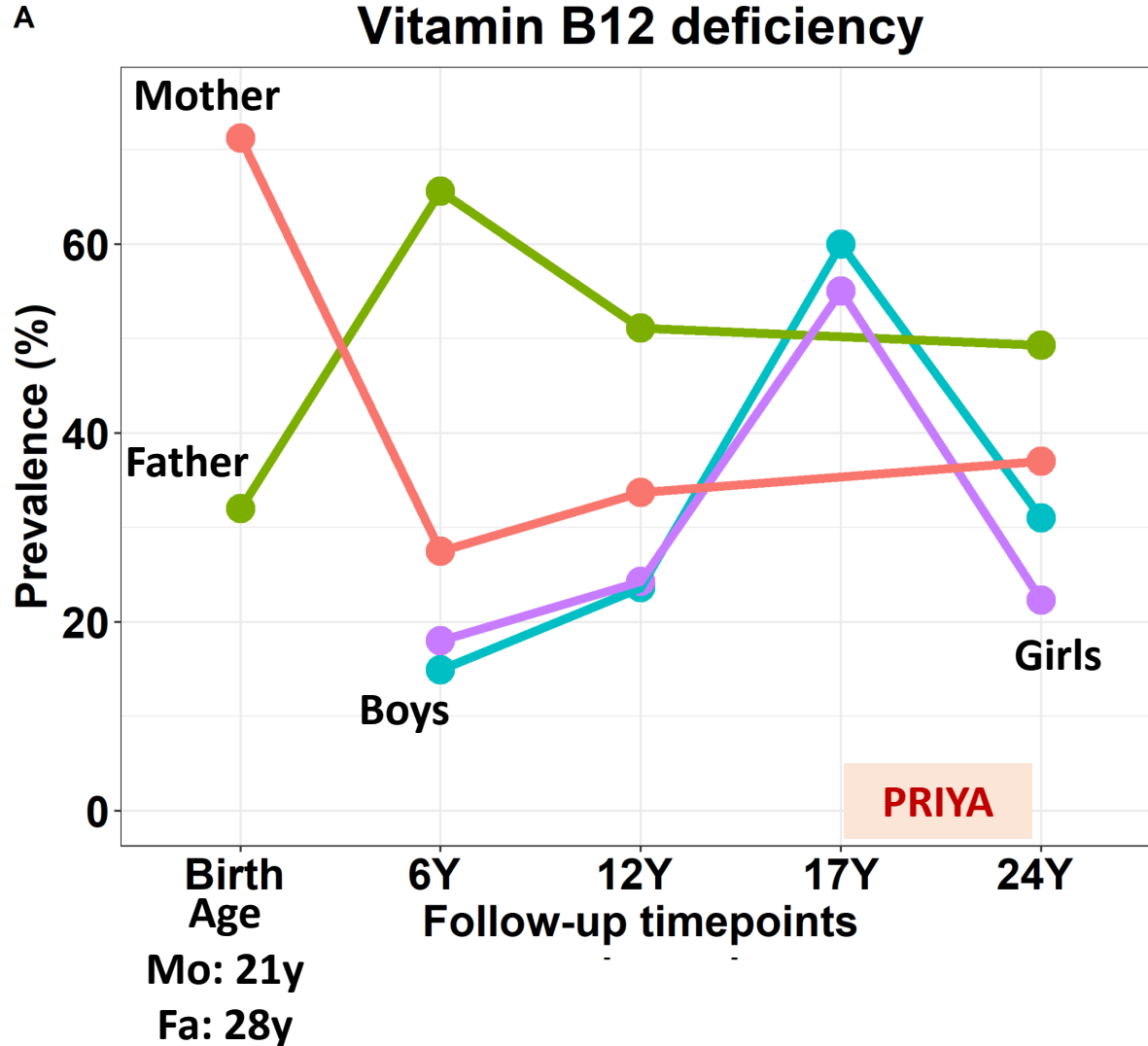
Mo: 21y

Fa: 28y

# Double Burden of Malnutrition - Micronutrient deficiencies

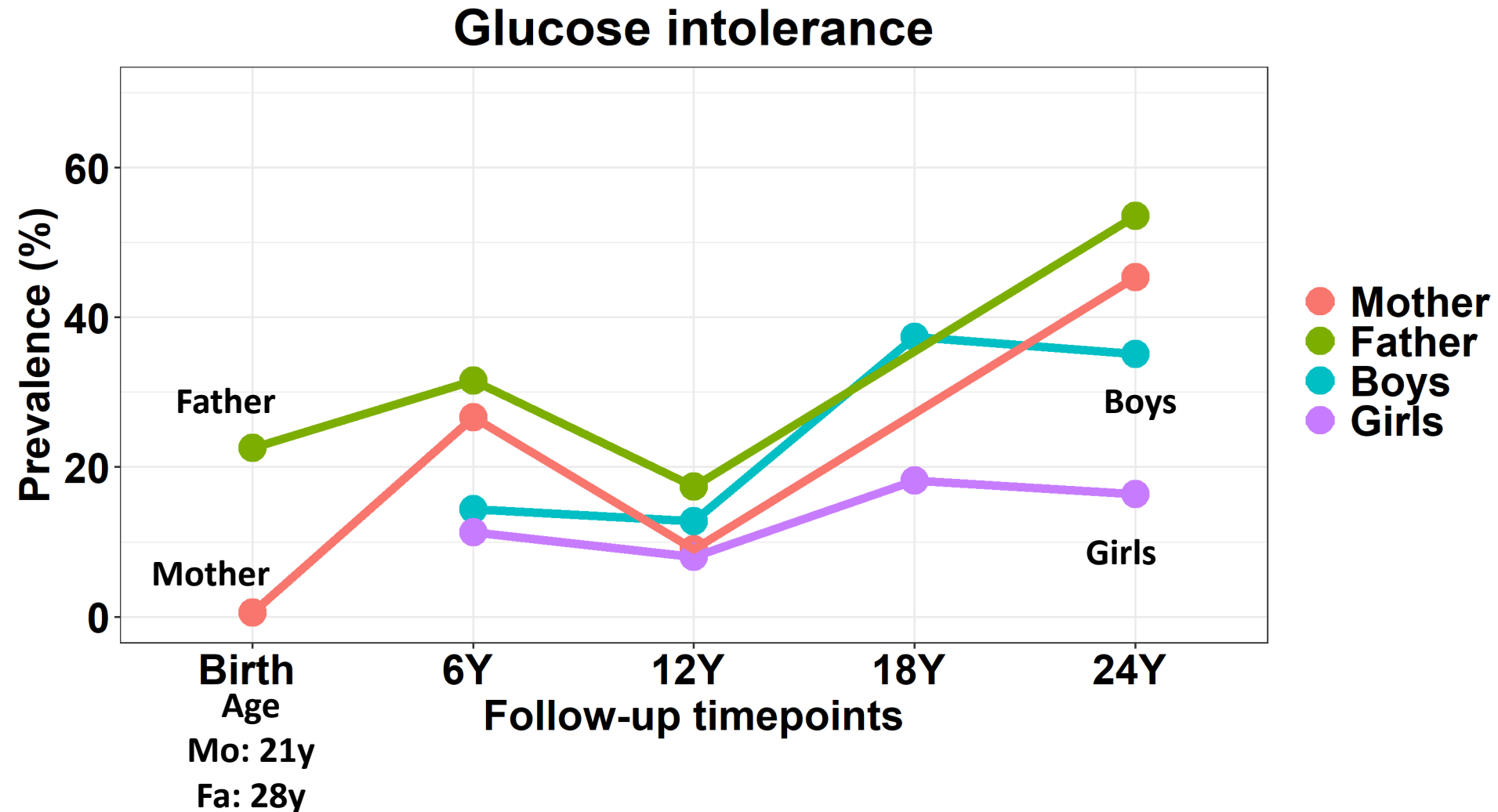
## The Pune Maternal Nutrition Study (1993-2022)

● Mother ● Father ● Boys ● Girls



# Double Burden of Malnutrition

## Glucose intolerance (Prediabetes + Diabetes)





# Glucose intolerance in the Pune Maternal Nutrition Study (18y F1 generation, BMI 19 kg/m<sup>2</sup>)

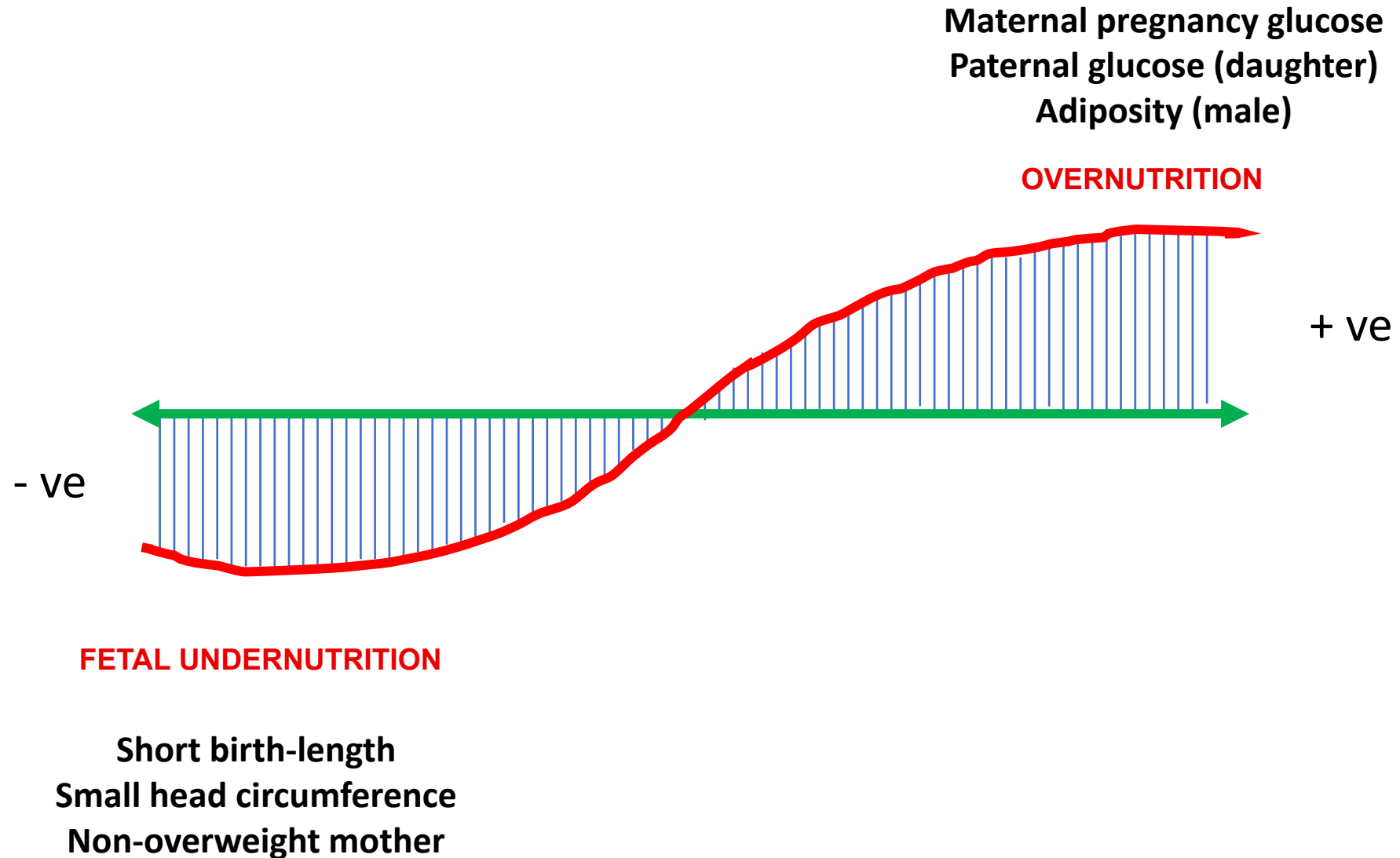


356	N	307
27	IFG %	8
10	IGT %	9
0	DM (n)	2
60	B12 defi (%)	55

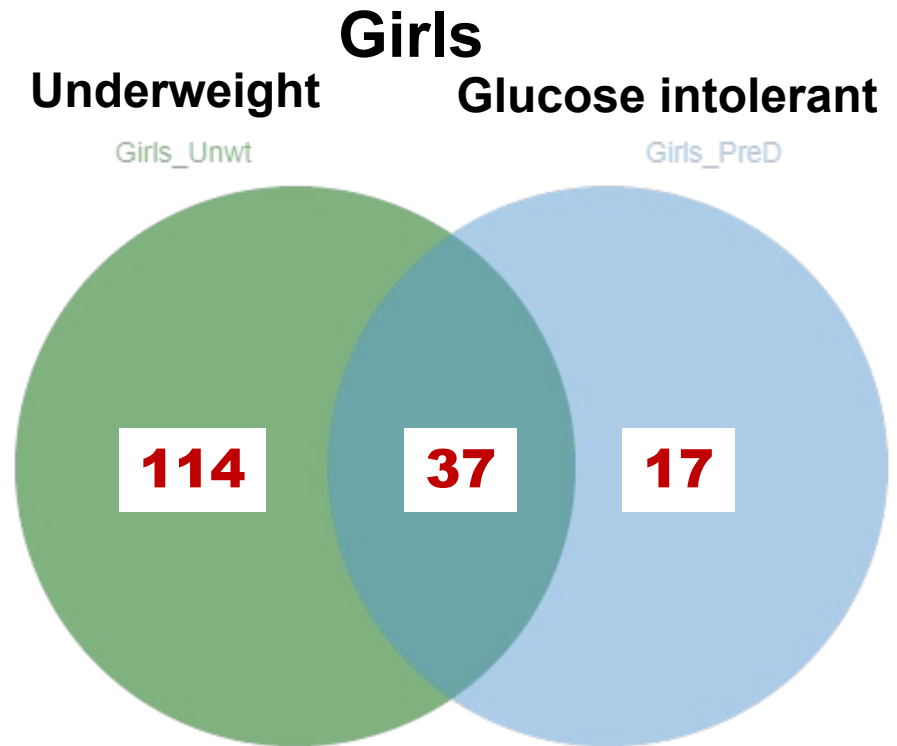
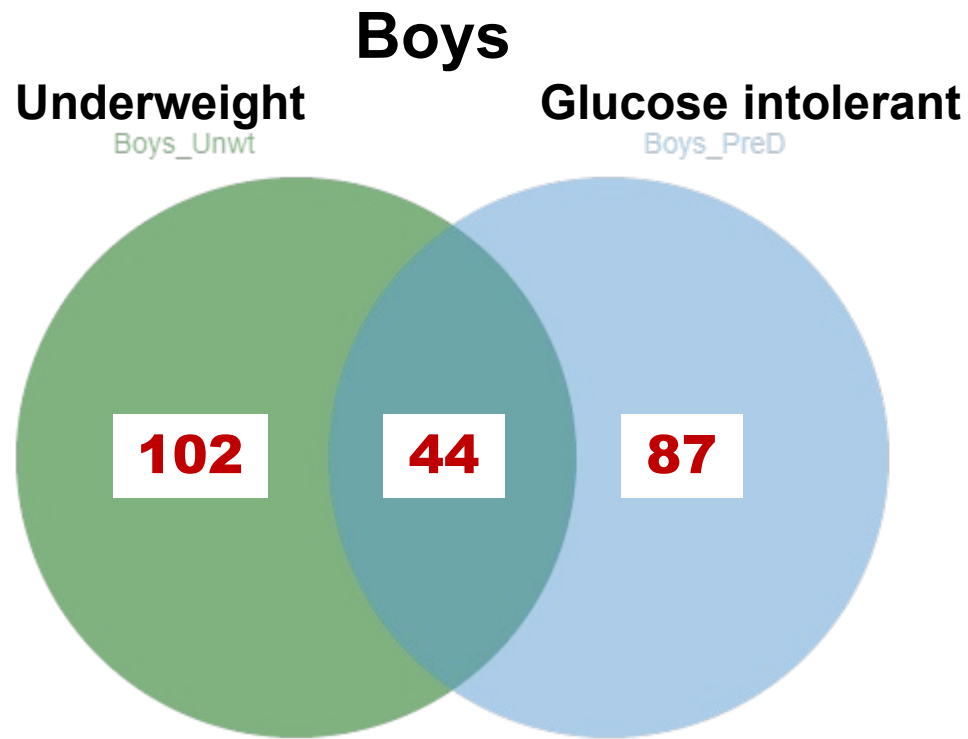
**Males: 40%, Females: 20%**  
**IFG + IGT = Prediabetes**



# Lifecourse Determinants of Glucose intolerance - 18y PMNS



# Double Burden of Malnutrition Underweight and Glucose intolerance PMNS 18y F1



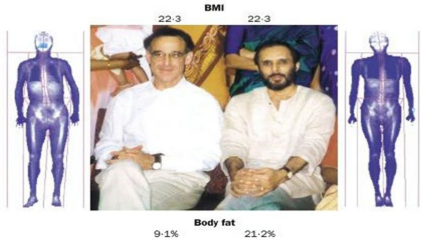
**1/3<sup>rd</sup> glucose intolerant boys and 2/3<sup>rd</sup> girls were underweight (BMI <18.5kg/m<sup>2</sup>)**

# 'Thin-Fat' and 'Short-Fat' individuals are at higher risk of glucose intolerance

## Clinical picture

### The Y-Y paradox

Chittaranjan S Yajnik, John S Yudkin



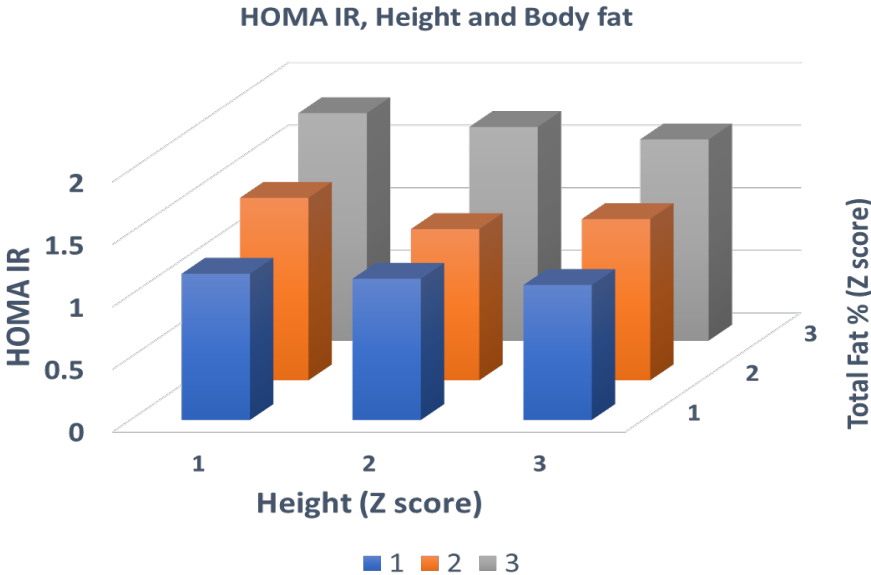
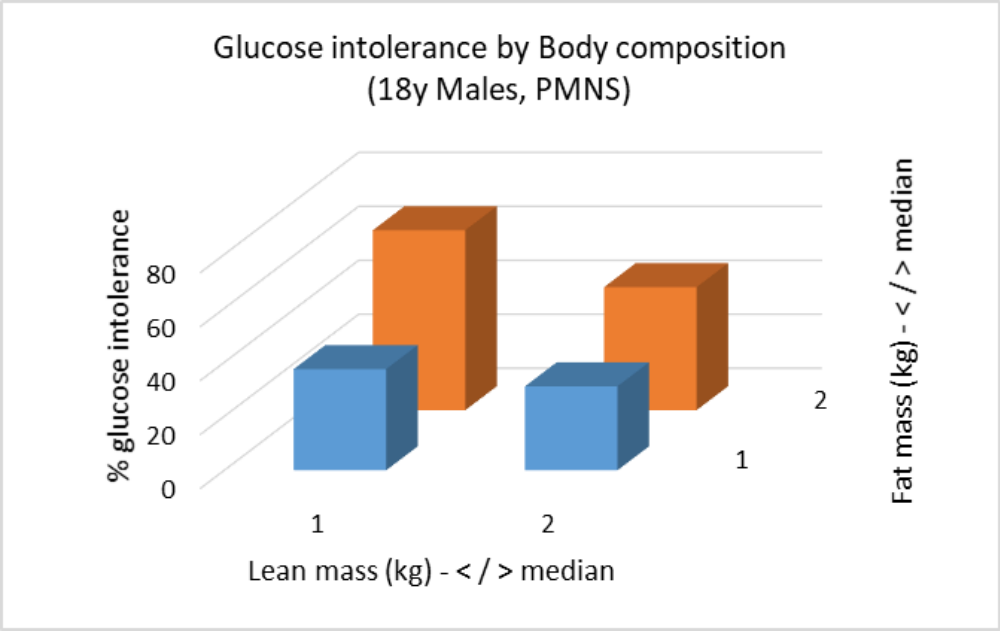
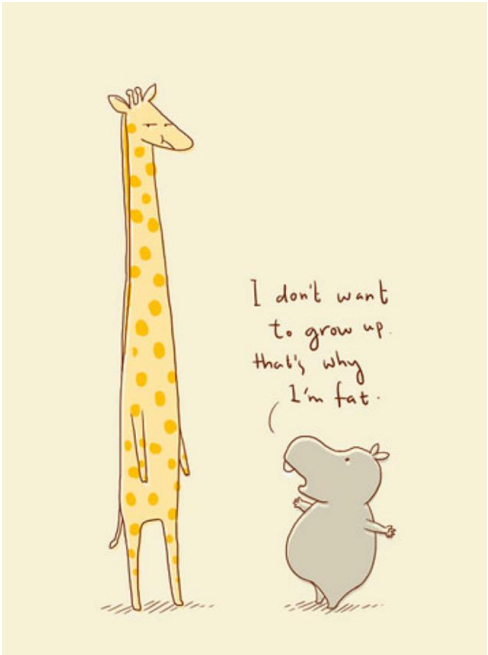
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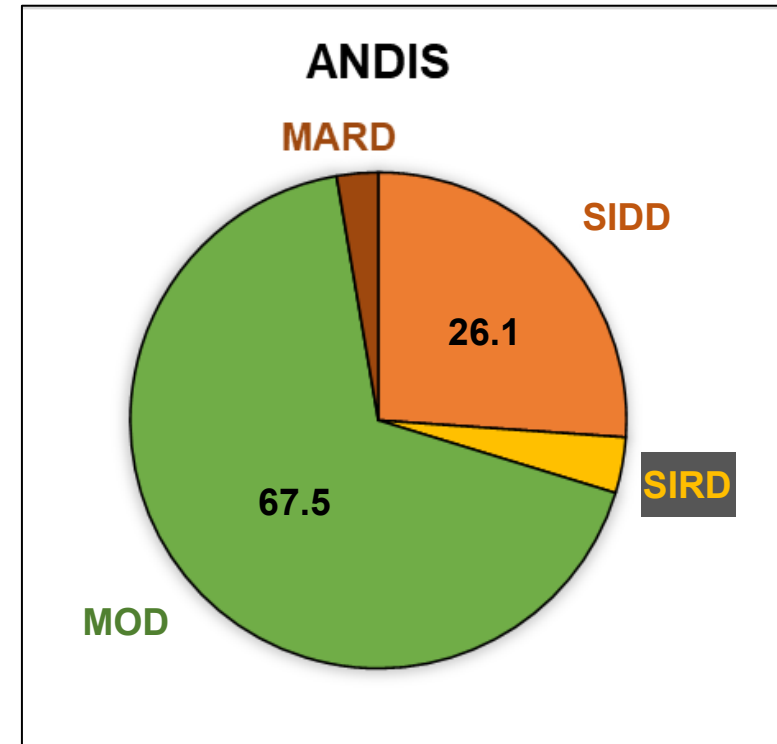
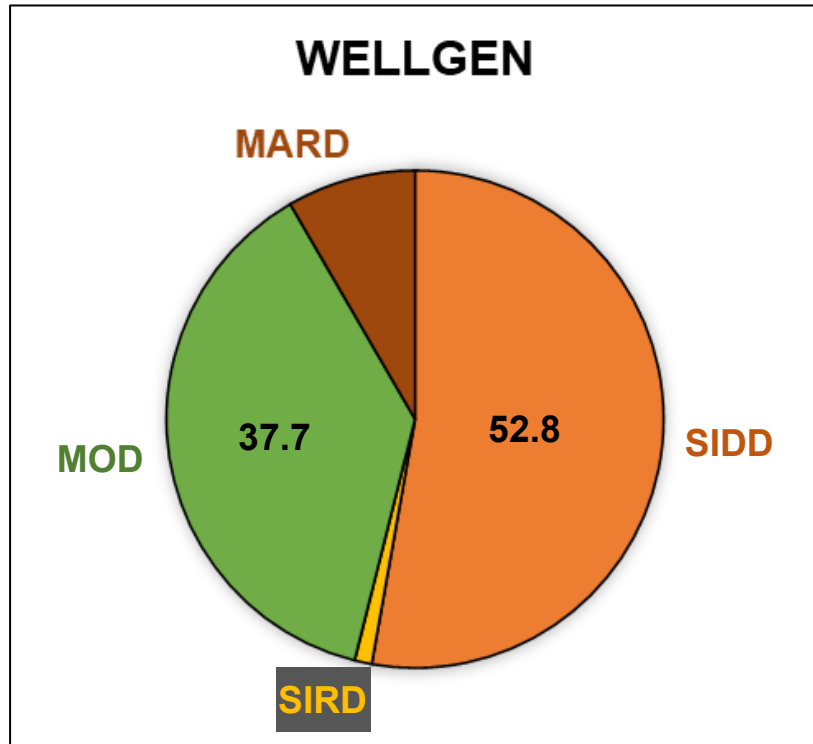
THE LANCET • Vol 363 • January 10, 2004 • www.thelancet.com

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\*Fat = Body fat %



## Subtypes of Type 2 Diabetes in India (WELLGEN cohort) and Sweden (ANDIS cohort)



Pathophysiology of type 2 diabetes in the young in LMICs is predominantly driven by insulin deficiency while it is driven by insulin resistance in the HICs

# Mechanisms increasing risk of NCDs in double burden of malnutrition

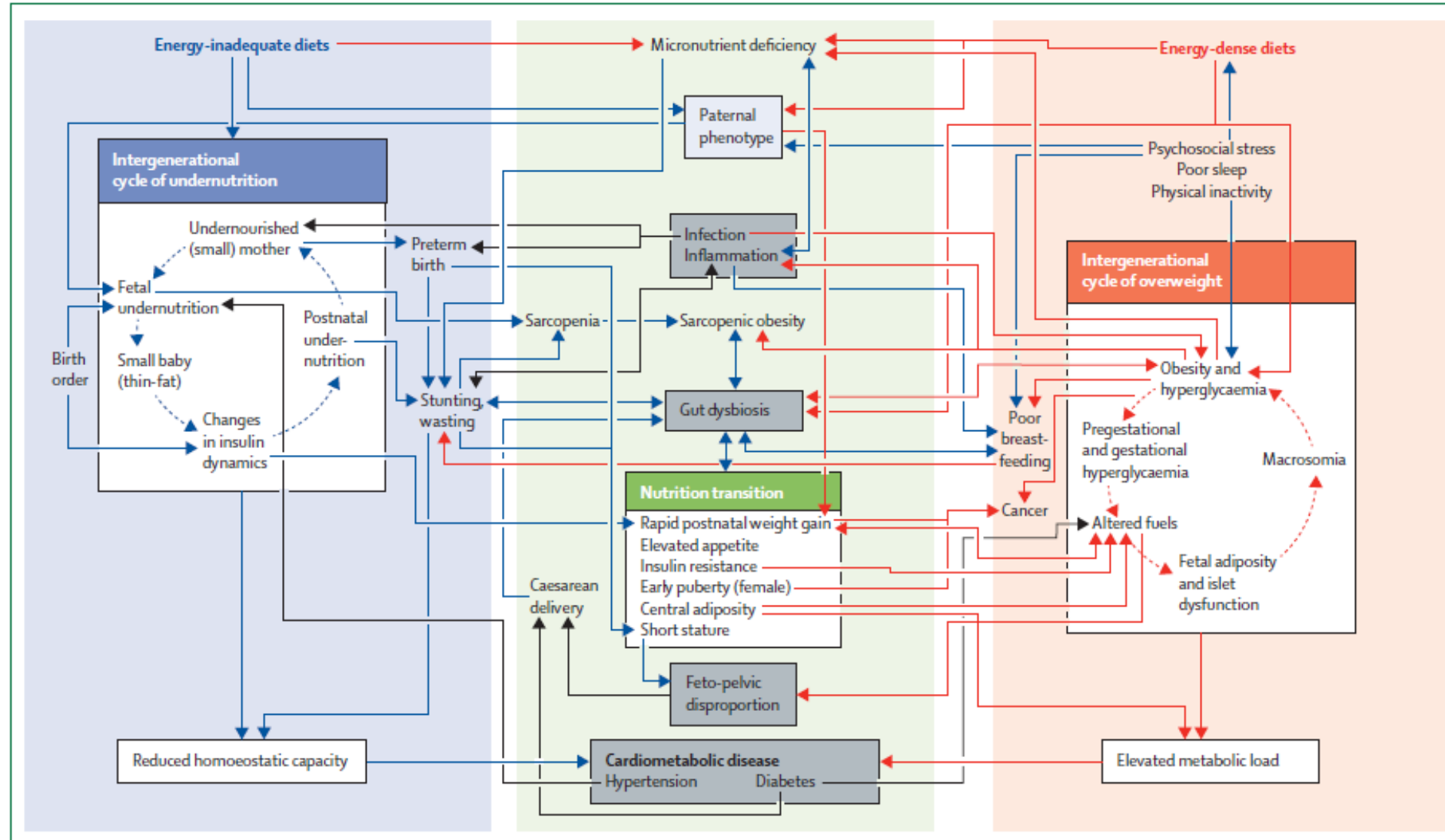


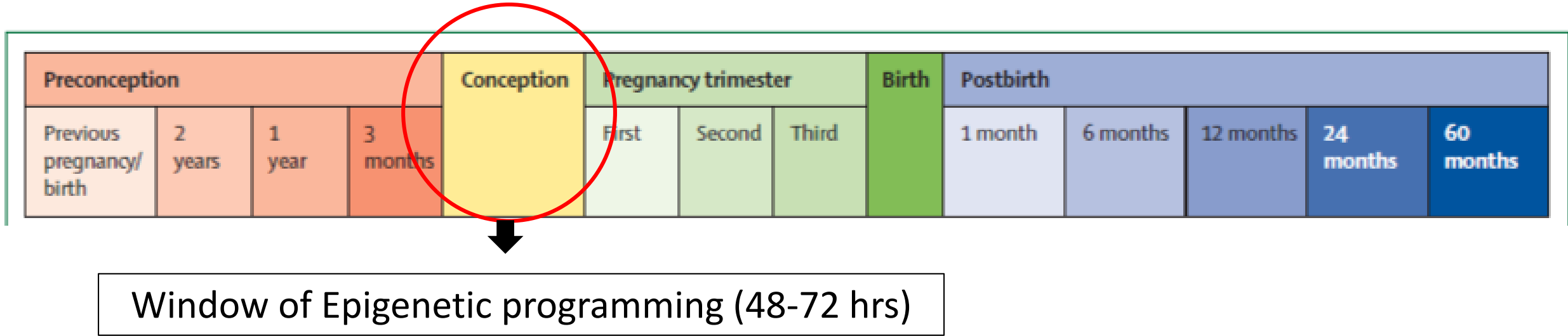
Figure 1: Complex interconnections between intergenerational cycles of undernutrition and nutritional excess and the effect of nutrition transition

Life is complex!

Wells, Yajnik et al, Lancet 2019



# '1000 days' miss the preconception-periconception window of epigenetic programming

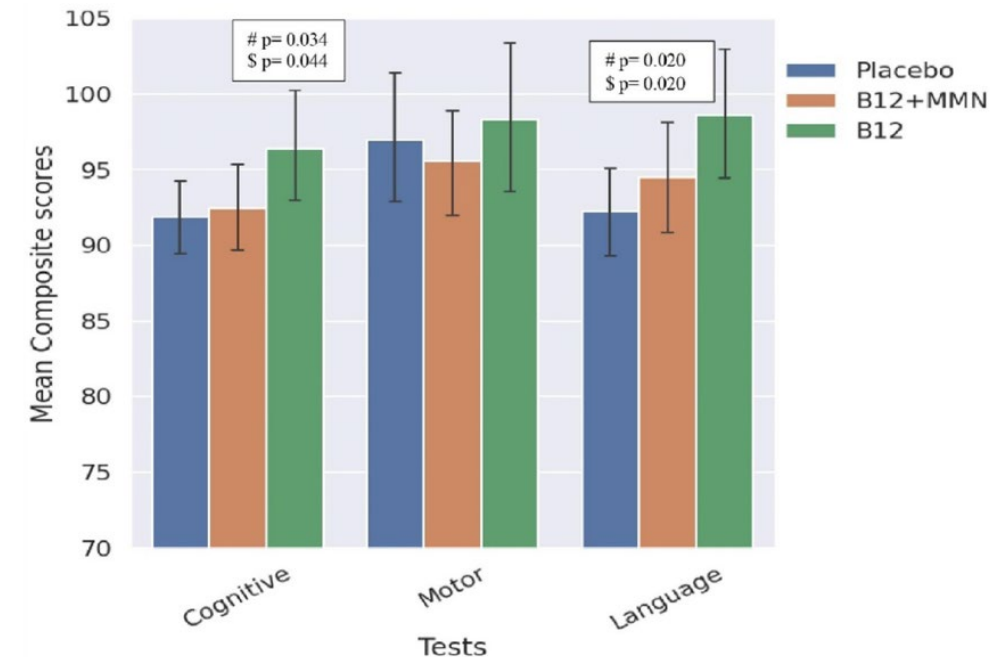
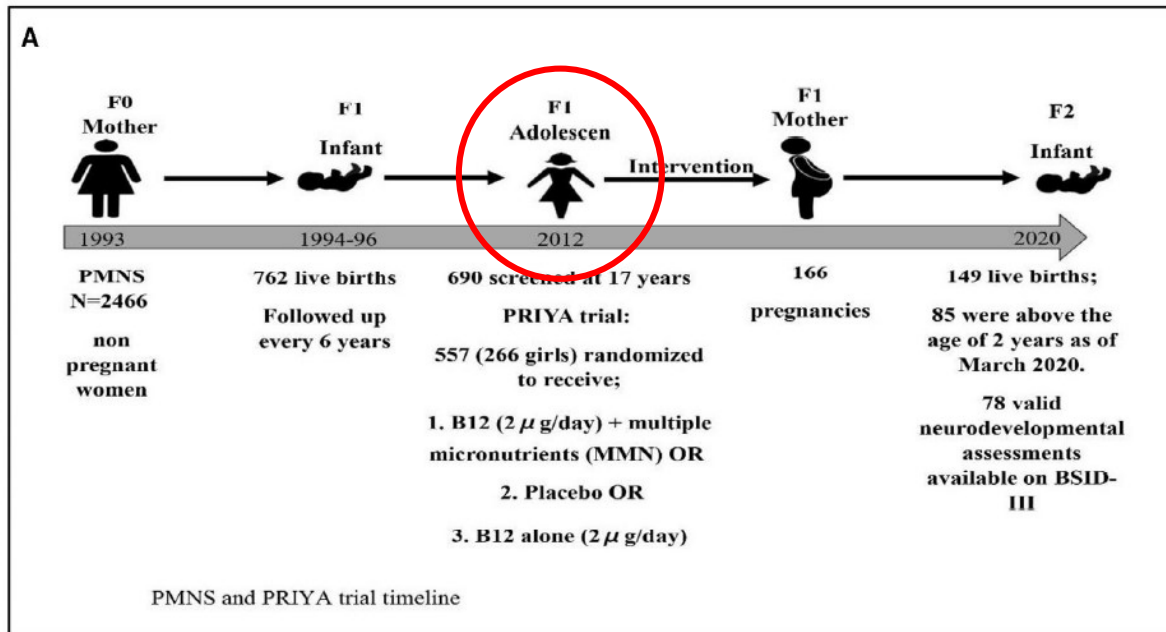


**"Timing is everything"**  
G Desoye et al, Lancet 2021



# Pre-conceptional Maternal Vitamin B12 Supplementation Improves Offspring Neurodevelopment at 2 Years of Age: PRIYA Trial

SS Naomi D'souza<sup>1†</sup>, Rishikesh V. Behere<sup>1†</sup>, Bindu Patni<sup>2</sup>, Madhavi Deshpande<sup>2</sup>, Dattatray Bhat<sup>1</sup>, Aboli Bhalerao<sup>1</sup>, Swapnali Sonawane<sup>1</sup>, Rohan Shah<sup>1</sup>, Rasika Ladkat<sup>1</sup>, Pallavi Yajnik<sup>1</sup>, Souvik K. Bandyopadhyay<sup>3</sup>, Kalyanaraman Kumaran<sup>4</sup>, Caroline Fall<sup>4</sup> and Chittaranjan S. Yajnik<sup>1\*</sup>



# Determinants of non-communicable diseases





## साखरेपेक्षा गोड ( 'Sakharepeksha Goad' )

The story unfolds in the short film driven by Dr. Chittaranjan Yajnik's science and Dr. Mohan Agashe and Smt. Sumitra Bhavé's art and creativity  
(The film will be launched on Youtube after the webinar)

*Save the Date*

Friday, 14<sup>th</sup> August 2020 | 15:00 PM - 16:30 PM

Watch the Zoom Webinar streaming **Live on Facebook**

In Association with



Mukul Madhav  
Foundation



Welcome speech by: **Dr. Chittaranjan Yajnik**

Keynote Speakers: **Dr. Mohan Agashe,**  
**Smt. Sumitra Bhavé**

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DEVELOPING ATTITUDES  
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Note: Request all the participants to please be on time and follow virtual webinar etiquette  
The film is in Marathi with English subtitles

## Tribute to Dr Sumitra Bhavé

<https://youtu.be/6e8zLgF9ggQ>

**KEM Hospital Pune**  
**> 1.3 million hits**





# Thank U

