सत्यमेव जयते

Ministry of Health and Family Welfare
Government of India

Comprehensive National Nutrition Survey

2016 – 2018

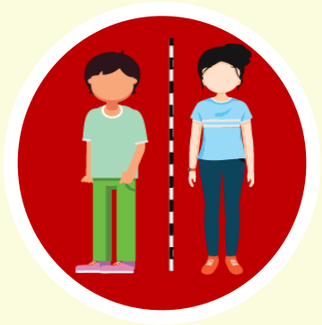
Sikkim
State Presentation

Birth to Adolescence

Largest Micronutrient Survey ever conducted: CNNS 2016-

112,316
Children and adolescents interviewed

51,029
Blood, stool and urine samples collected



360
Anthropometric measurers

2500
Survey personnel in 30 states

30
Microscopists

100
Data Quality assurance monitors

200
Trainers and coordinators

200
Lab technicians

900
Interviewers

360
Phlebotomists

Justification and Objectives

- To assess the prevalence of malnutrition in both children and adolescents with special focus on assessment of micronutrient deficiencies through biochemical measures.
- To identify determinants and associations of various risk factors for anaemia in both children and adolescents.
- To assess biomarkers for hypertension, diabetes, cholesterol and kidney function and their associations with various risk factors for Non-Communicable Diseases (NCDs).

Malnutrition is responsible for 68% of total under five mortality in India*

*Soumya Swaminathan, et al. (2019), The burden of child and maternal malnutrition and trends in its indicators in the states of India: the Global Burden of Disease Study 1990–2017. https://doi.org/10.1016/S2352-4642(19)30273-1

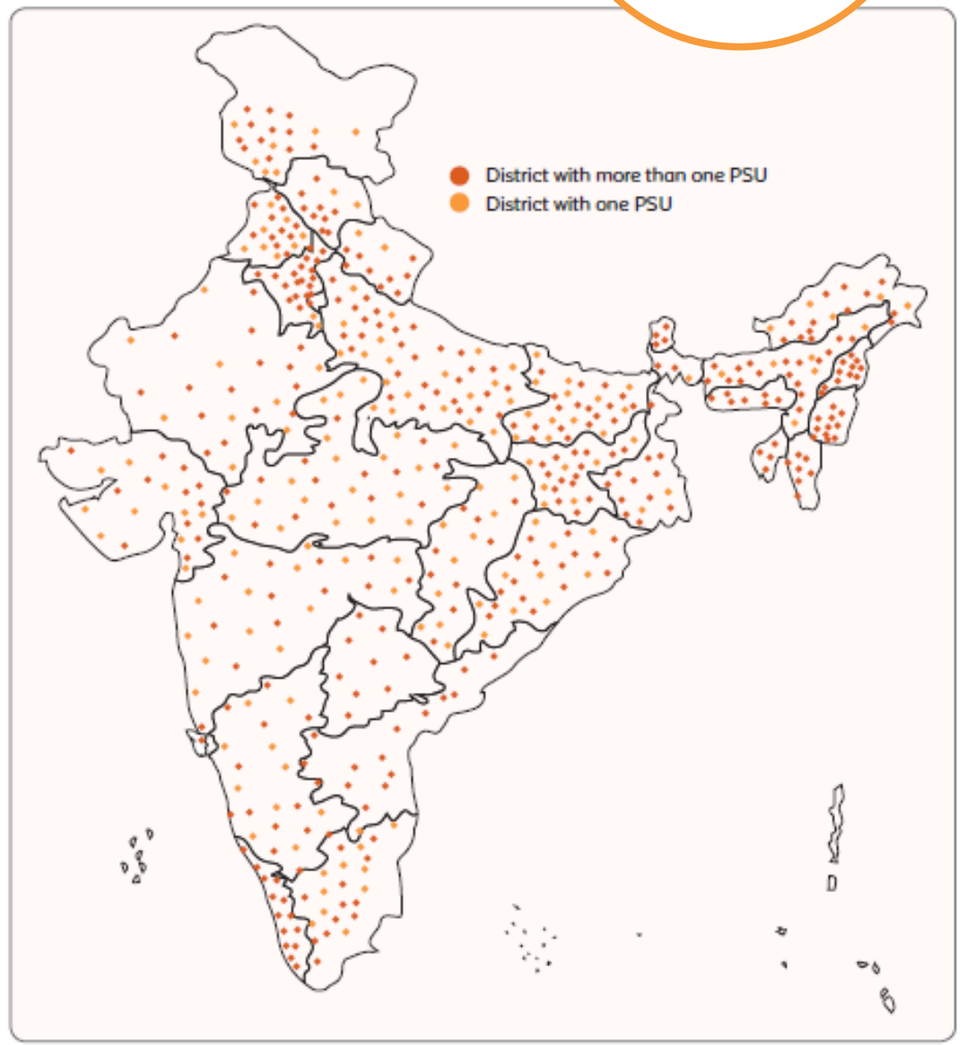
CINS Birth to Adolescence

Survey Design

CNNS is a cross-sectional, household survey using a multi-stage sampling design.

CNNS covered **2035 Primary Sampling Units (PSUs)** from more than **82%** of all districts from the Census 2011 (516 out of 628 districts) across 30 states:

- 160 Districts- one PSU
- 356 Districts- two or more PSUs



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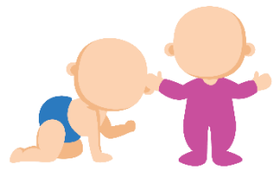
Anthropometry data

	Pre-school children (0-4 years)	School-age children (5-9 years)	Adolescents (10-19 years)
			
Anthropometric measurements	• Height • Weight • Mid-upper arm circumference (MUAC) • Triceps skinfold • Subscapular skinfold (1-4 years)		
		• Waist circumference	

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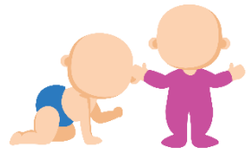
Biochemical indicators - micronutrient deficiencies and NCDs

Indicator Group			
Anaemia and haemoglobinopathies	• Haemoglobin • Variant haemoglobins		
Inflammatory biomarkers	• C-reactive protein		
Protein	• Serum protein and albumin		
Micronutrients	• Iron: Serum ferritin, serum transferrin receptor • Vitamin A: Serum retinol • Zinc: Serum zinc • B-vitamins: Erythrocyte folate, serum B12 • Vitamin D: Serum 25 (OH) D • Urinary Iodine		
Non-communicable diseases		• Blood Pressure • Blood glucose, HbA1c • Lipid profile: Serum cholesterol, LDL, HDL, and triglycerides • Renal function: Serum creatinine, urinary protein creatinine ratio	

Monitoring and Supervision

Three-tiers of Data Quality Assurance

Third Level

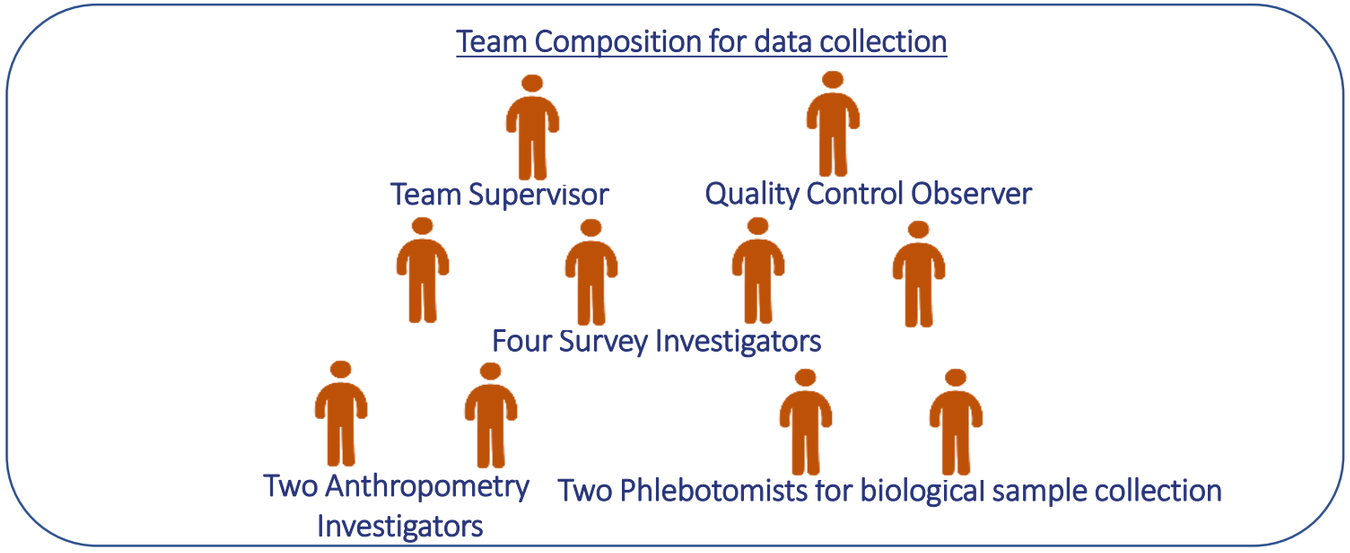
- Field work/protocol/training monitoring: by quality control team
- Biological sample quality control : by AIIMS, NIN and US CDC

Second Level

- 3-member Data Quality Assurance (DQA) team for re-interviews & observations
- Concurrent monitoring of biological sample collection, storage and transportation by CDSA

First Level

- Internal monitoring by the Quality Control Observer
- Daily supervision of the field work by Team Supervisor



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Quality Assurance Measures for Data Quality

Evaluation of Interviewers
prior to employment

Survey team
- Written and oral test
- Mock interview
- Ethics test

Anthropometry team
- Standardisation
- Selection based of demonstrated capacity measured by technical error of measurements (TEM)

Quality Assurance Measures

	DQA team conducted consistency checks, and provided feedback on real time basis
	No more than 4 interviews allowed in a day by an interviewer
	Daily SMS based monitoring/ alerts system for biological sample (from PSUs, collection points and reference labs).
	Sample transportation in thermal insulation bags maintaining temperature at 2-8° Celsius for up to 16 hours
	Time and temperature monitoring of samples by digital data loggers

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Agencies engaged in the implementation of CNNS

Survey Implementation by MoHFW, Government of India and supported by UNICEF

Technical support:
US Centre for Disease Control and UNICEF

Regular review and technical guidance: Technical advisory group constituted by MoHFW

Quality assurance and external monitoring: AIIMS, PGIMER, NIN, KSCH and CDSA

Overall field coordination, training, quality monitoring, data management and analysis: Population Council

Biological sample collection, transportation & analysis: SRL Limited

Survey and anthropometric data collection: IIHMR, Kantar Public, Gfk Mode and Sigma Consulting

Sample size in Sikkim

CNNS covered 60 PSUs for data collection in Sikkim

Achieved following sample size by age groups:

	0-4 years	5-9 years	10-19 years	Total
Household and anthropometry data	1,121	1,107	996	**3,224**
Biological sample	805	660	629	**2,094**

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Birth to Adolescence

Period of data collection in Sikkim

CNNS data collection period: July 8 to October 7, 2018

- CNNS collected data during the rainy season through early autumn season of 2018
- NFHS collected data during winter through rainy season of the year 2015

Survey	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CNNS 2018							July to October, 2018					
NFHS 4 2015	January to July, 2015											

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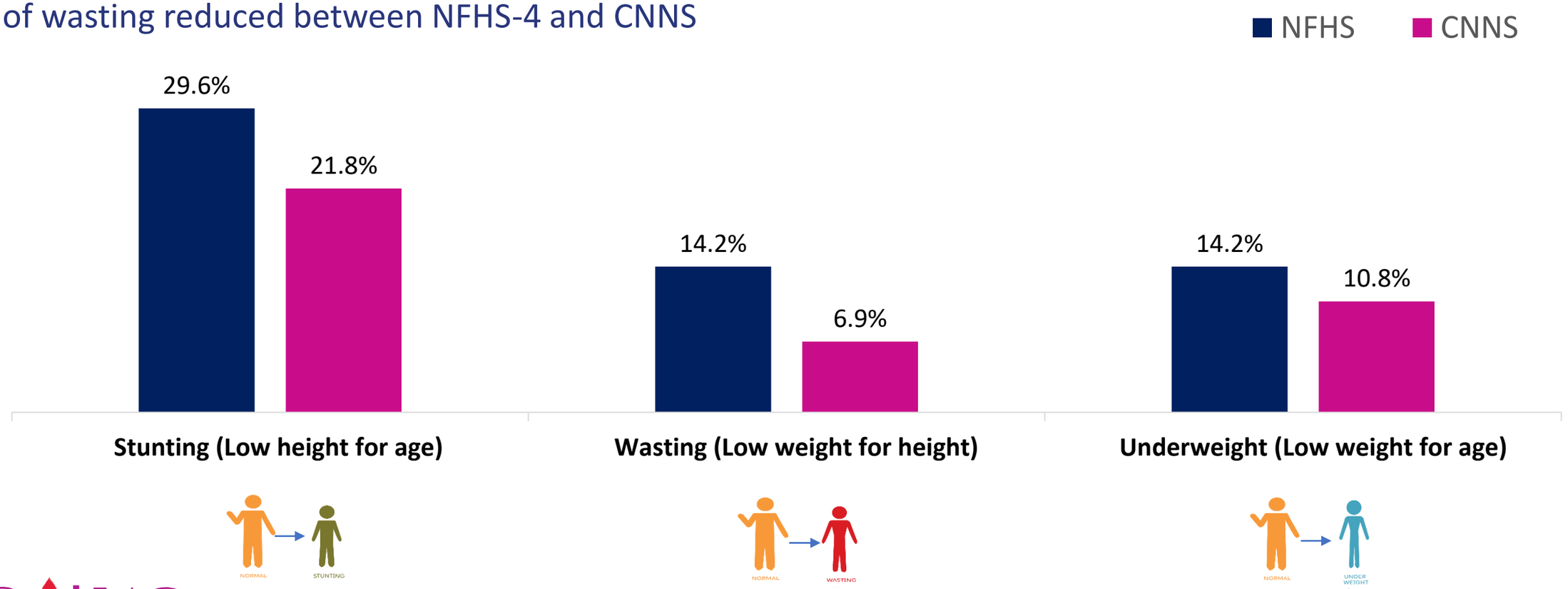
Birth to Adolescence

Sikkim key findings: Anthropometry (1/2)

Prevalence of stunting and underweight did not decline significantly in children under 5 years, however that of wasting reduced between NFHS-4 and CNNS



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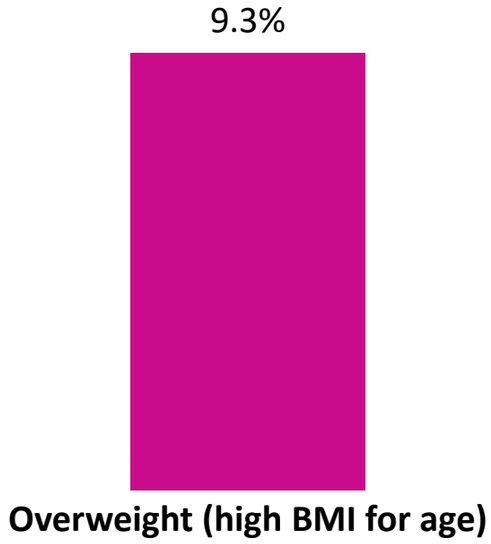
Birth to Adolescence

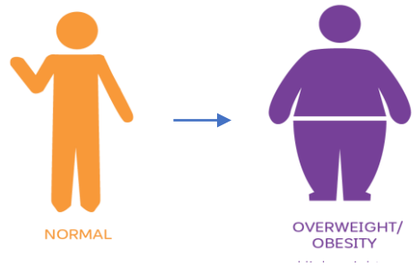
Sikkim key findings: Anthropometry (2/2)

1/10 adolescents aged 10-19 years was thin for their age (BMI-Age <-2SD)

1/5 children aged 5-9 years was stunted. The school age period does not provide an opportunity for catch up growth in height.

9% of adolescents aged 10-19 years were overweight or obese.



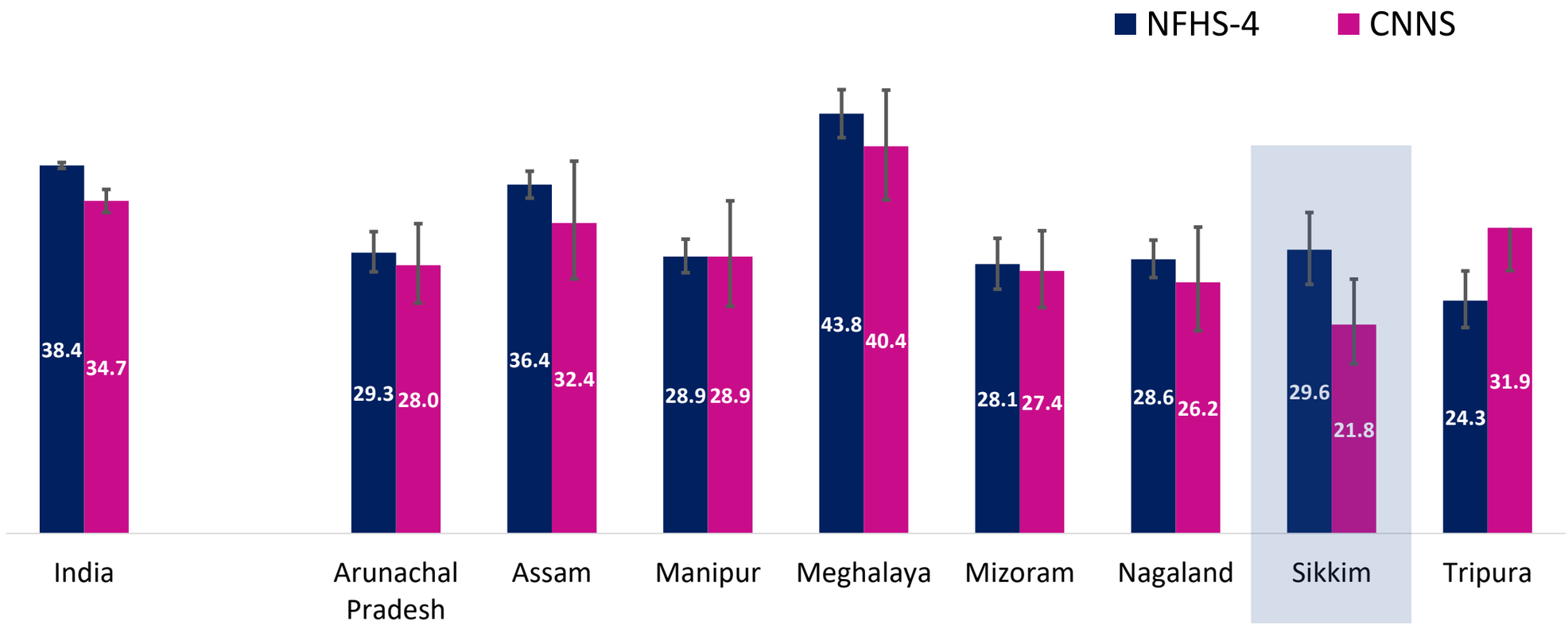


Birth to Adolescence

Stunting among children under five

Prevalence of stunting did not decline significantly in CNNS compared to NFHS-4 – **22% vs 30%** in Sikkim

In none of the northeastern states stunting declined significantly

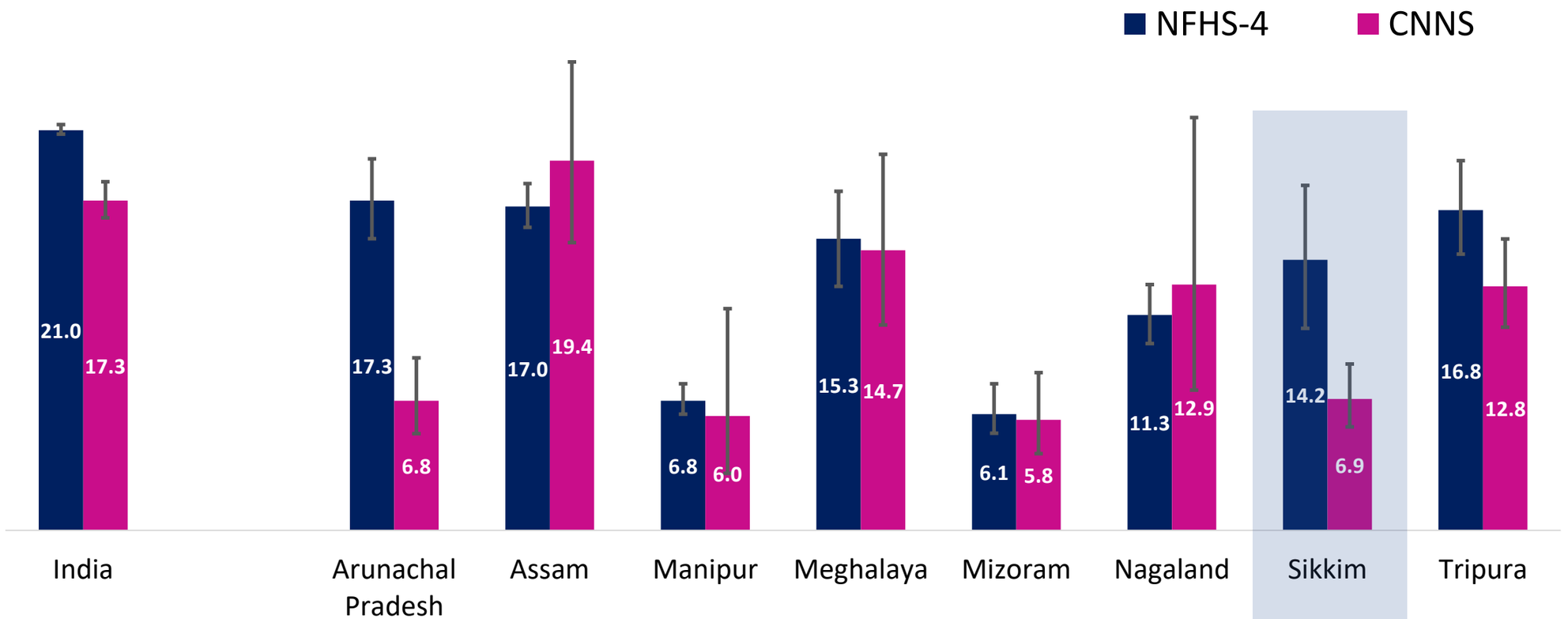


Birth to Adolescence

Wasting among children under five

Prevalence of wasting halved in Sikkim between NFHS-4 and CNNS – **14%** Vs **7%**

Among the northeastern states, wasting declined significantly only in Arunachal Pradesh and Sikkim



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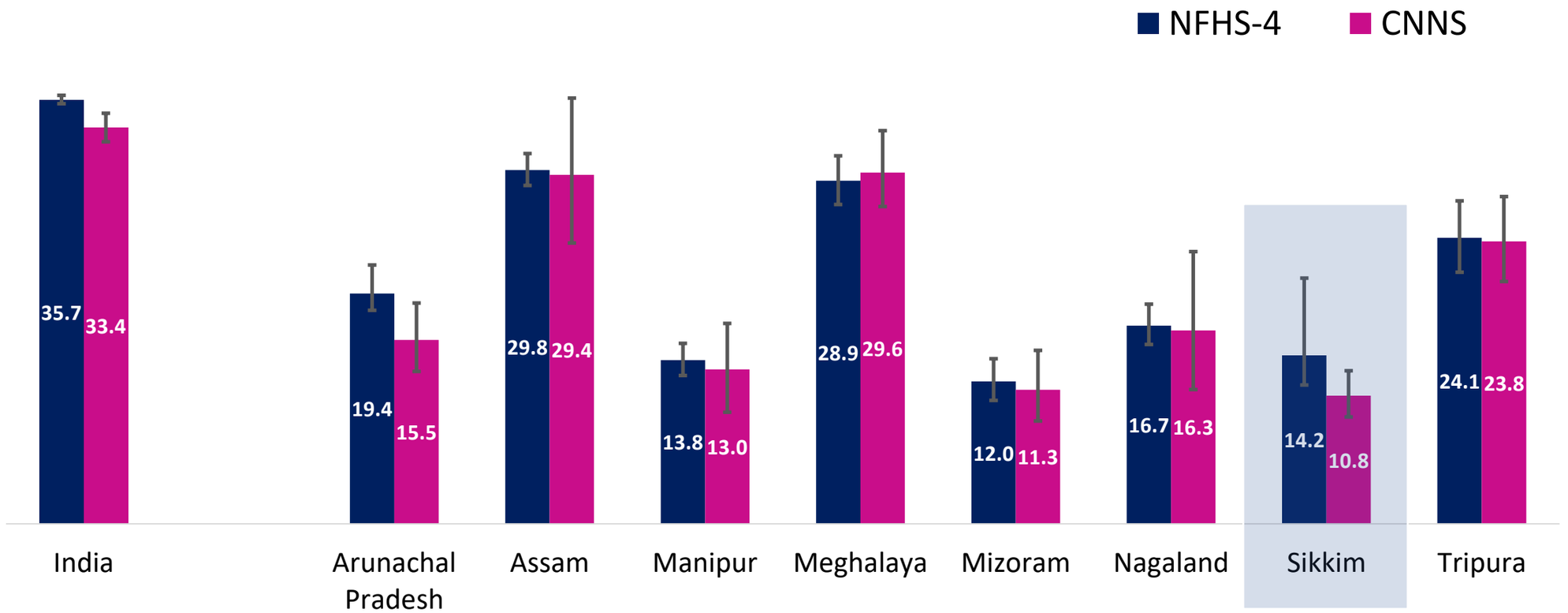
Prevalence of underweight among children under five

Underweight is a composite measure of chronic and acute malnutrition

The prevalence of underweight did not decline significantly between NFHS-4 and CNNS – **14%** Vs **11%**

Prevalence remained nearly unchanged in all northeastern states



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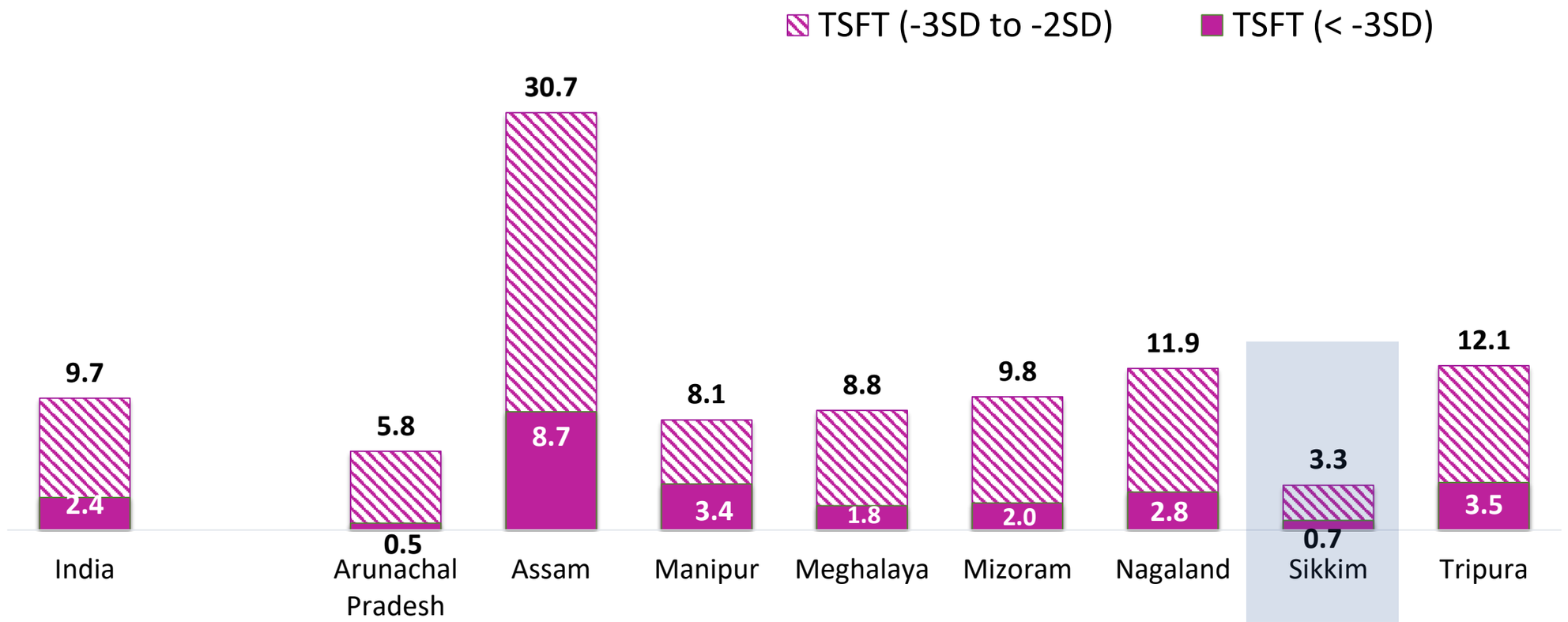
Birth to Adolescence

Triceps Skinfold Thickness (TSFT) for children under five

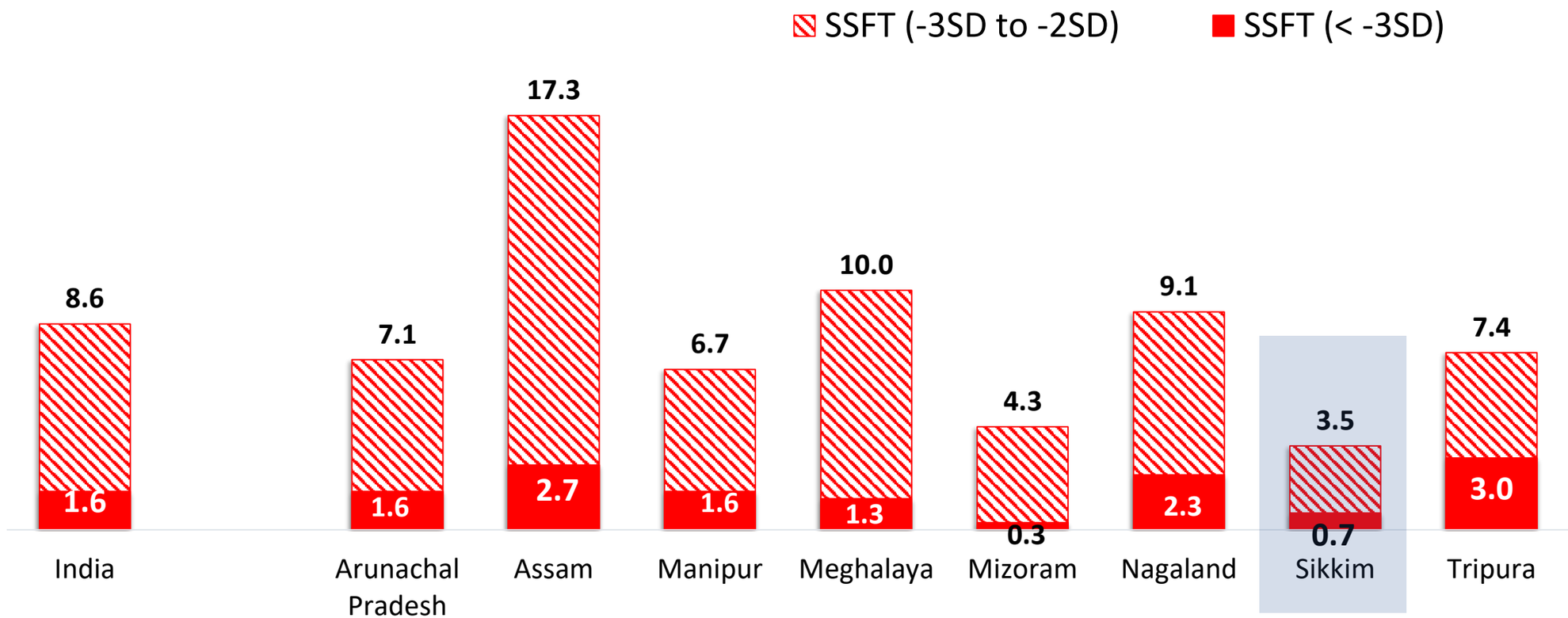
Low fat mass as reported by TSFT in Sikkim (**3%**) was lowest among northeast states and significantly lower than the national average (**10%**); highest in the region was Assam (**31%**)



Birth to Adolescence

Subscapular Skinfold Thickness (SSFT) for children aged 1-4 years

Thinness as reported by SSFT in Sikkim (**4%**) was lowest among the northeastern states and less than half of the national average (**9%**)

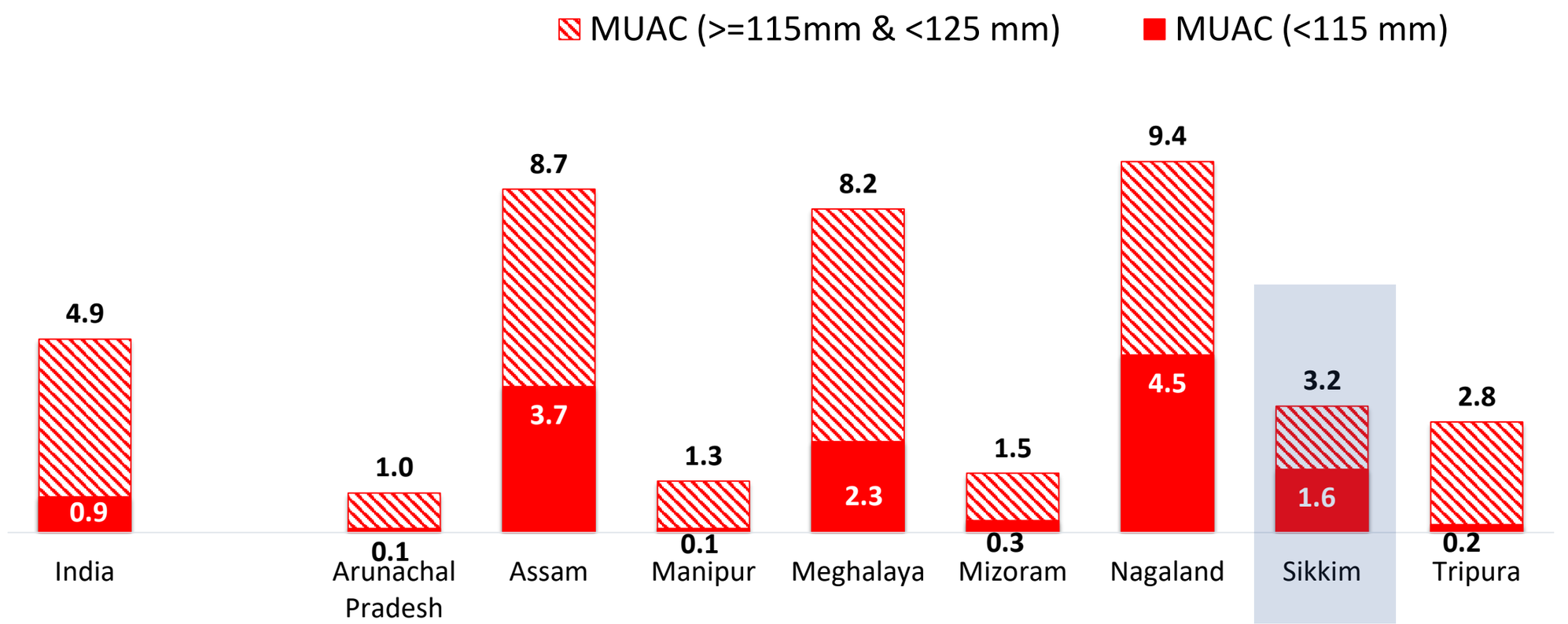


Birth to Adolescence

Mid Upper Arm Circumference (MUAC) for children aged 6-59 months

About **3%** children in Sikkim had low MUAC

Prevalence of low MUAC ranged between **1%** and **9%** across the northeastern states

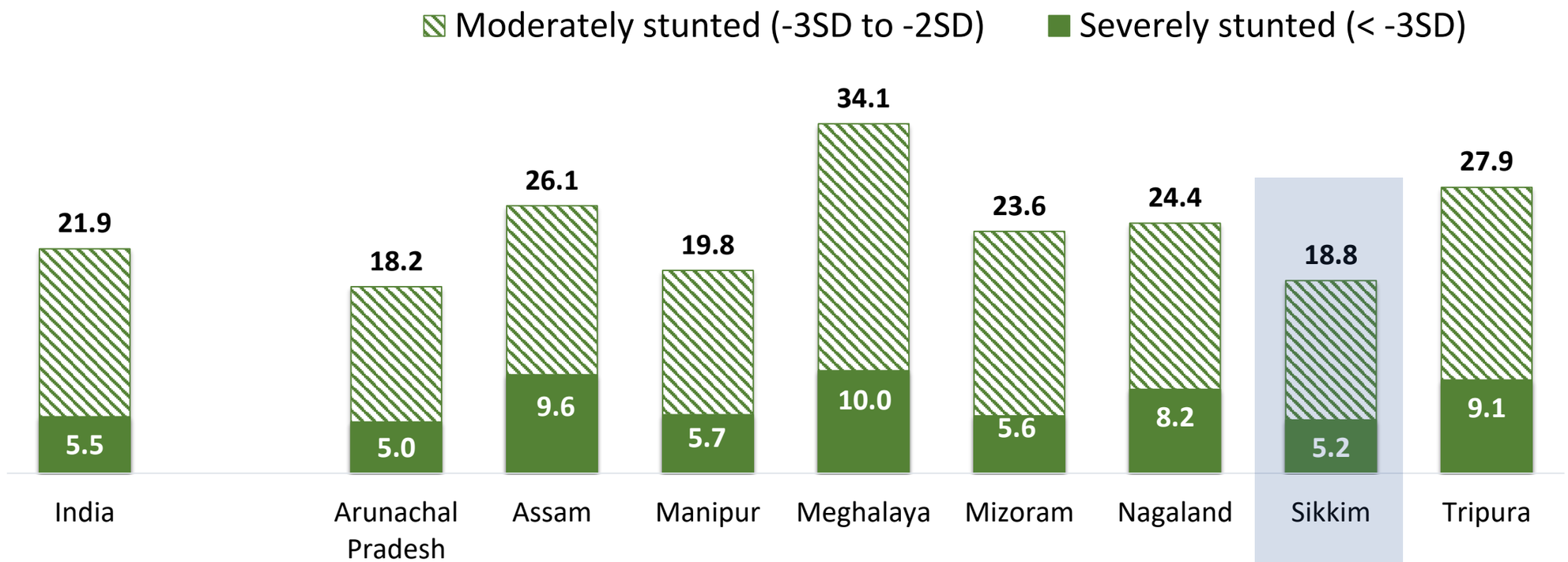


Birth to Adolescence

Stunting among school-age children (5-9 years)

1/5 children aged 5-9 years was stunted (**19%**); significant proportion of children who were stunted in childhood remained stunted into their schooling age reducing their potential capacity for education

Prevalence of stunting among most of the northeast states ranged between 18% and 34% while the national average was 22%

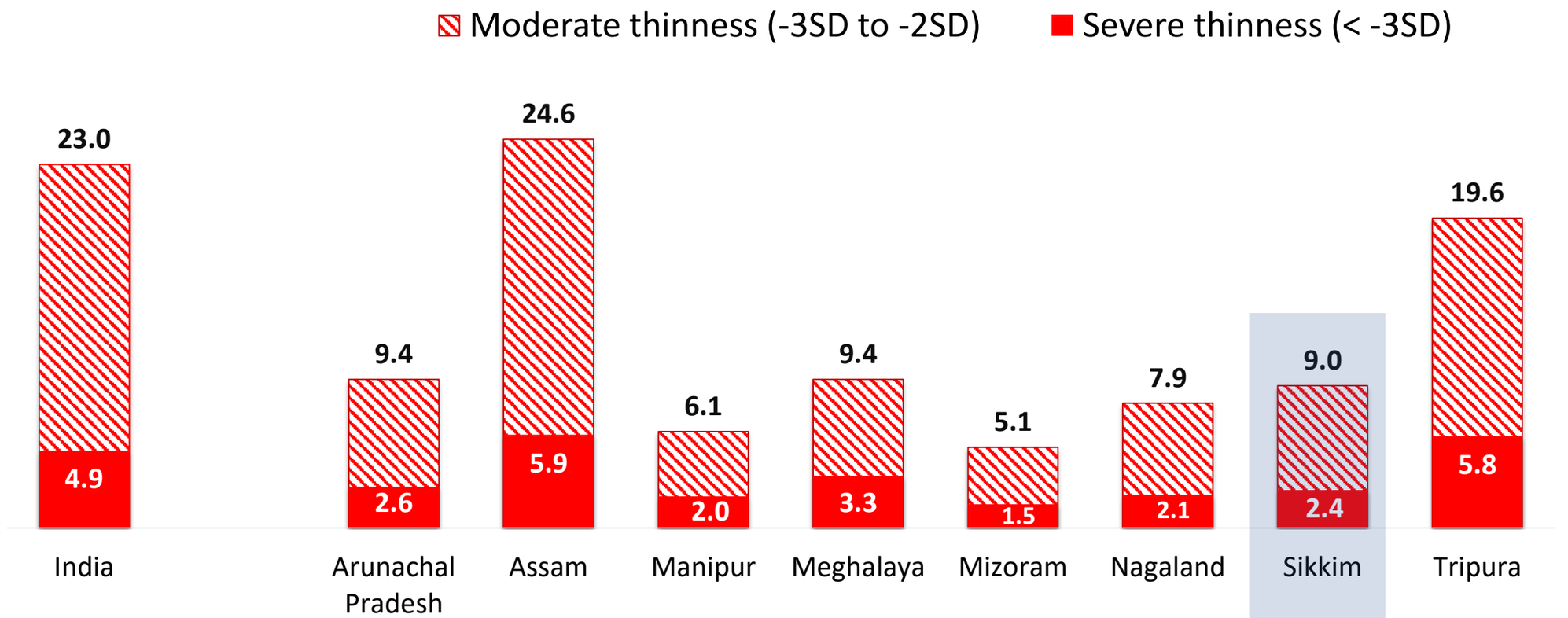


Birth to Adolescence

Thinness among school-age children (5-9 years)

9% of children aged 5-9 years were thin in Sikkim

Prevalence of thinness in Sikkim was moderately high among northeastern states and significantly lower than national level (**23%),** Assam **(25%)** and Tripura (**20%**)



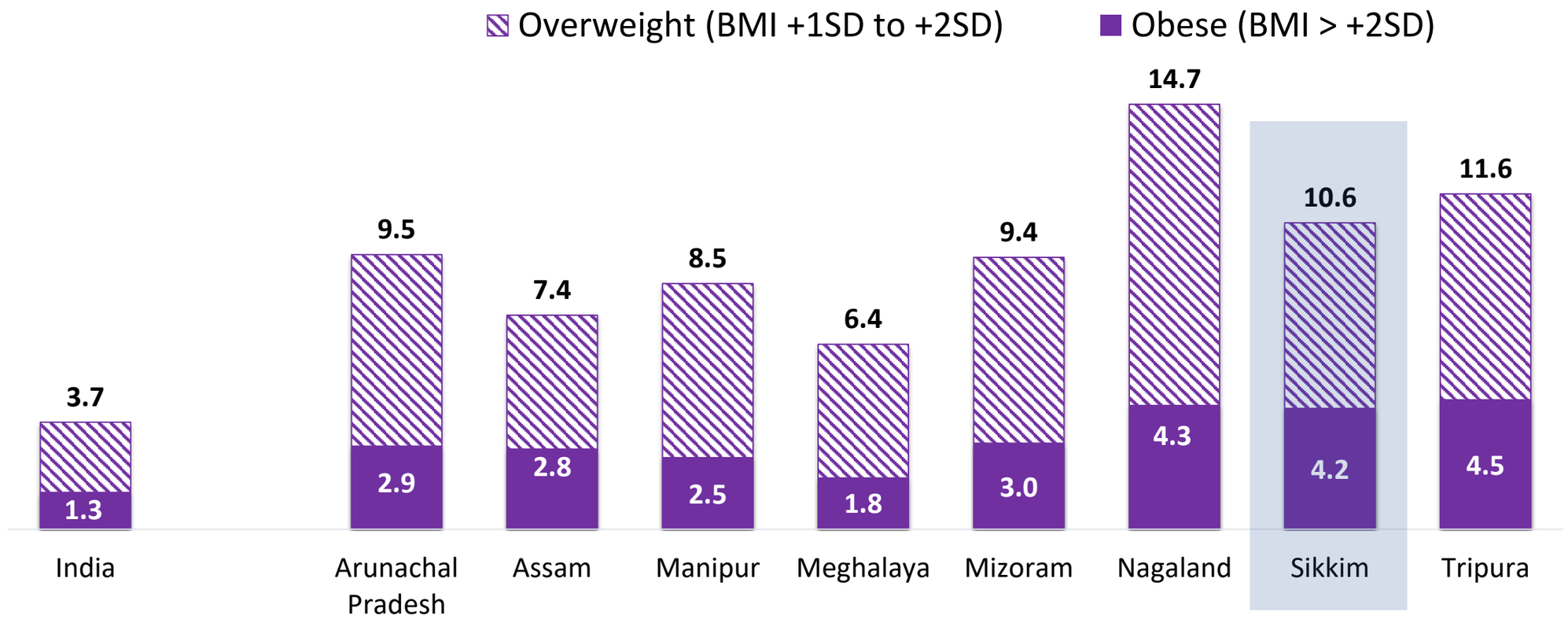
Birth to Adolescence

Overweight and obesity among school-age children (5-9 years) increasing

Overweight and obesity are on rise even among children aged 5-9 years

Prevalence of overweight in Sikkim (**11%**) was more than double the national average (**4%**)

Among northeastern states, Sikkim had substantially high prevalence of overweight in this age group

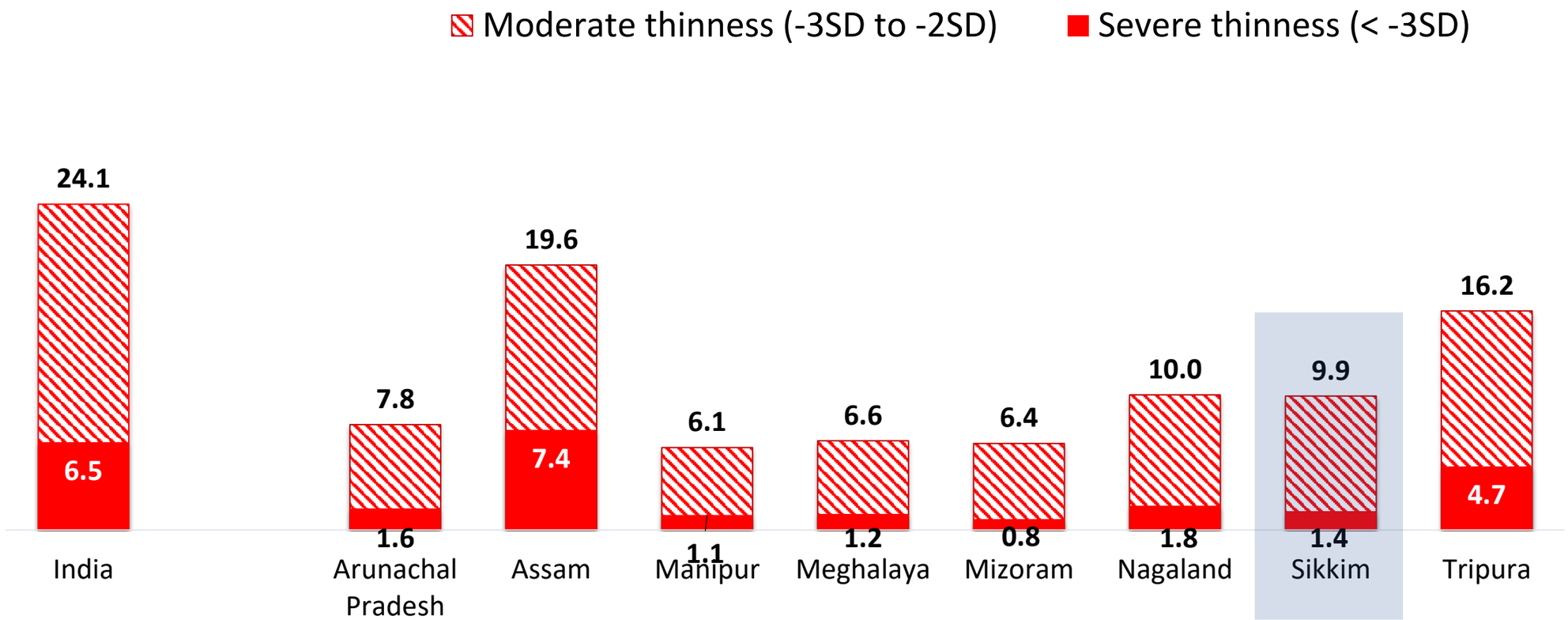


Birth to Adolescence

Thinness among adolescents aged 10-19 years substantially high

1/10 adolescents aged 10-19 years was thin in Sikkim (**10**%), significantly lower than national average (**24%**)

Among the northeastern states, Assam (**20%**) had the highest prevalence of thinness, followed by Tripura

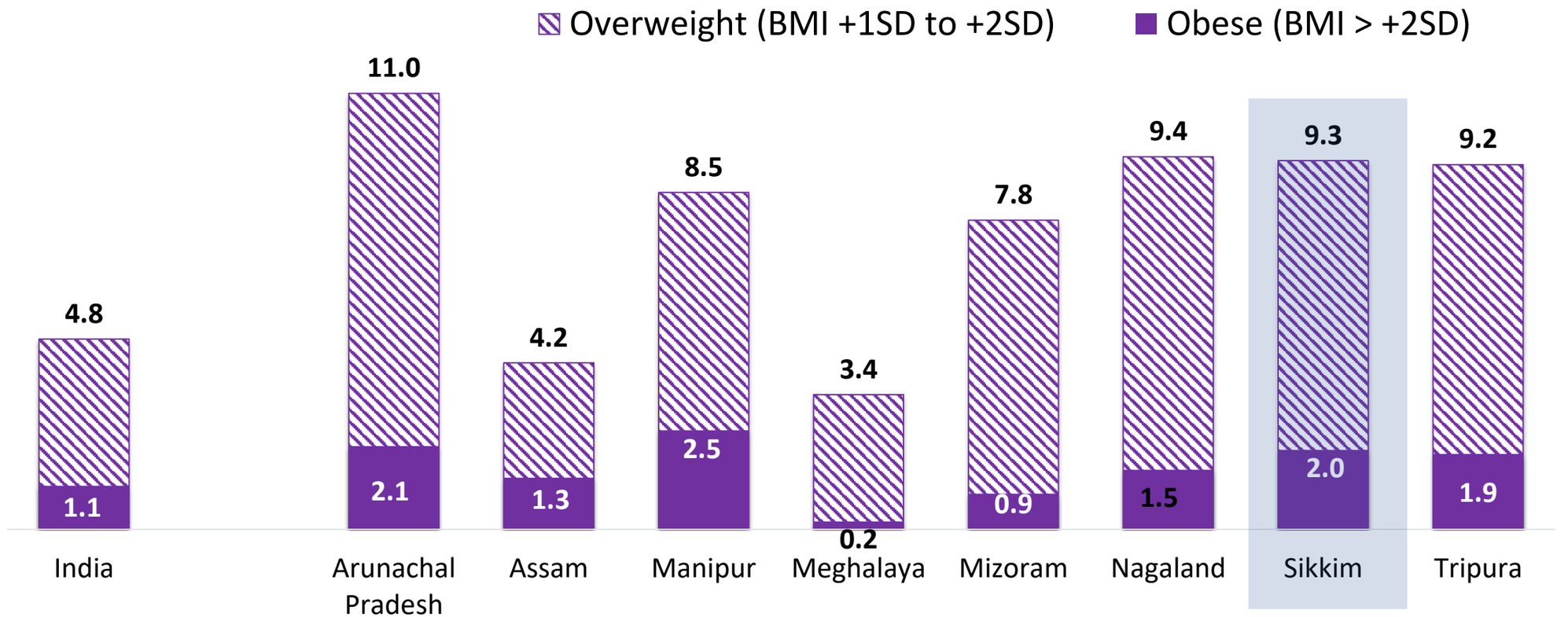


Birth to Adolescence

Prevalence of overweight among adolescents aged 10-19 years high

Nearly **1/10** adolescents was overweight in Sikkim (**9%**), double the national average (**5%**)

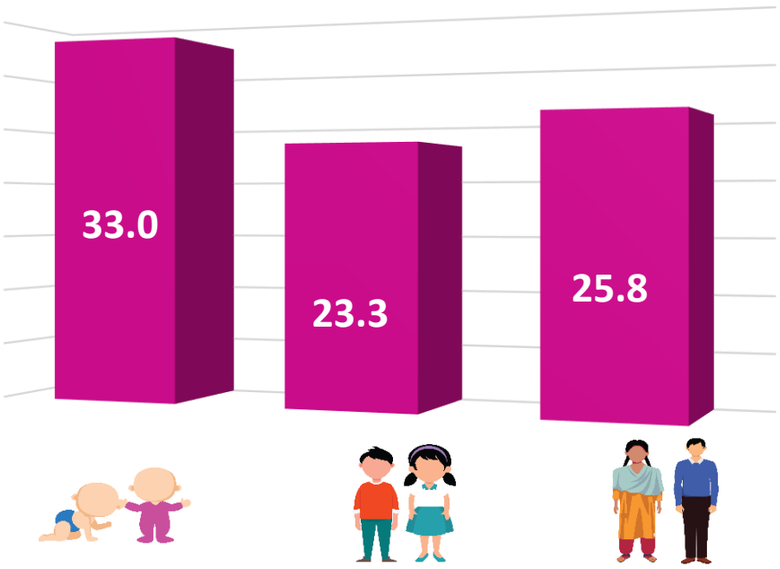
Among the northeastern states, Arunachal Pradesh had highest prevalence of overweight (**11%**)



Birth to Adolescence

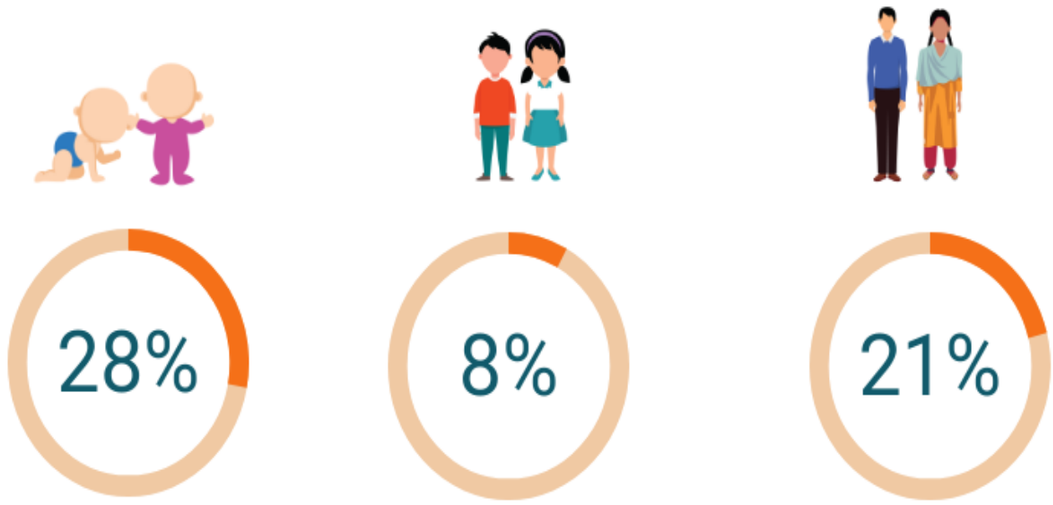
Sikkim key findings: Anaemia and iron deficiency

Anaemia



In Sikkim , like in most states, anaemia was significantly higher among children aged 1-4 years compared to children aged 5-9 years and adolescents aged 10-19 years

Iron deficiency



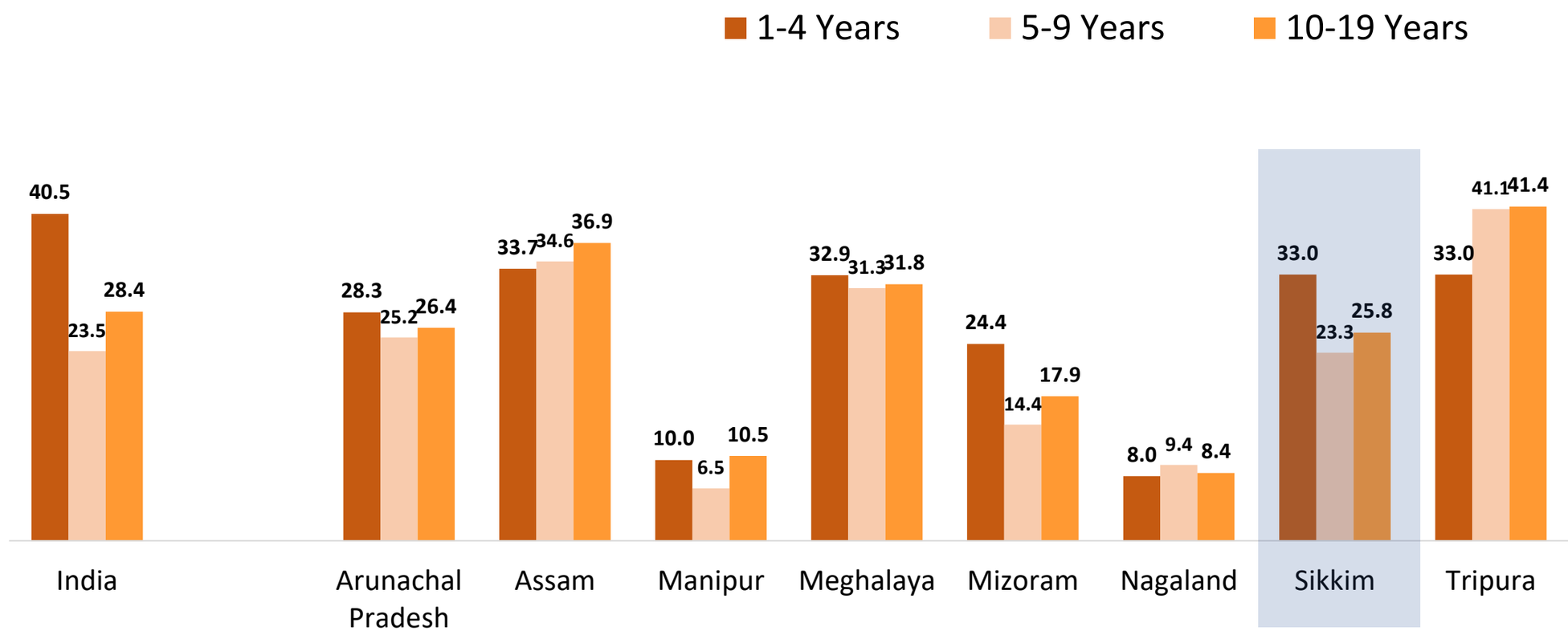
Findings indicate that children aged 1-4 years had higher iron deficiency (measured by serum ferritin) than other children or adolescents

CNNS Birth to Adolescence

Prevalence of Anaemia among children and adolescents

1/3 children aged 1-4 years was anaemic in Sikkim (**33**%), lower than national average (**41%**)

Prevalence of anaemia was highest among children aged 1-4 years, increased again in adolescence



Anaemia Cut Offs (WHO)

1-4 years: Hb<11.0 g/dl

5-11 years: Hb<11.5 g/dl

12-14 years: Hb< 12 g/dl

Girls ≥15years: Hb< 12g/dl

Boys ≥15 years: Hb< 13 g/dl

(Adjusted for altitude)

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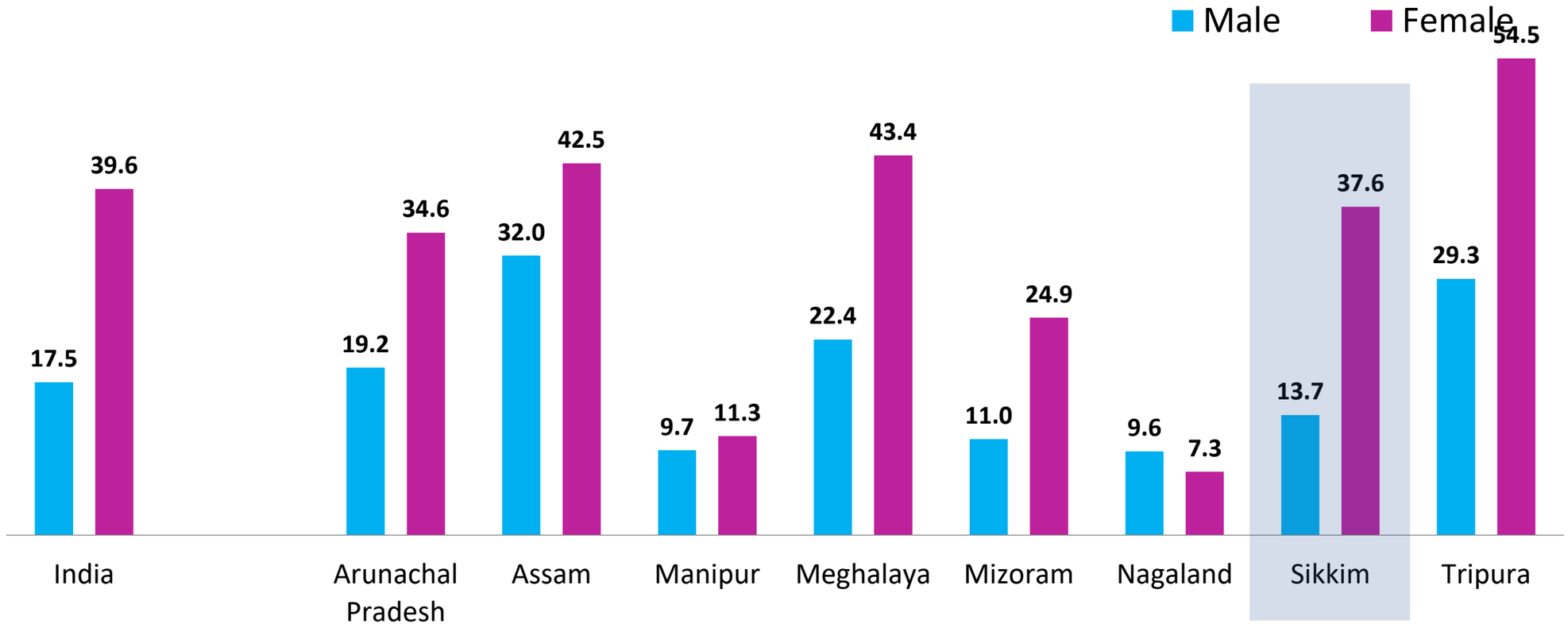
Birth to Adolescence

Prevalence of Anaemia among adolescents (10-19 years)

Overall, in the country, anaemia prevalence among adolescent girls (10-19 years) was twice that of adolescent boys

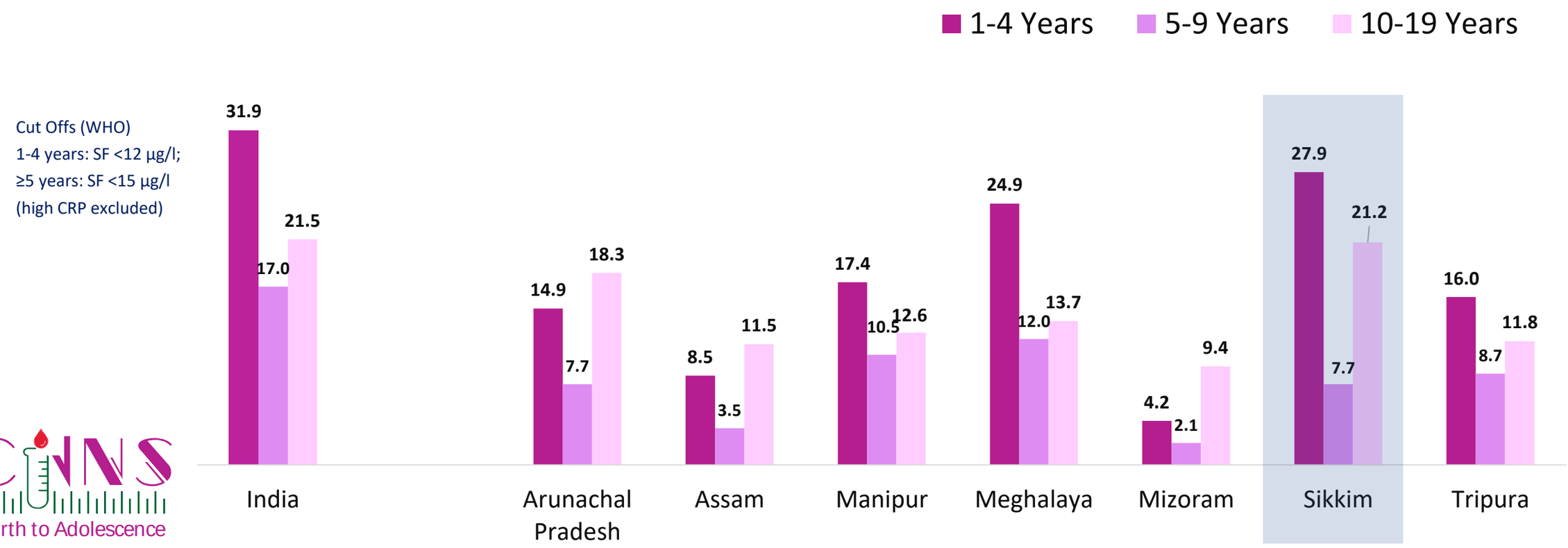
In Sikkim, as in many other northeastern states, adolescent girls were more than twice as likely as the adolescent boys to be anaemic



Birth to Adolescence

Iron deficiency measured by serum ferritin among children and adolescents

28% of children aged 1-4 years had iron deficiency in Sikkim, slightly lower than the national average (**32%**); prevalence was highest among children aged 1-4 years, increased in adolescence (**21%**)



Birth to Adolescence

Sikkim key findings: Vitamin A and Vitamin D deficiency

Vitamin A deficiency was less (5% or less) at similar level among school-aged children and adolescents, and higher than among children aged 1-4 years

Vitamin D deficiency varied from 14% to 19% in 1-19 years age group as per cut off by expert panel of IOM.

Adolescents aged 10-19 years were found to have higher level of Vitamin D deficiency than children aged 1-9 years

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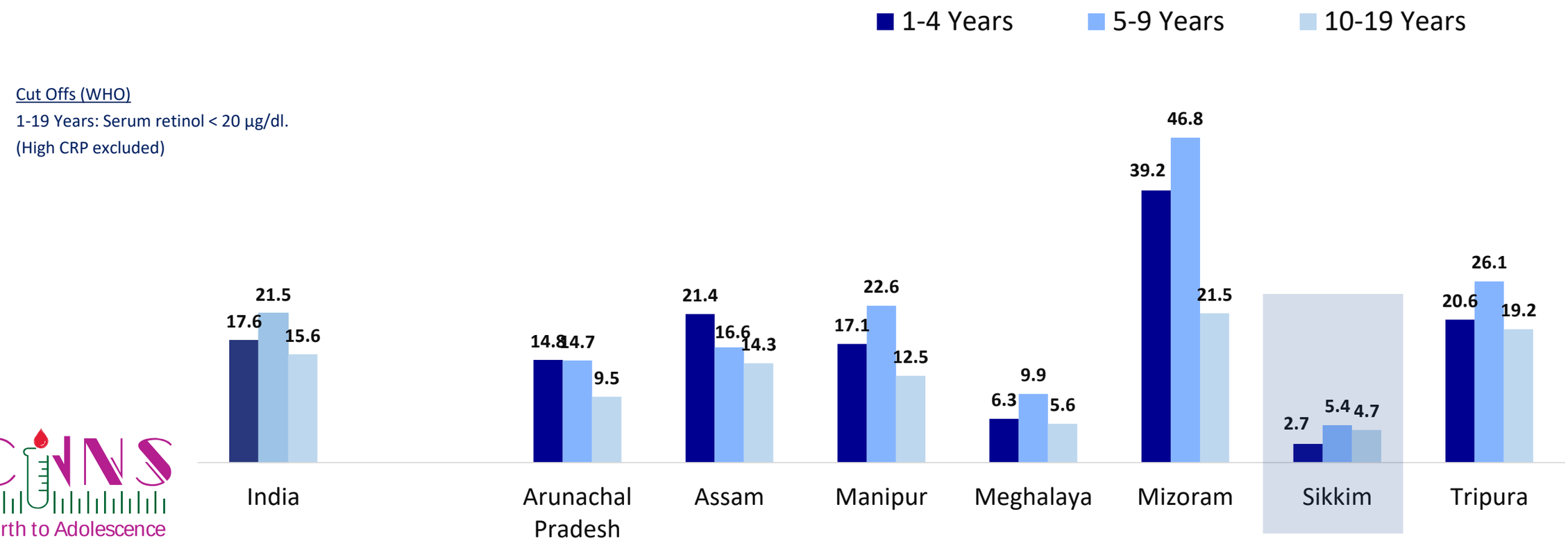
Birth to Adolescence

Vitamin A deficiency among children and adolescents

About **3-5%** children and adolescents had Vitamin A deficiency in Sikkim

Prevalence of Vitamin A deficiency in all age group did not show any particular pattern among northeastern states; highest in Mizoram and lowest in Sikkim

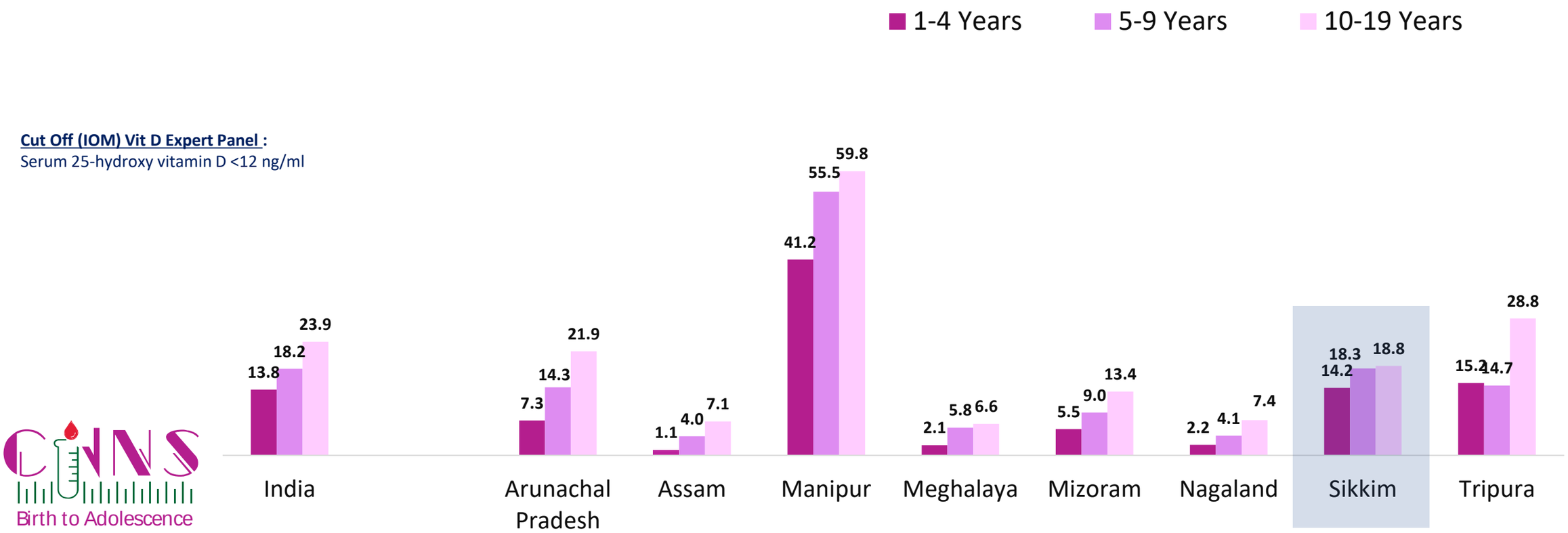


Birth to Adolescence

Vitamin D deficiency increases with age

14-19% of children and adolescents had Vitamin D deficiency in Sikkim

Among northeast states, Manipur had the highest Vitamin D deficiency among children and adolescents (**41-60%**)



Birth to Adolescence

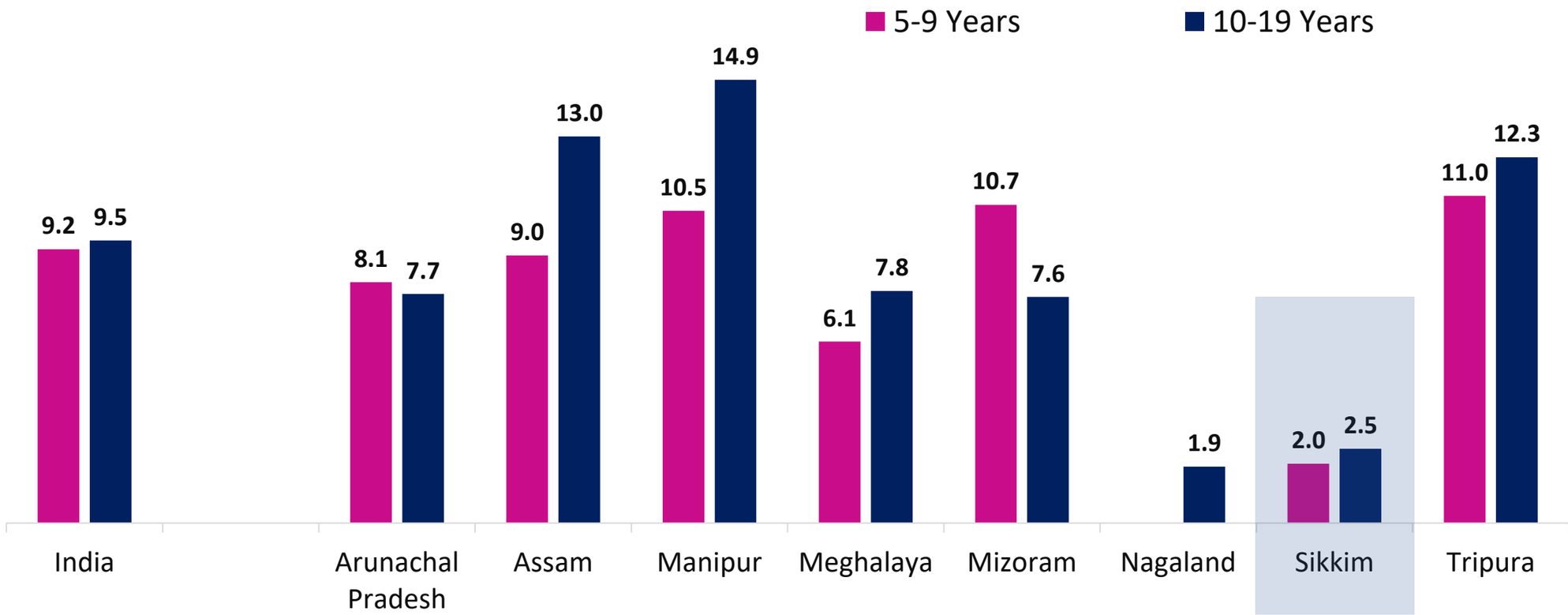
Sikkim key findings: Non-communicable diseases

2% of school-age children and 3% of adolescents were found with high level of glycosylated haemoglobin (HbA1c).

Other indicators of risks of NCDs, such as level of cholesterol, triglycerides, LDL and HDL point to increased risks of NCDs among adolescents.

Risk of diabetes among school-age children and adolescents

Based on Glycosylated hemoglobin (HbA1c), **2-3%** of children and adolescents had increased risk of diabetes in Sikkim, which was significantly lower than national average (**9-10%**)

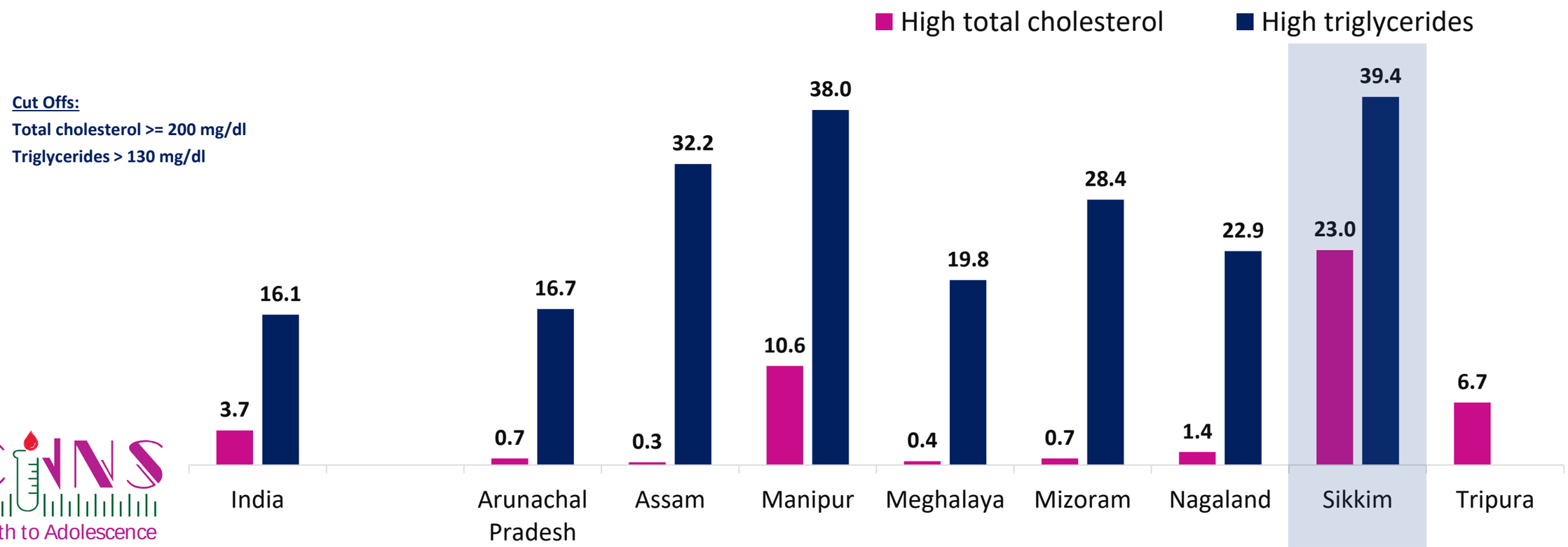


Birth to Adolescence

High total cholesterol and high triglycerides among adolescents

Elevated risk of NCDs in Sikkim among adolescents – **23%** had high level of total cholesterol and **39%** with high level of triglycerides

Prevalence of high total cholesterol and high triglycerides were highest in Sikkim among northeastern states

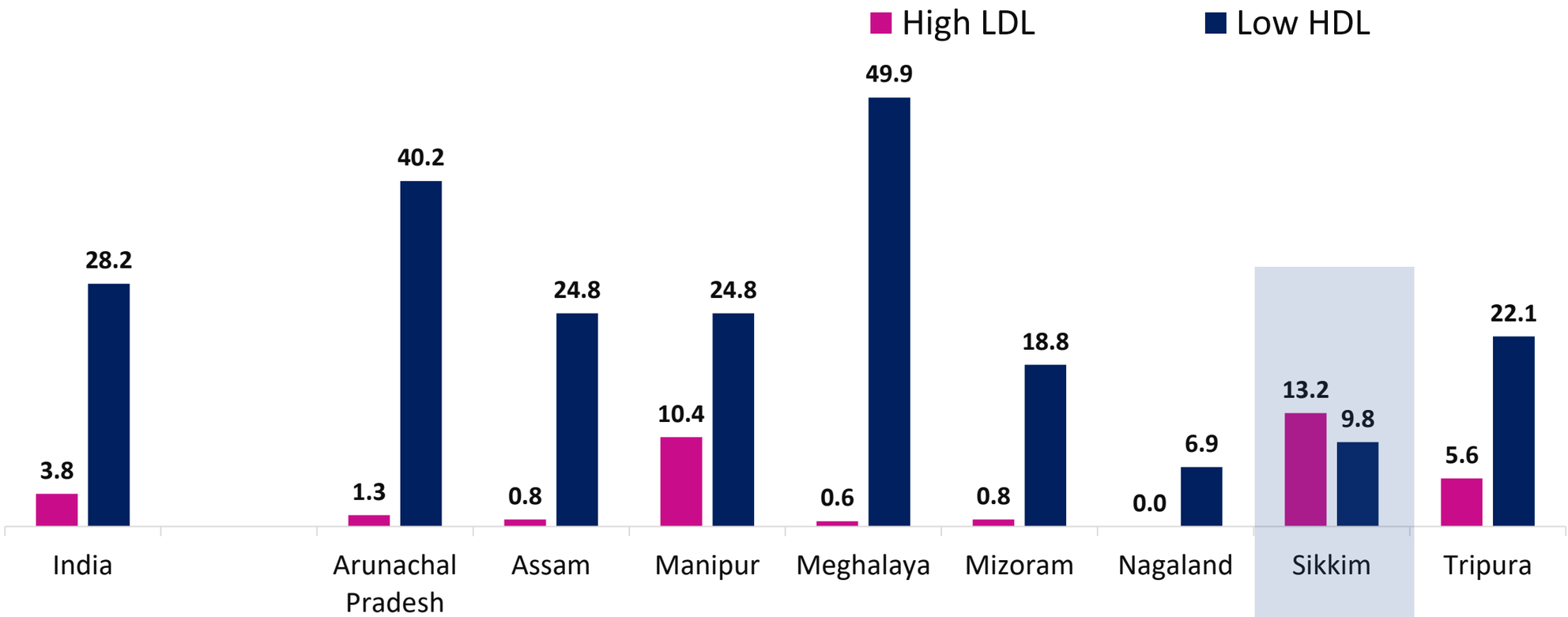


Birth to Adolescence

High LDL and low HDL among adolescents

Risk of NCDs among adolescents in Sikkim– **13%** had high level of LDL and **10%** had low level of HDL

Cut Offs:
LDL >= 130 mg/dl
HDL < 40 mg/dl



Birth to Adolescence

Preliminary Policy Discussions from CNNS

- Only about half of anaemia is caused by iron deficiency. Programmes must address all causes of anaemia but continue to address iron deficiency in children under five and adolescent girls (population with largest burden).

- Vitamin A deficiency is less prevalent than expected. Policy review is warranted. Interventions such as dietary diversification and fortification can be taken to scale to address the remaining burden.

- Vitamin D deficiency is an emerging public health issue among urban children and adolescents. Scaling up of fortification efforts can be considered. Further research is required to uncover the effects of pollution and other factors to design better programmes.

- Urinary Iodine data need to be examined in conjunction with salt consumption data for the population and level of iodine in salt at the household level.

- Control of NCDs such as diabetes and cardiovascular disease must start in the early ages to instil lifelong healthy habits as adult diseases start in childhood.

CNNS
Birth to Adolescence

The survey was conducted with generous financial support from

Aditya and Megha Mittal

and technical support from

unicef | for every child

POPULATION COUNCIL
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AIIMS New Delhi

CDSA

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

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