Ministry of Health and Family Welfare
Government of India

POSHAN Abhiyaan
PM's Overarching Scheme for Holistic Nourishment

Comprehensive National Nutrition Survey

2016 – 2018

Arunachal Pradesh
State Presentation

CNNS
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

30
Microscopists
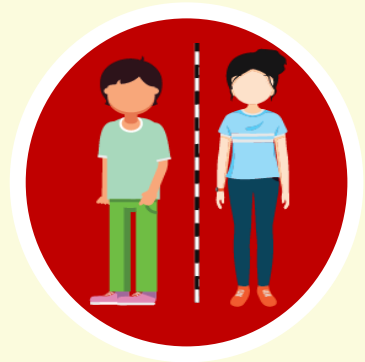
2500
Survey personnel in 30 states

100
Data Quality assurance monitors

200
Lab technicians

900
Interviewers

200
Trainers and coordinators

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*

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*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

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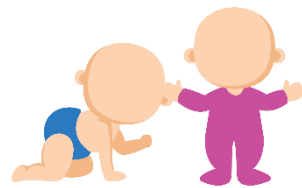
- 160 Districts- one PSU
- 356 Districts- two or more PSUs

● District with more than one PSU
● District with one PSU

Birth to Adolescence
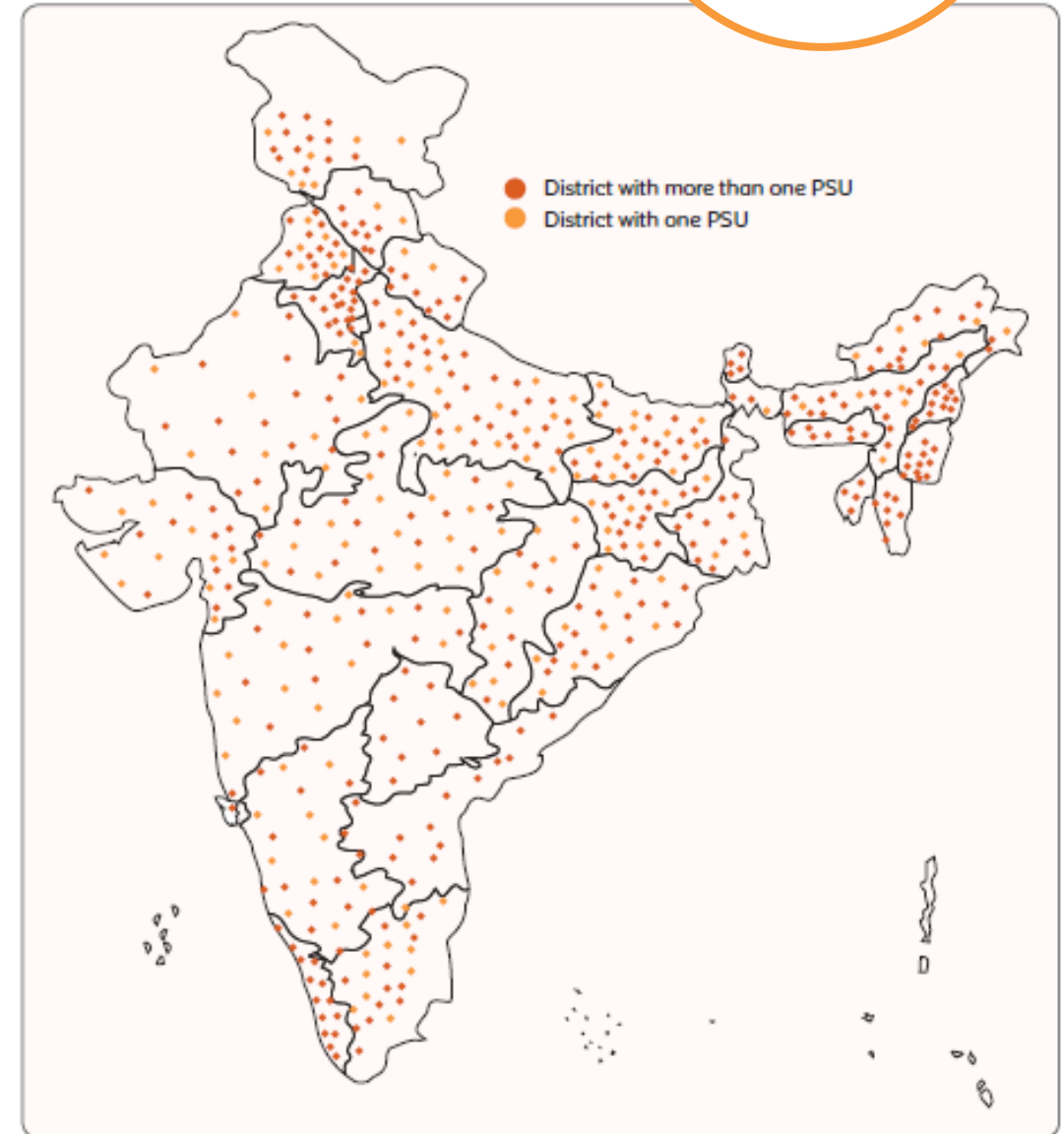
Anthropometry data

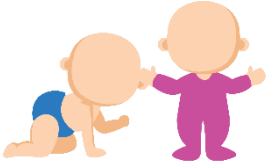|	Pre-school children (0-4 years)	School-age children (5-9 years)	Adolescents (10-19 years)
Anthropometric measurements	• Height • Weight • Mid-upper arm circumference (MUAC) • Triceps skinfold • Subscapular skinfold (1-4 years)		
		• Waist circumference	

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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

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

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

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

Team Composition for data collection

Team Supervisor   Quality Control Observer

Four Survey Investigators

Two Anthropometry Investigators   Two Phlebotomists for biological sample collection

Birth to Adolescence
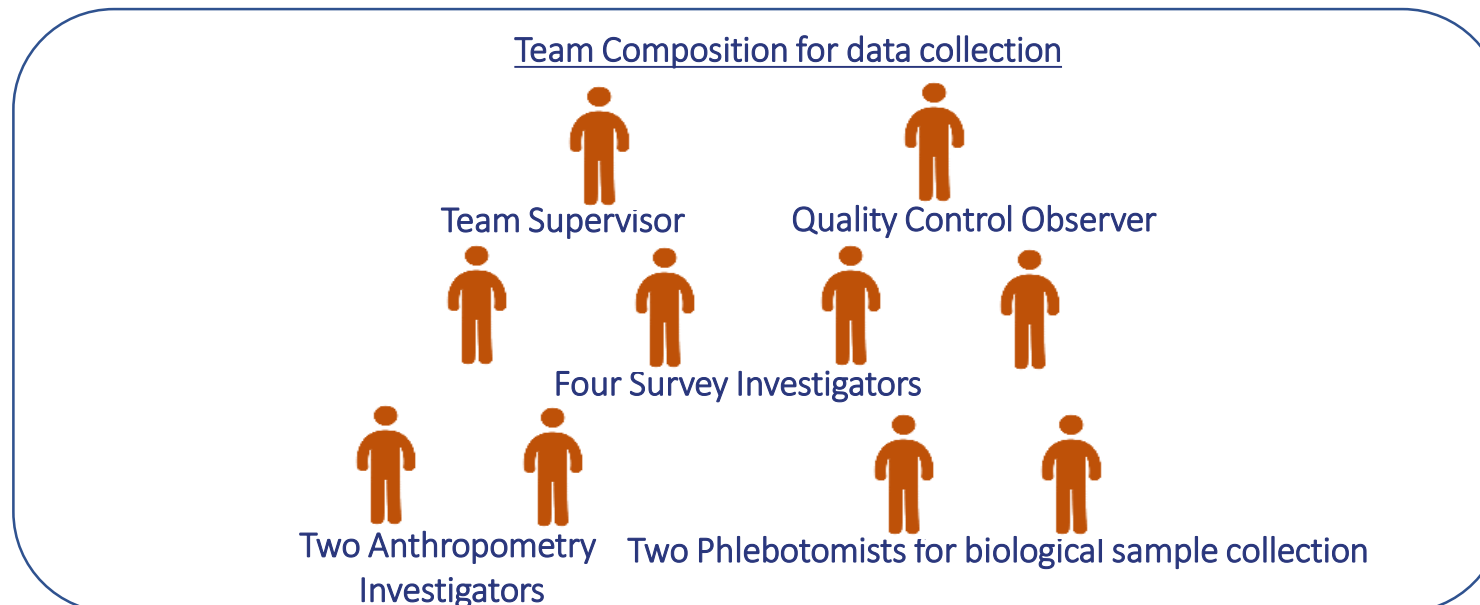
Quality Assurance Measures for Data Quality

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

CNNS
Birth to Adolescence

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 Arunachal Pradesh

CNNS covered 65 PSUs for data collection in Arunachal Pradesh

Achieved following sample size by age groups:

	0-4 years	5-9 years	10-19 years	Total
Household and anthropometry data	1,268	1,181	1,072	3,521
Biological sample	840	665	582	2,087

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Birth to Adolescence

Period of data collection in Arunachal Pradesh

CNNS data collection period: April 28, 2018 to October 3, 2018

- CNNS collected data during the summer through early autumn season of 2018

- NFHS collected data during the summer through early winter of 2016.

Survey	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CNNS 2018				April to October, 2018								
NFHS 4 2016				April to December, 2016								

Birth to Adolescence

Arunachal Pradesh key findings: Anthropometry (1/2)

Prevalence of stunting and underweight did not decline significantly, while wasting did, in children under 5 years

■ NFHS ■ CNNS

	Stunting (Low height for age)	Wasting (Low weight for height)	Underweight (Low weight for age)
NFHS	29.3%	17.3%	19.4%
CNNS	28.0%	6.8%	15.5%

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Birth to Adolescence

1/12 adolescents aged 10-19 years was thin for their age (BMI-Age <- 2SD)

18% of children aged 5-9 years were stunted. The school age period does not provide an opportunity for catch up growth in height.

11% of adolescents aged 10-19 years were overweight or obese.

11.0%

Overweight (high BMI for age)

Birth to Adolescence

NORMAL

OVERWEIGHT/ OBESITY
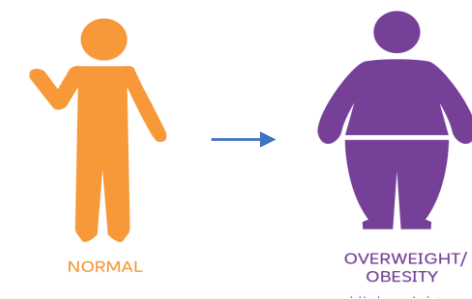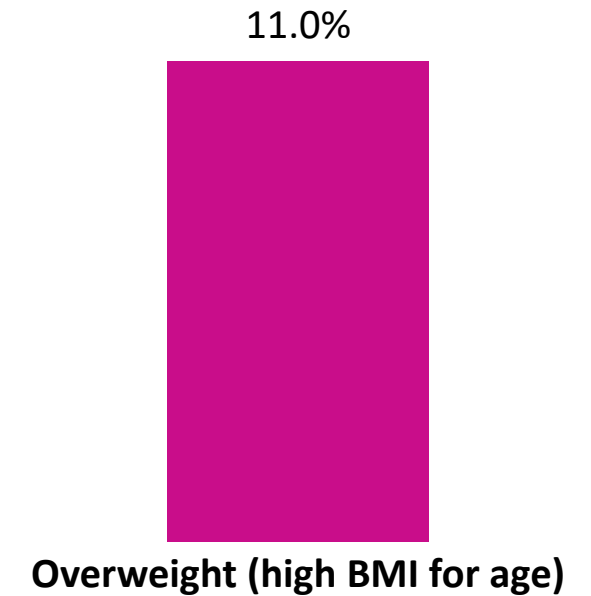
Stunting among children under five
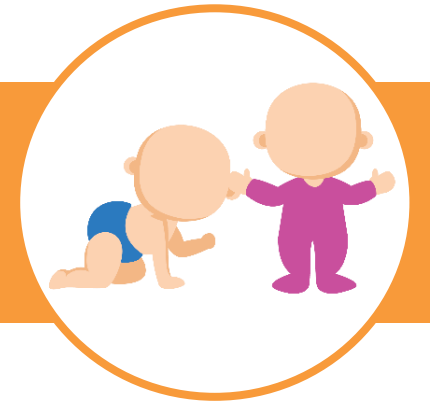
No significant decline in prevalence of stunting was observed in Arunachal Pradesh between CNNS and NFHS-4 – **28%** vs **29%**

In none of the northeastern states stunting declined significantly

■ NFHS-4 ■ CNNS

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
NFHS-4	38.4	29.3	36.4	28.9	43.8	28.1	28.6	29.6	24.3
CNNS	34.7	28.0	32.4	28.9	40.4	27.4	26.2	21.8	31.9

14
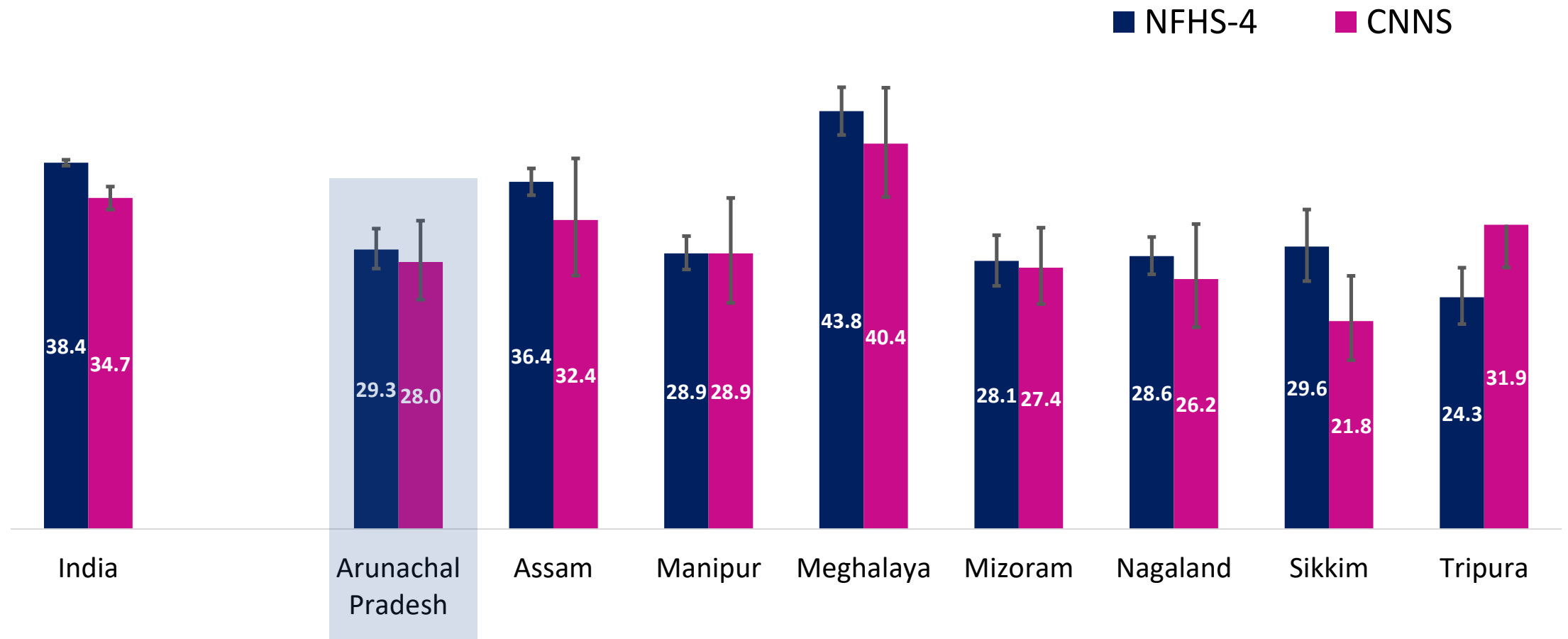
Wasting among children under five
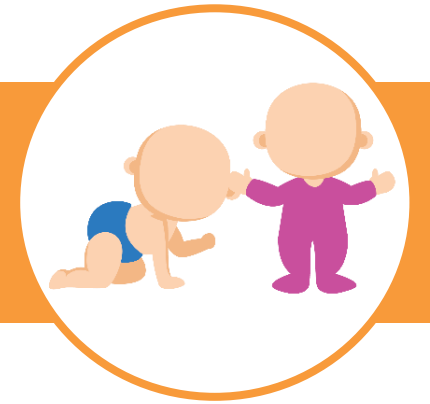
Prevalence of wasting decreased significantly in Arunachal Pradesh between NFHS-4 and CNNS – **17%** vs **7%**

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

■ NFHS-4   ■ CNNS

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
NFHS-4	21.0	17.3	17.0	6.8	15.3	6.1	11.3	14.2	16.8
CNNS	17.3	6.8	19.4	6.0	14.7	5.8	12.9	6.9	12.8

15

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Birth to Adolescence
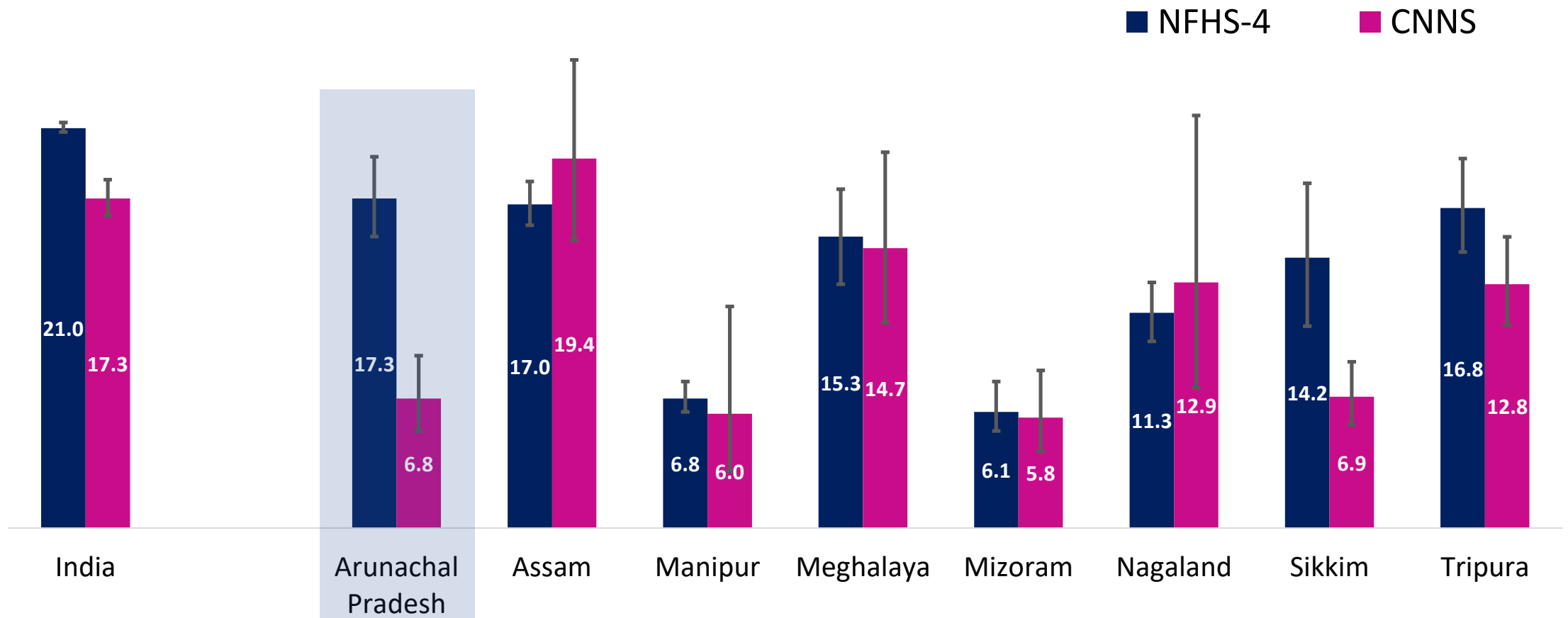
Prevalence of underweight among children under five
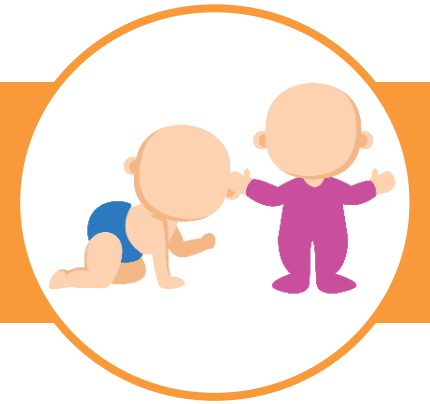
Underweight is a composite measure of chronic and acute malnutrition

The prevalence of underweight did not decline significantly between NFHS-4 and CNNS – **19%** Vs **16%**

Prevalence remained nearly unchanged in all northeastern states

Legend: ■ NFHS-4 ■ CNNS

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
NFHS-4	35.7	19.4	29.8	13.8	28.9	12.0	16.7	14.2	24.1
CNNS	33.4	15.5	29.4	13.0	29.6	11.3	16.3	10.8	23.8

CNNS
Birth to Adolescence
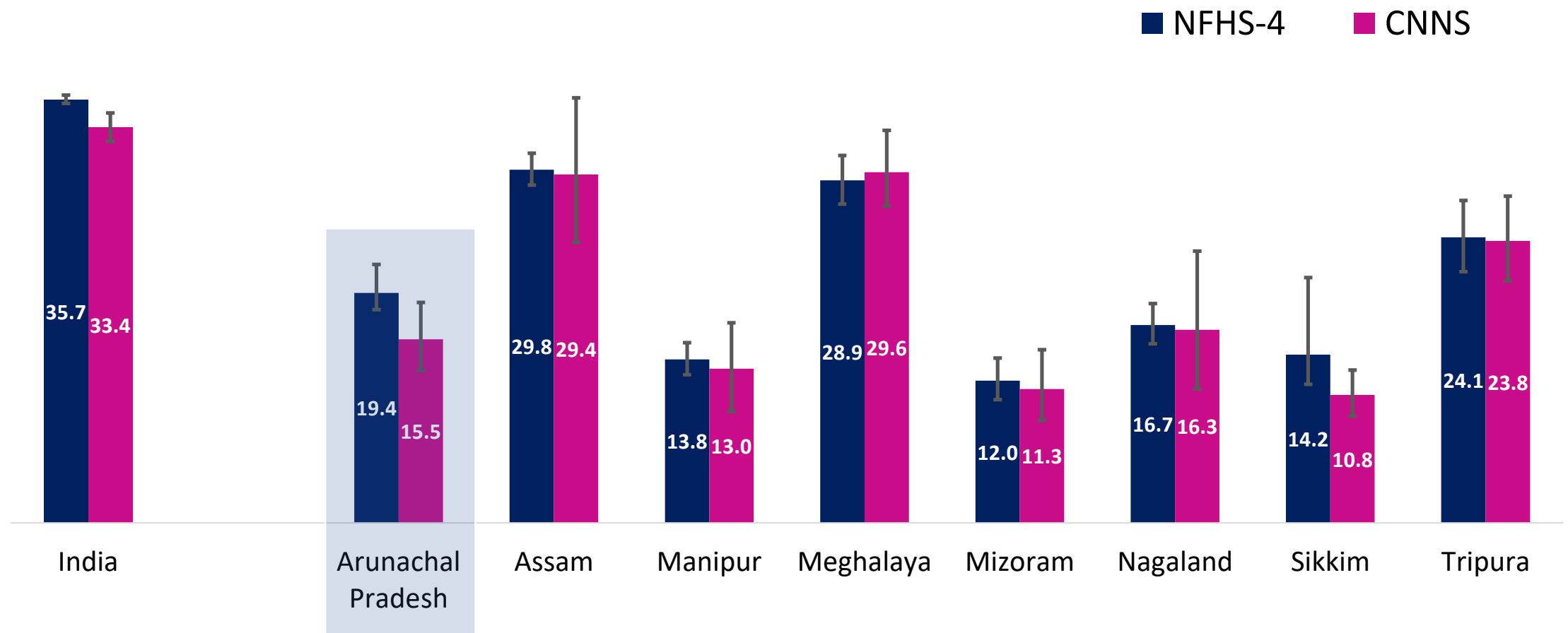
Triceps Skinfold Thickness (TSFT) for children under five

Low fat mass as reported by TSFT in Arunachal Pradesh (**6%**) was lower than the national average (**10%**) and most of the northeastern states

Legend:
- ▨ TSFT (-3SD to -2SD)
- ▉ TSFT (< -3SD)

State	TSFT (< -3SD)	Total
India	2.4	9.7
Arunachal Pradesh	0.5	5.8
Assam	8.7	30.7
Manipur	3.4	8.1
Meghalaya	1.8	8.8
Mizoram	2.0	9.8
Nagaland	2.8	11.9
Sikkim	0.7	3.3
Tripura	3.5	12.1

CNNS
Birth to Adolescence

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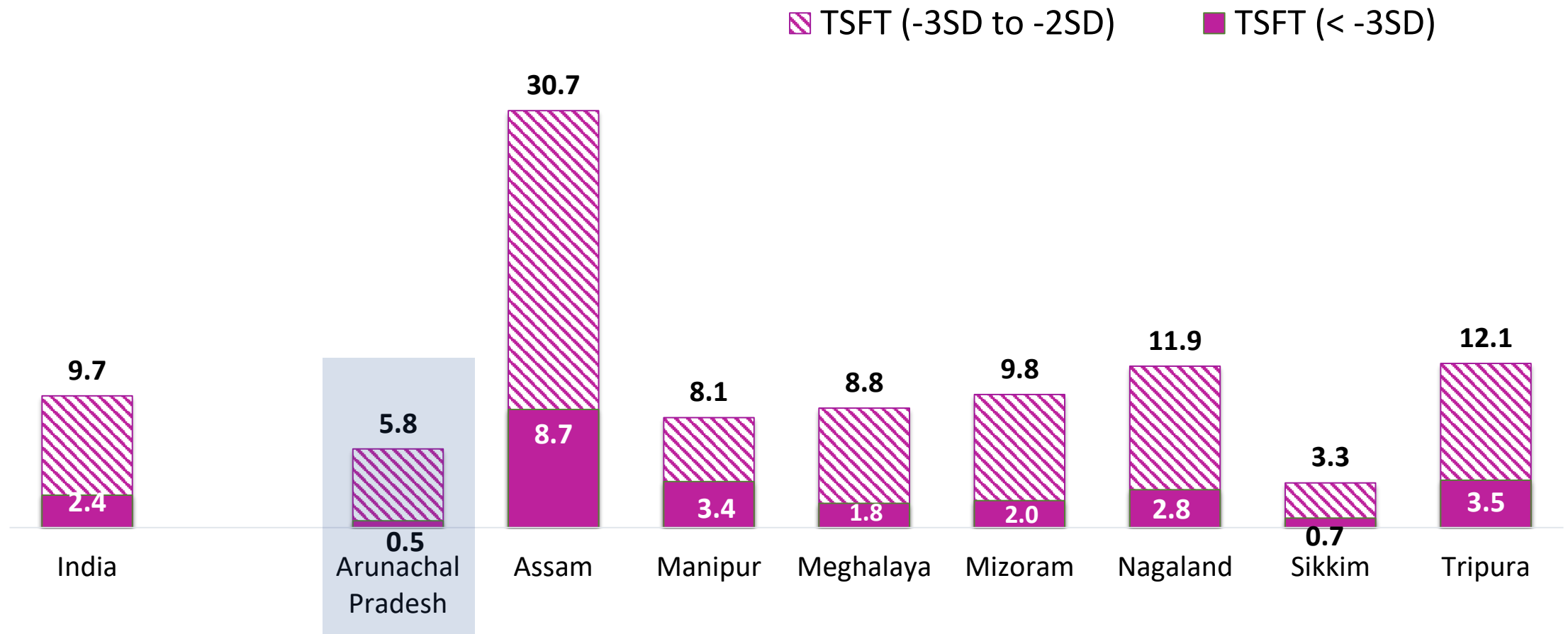
Subscapular Skinfold Thickness (SSFT) for children aged 1-4 years

Thinness as reported by SSFT in Arunachal Pradesh (**7%**) was moderately high among the northeastern states and slightly lower than the national average (**9%**)

Legend: ▨ SSFT (-3SD to -2SD) ■ SSFT (< -3SD)

State	SSFT (-3SD to -2SD) total	SSFT (< -3SD)
India	8.6	1.6
Arunachal Pradesh	7.1	1.6
Assam	17.3	2.7
Manipur	6.7	1.6
Meghalaya	10.0	1.3
Mizoram	4.3	0.3
Nagaland	9.1	2.3
Sikkim	3.5	0.7
Tripura	7.4	3.0

CNNS Birth to Adolescence
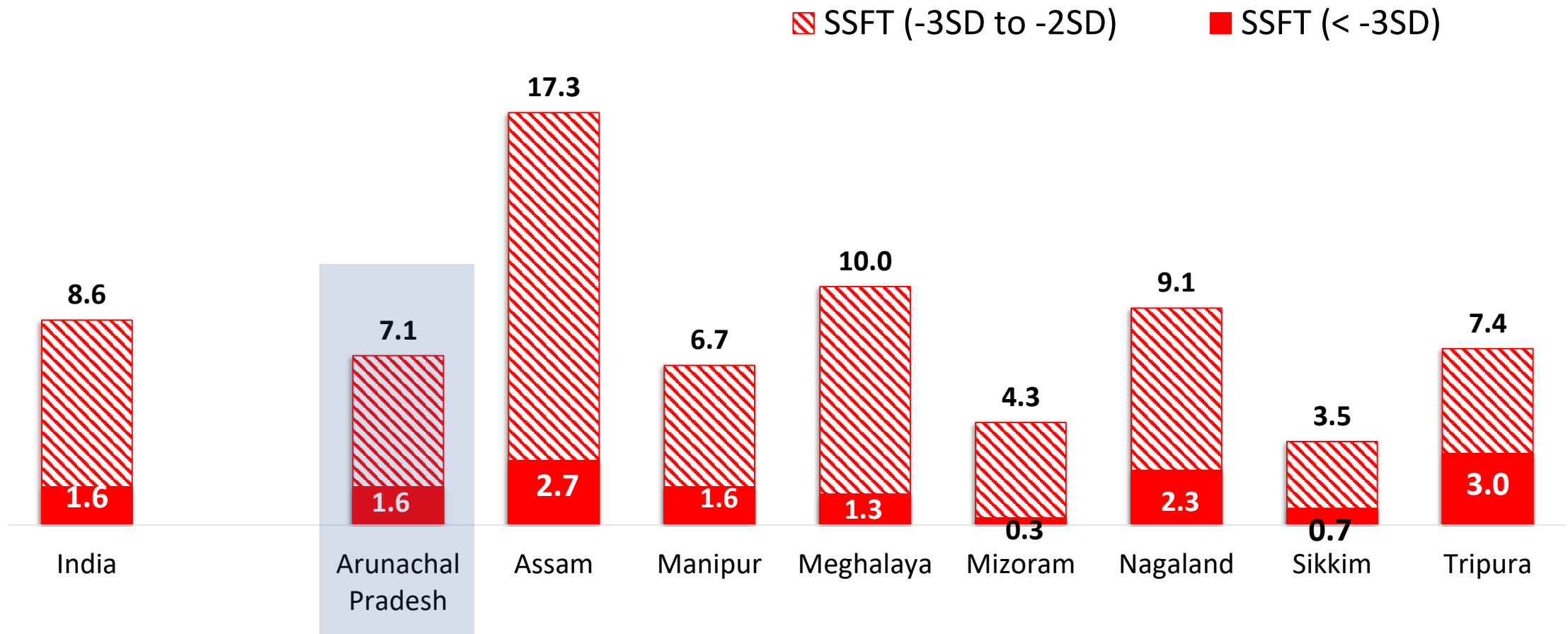
Mid Upper Arm Circumference (MUAC) for children aged 6-59 months
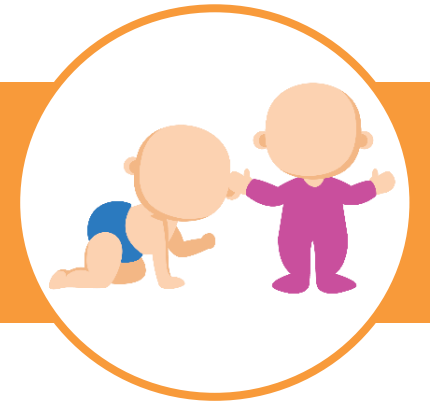
About **1%** children in Arunachal Pradesh had low MUAC

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

Legend: MUAC (>=115mm & <125 mm) ⬛ MUAC (<115 mm)

State	MUAC (<115 mm)	Total
India	0.9	4.9
Arunachal Pradesh	0.1	1.0
Assam	3.7	8.7
Manipur	0.1	1.3
Meghalaya	2.3	8.2
Mizoram	0.3	1.5
Nagaland	4.5	9.4
Sikkim	1.6	3.2
Tripura	0.2	2.8

CNNS
Birth to Adolescence
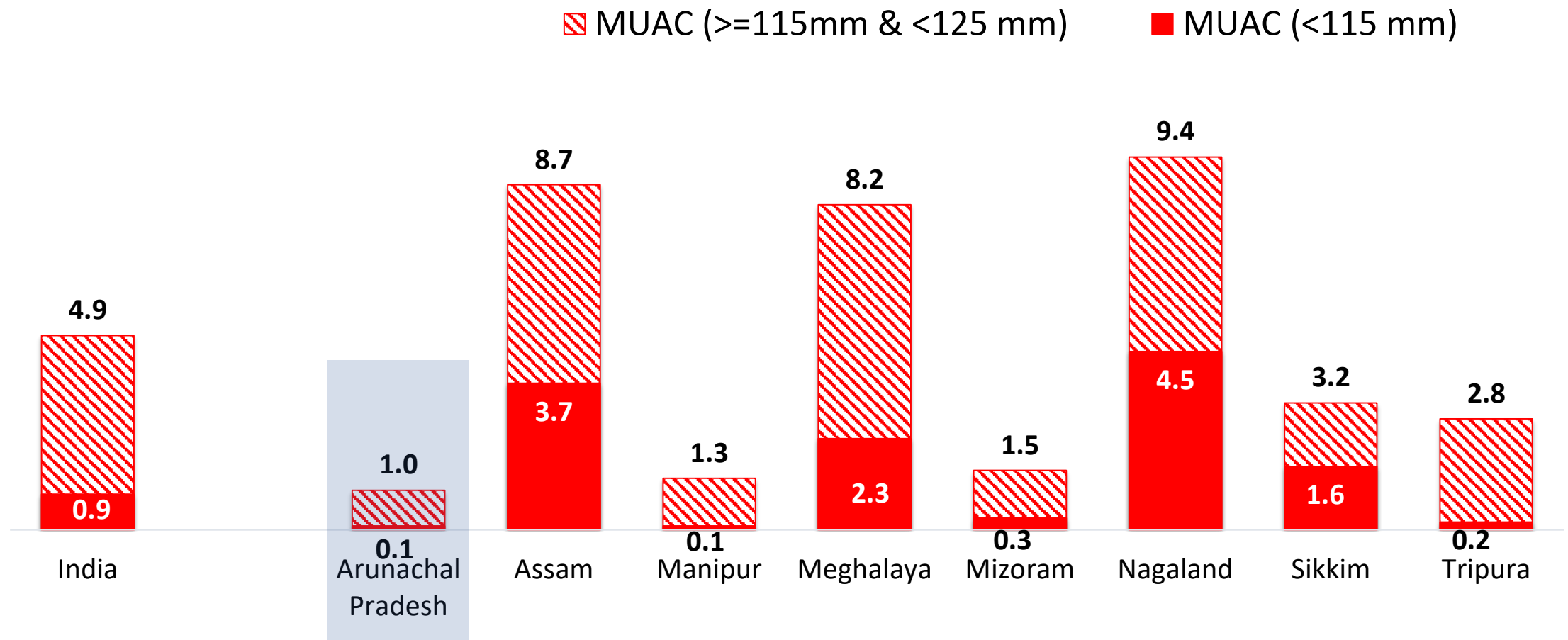
Stunting among school-age children (5-9 years)

1/5 of children aged 5-9 years was stunted (**18%**); 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 the northeast states varied, Assam, Meghalaya, Mizoram, Nagaland, Tripura were above national average

Legend: ▨ Moderately stunted (-3SD to -2SD)　■ Severely stunted (< -3SD)

State	Total	Severely stunted
India	21.9	5.5
Arunachal Pradesh	18.2	5.0
Assam	26.1	9.6
Manipur	19.8	5.7
Meghalaya	34.1	10.0
Mizoram	23.6	5.6
Nagaland	24.4	8.2
Sikkim	18.8	5.2
Tripura	27.9	9.1

CNNS
Birth to Adolescence
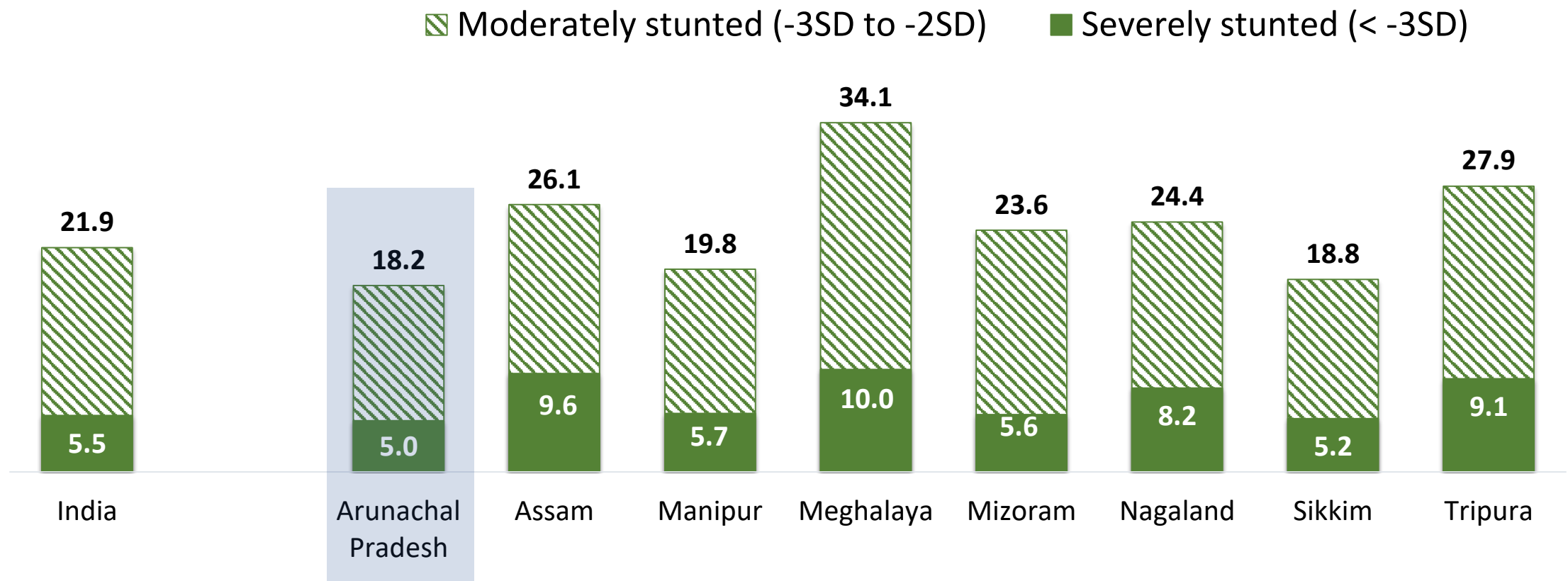
Thinness among school-age children (5-9 years)

Nearly **1/10** children aged 5-9 years was thin in Arunachal Pradesh, significantly lower than national average (**23%**)

Prevalence of thinness ranged between 5% and 25% among northeastern states

Legend: ▨ Moderate thinness (-3SD to -2SD) ■ Severe thinness (< -3SD)

State	Total	Severe thinness
India	23.0	4.9
Arunachal Pradesh	9.4	2.6
Assam	24.6	5.9
Manipur	6.1	2.0
Meghalaya	9.4	3.3
Mizoram	5.1	1.5
Nagaland	7.9	2.1
Sikkim	9.0	2.4
Tripura	19.6	5.8

CNNS
Birth to Adolescence
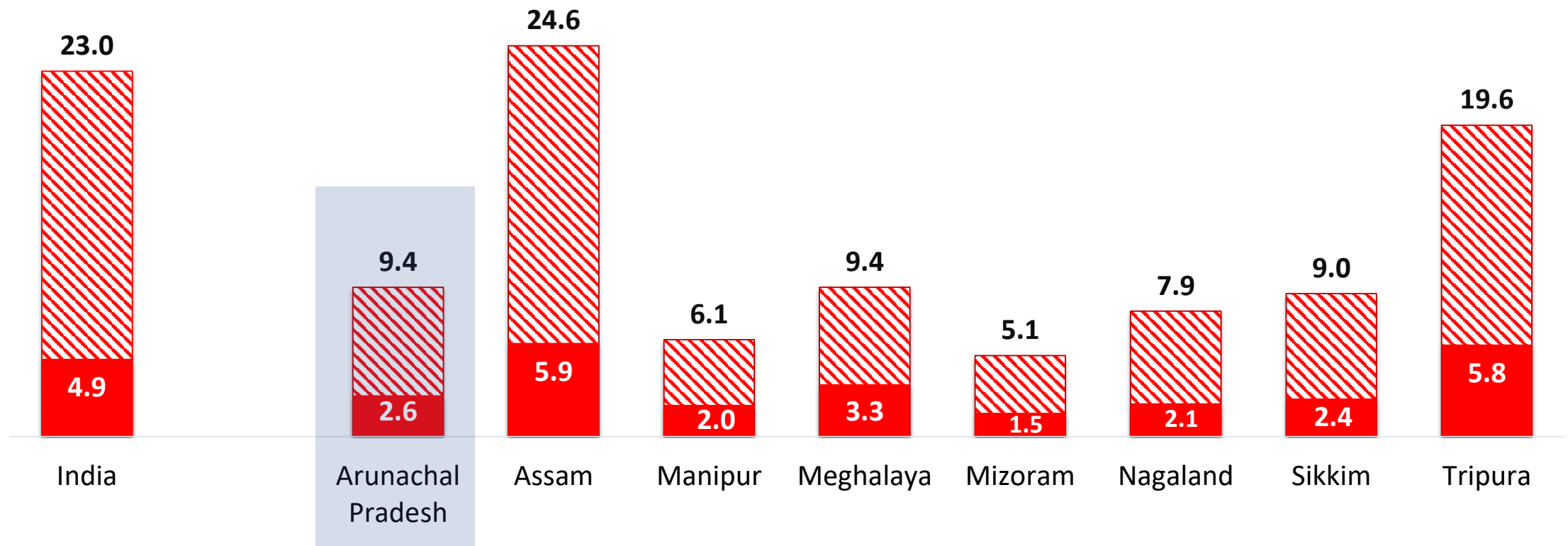
Overweight and obesity among school-age children (5-9 years) increasing

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

Prevalence of overweight in Arunachal Pradesh (**10%**) was more than double national average (4%)

Among northeastern states, Arunachal Pradesh had moderately high prevalence of overweight in this age group

▨ Overweight (BMI +1SD to +2SD)　　■ Obese (BMI > +2SD)

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
Total	3.7	9.5	7.4	8.5	6.4	9.4	14.7	10.6	11.6
Obese	1.3	2.9	2.8	2.5	1.8	3.0	4.3	4.2	4.5

CNNS
Birth to Adolescence
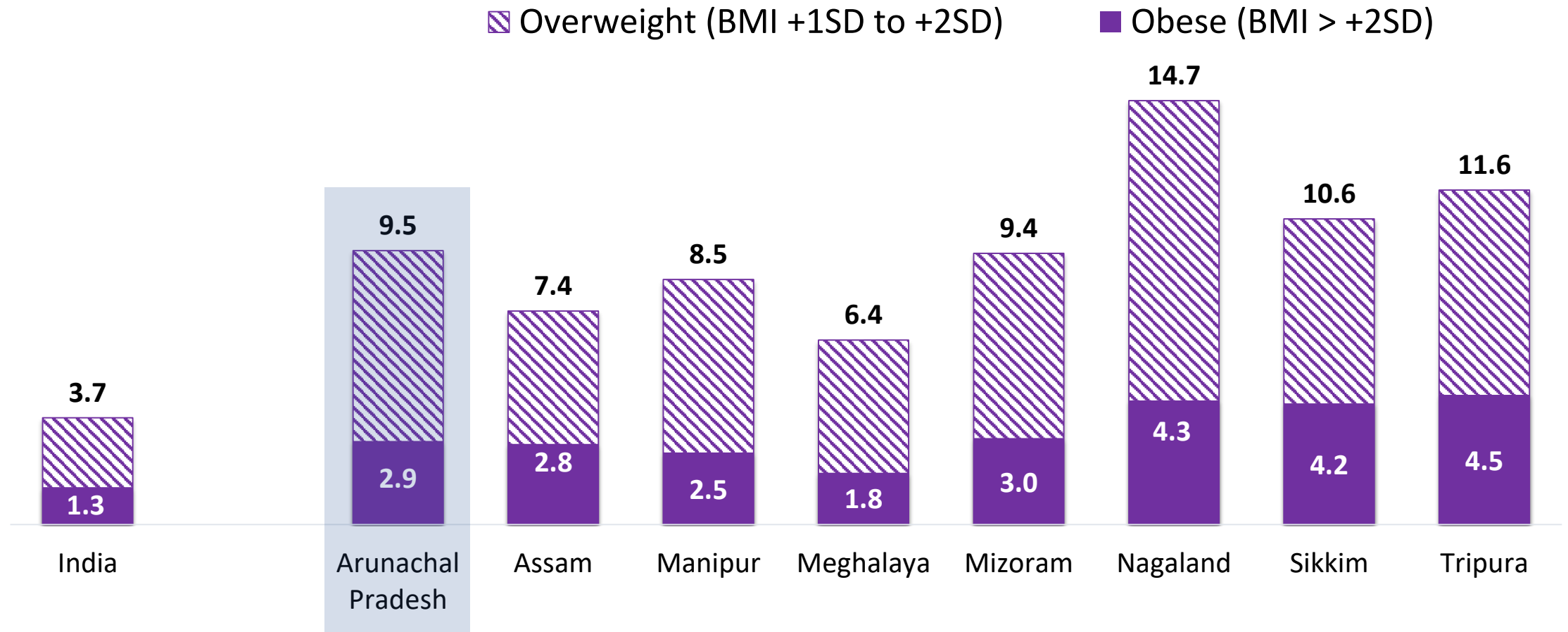
Thinness among adolescents aged 10-19 years substantially high

8% of adolescents aged 10-19 years were thin in Arunachal Pradesh, significantly lower than national average (**24%**)

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

⊠ Moderate thinness (-3SD to -2SD)　　■ Severe thinness (< -3SD)

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
Total	24.1	7.8	19.6	6.1	6.6	6.4	10.0	9.9	16.2
Severe	6.5	1.0	7.4				1.8	1.4	4.7

CNNS
Birth to Adolescence
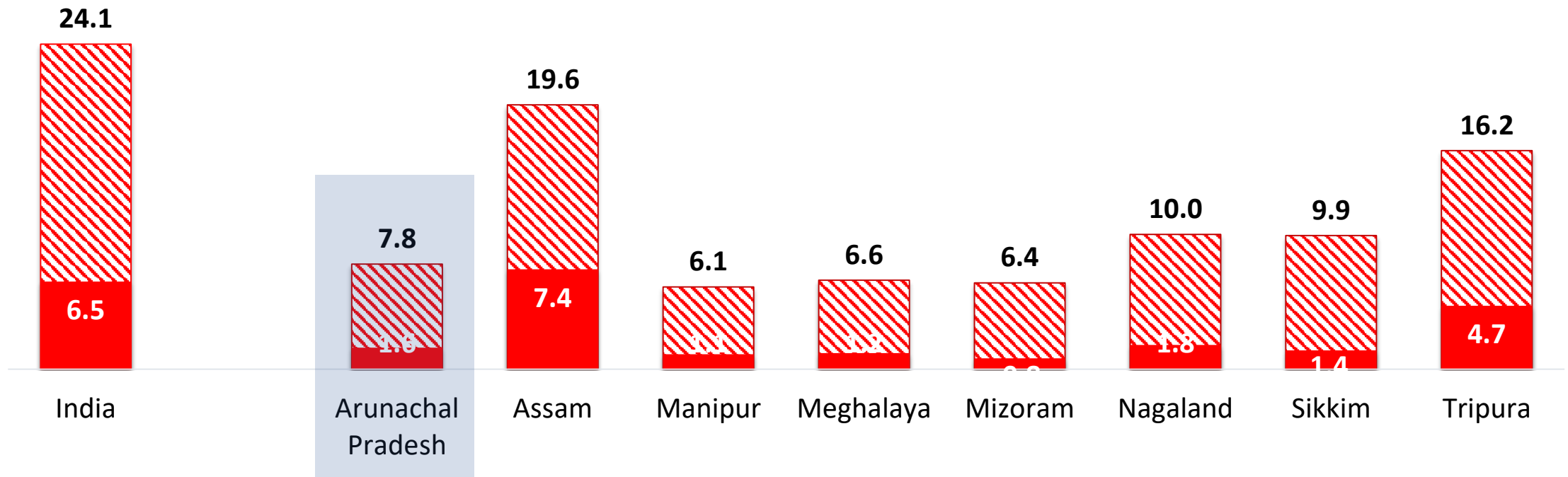
Prevalence of overweight among adolescents aged 10-19 years high

Nearly **1/10** of adolescents was overweight in Arunachal Pradesh (**11%**), more than double the national average (**5%**)

Among the northeastern states, Arunachal Pradesh had highest prevalence of overweight

Legend: ▨ Overweight (BMI +1SD to +2SD) ■ Obese (BMI > +2SD)

State	Obese	Overweight	Total
India	1.1		4.8
Arunachal Pradesh	2.1		11.0
Assam	1.3		4.2
Manipur	2.5		8.5
Meghalaya			3.4
Mizoram	0.9		7.8
Nagaland	1.5		9.4
Sikkim	2.0		9.3
Tripura	1.9		9.2

CNNS
Birth to Adolescence
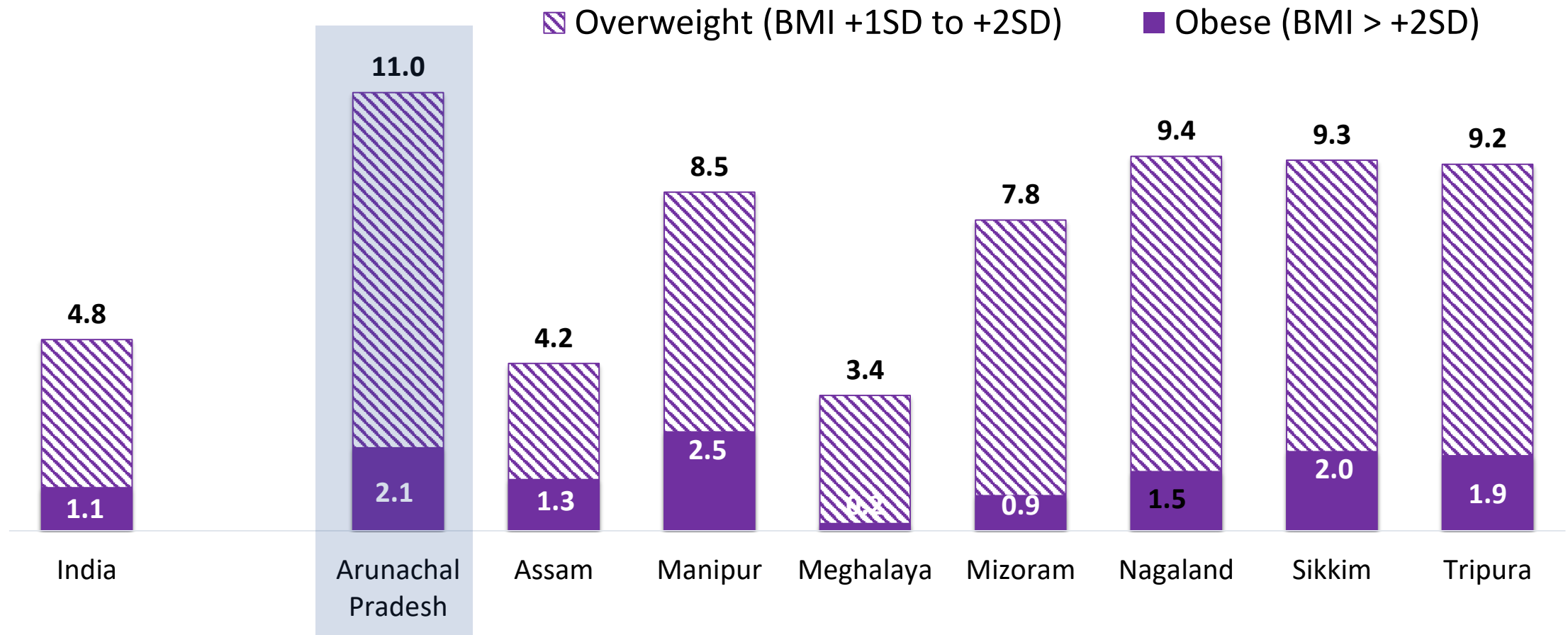
Arunachal Pradesh key findings: Anaemia and iron deficiency

Anaemia

28.3
25.2
26.4
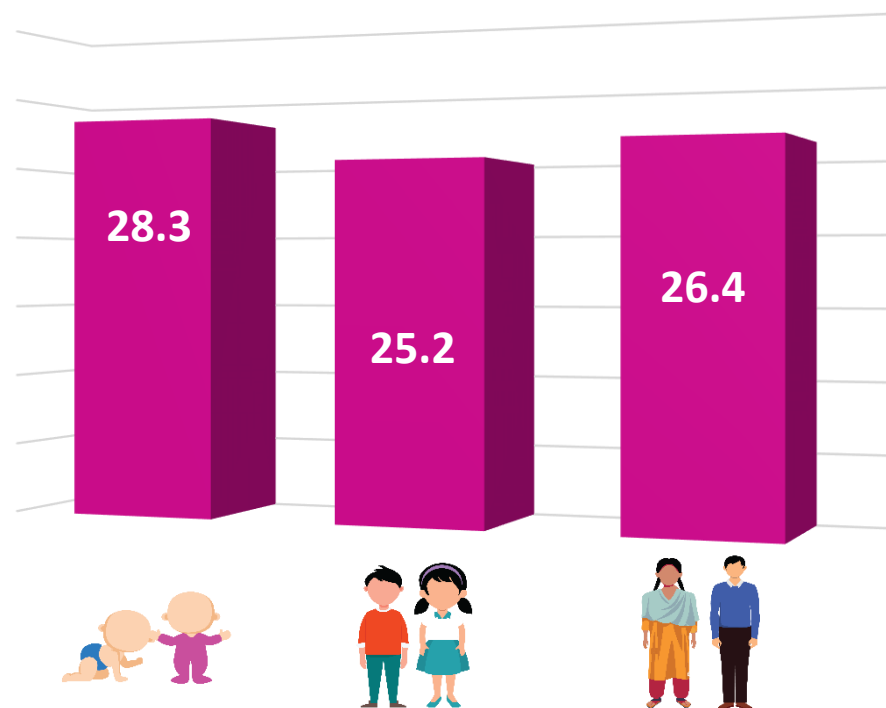
Unlike in most states, in Arunachal Pradesh, anaemia among children and adolescents were at similar level

Iron deficiency

15%
8%
18%

Findings indicate that children aged 5-9 years had lower iron deficiency (measured by serum ferritin) than other children or adolescents

CNNS
Birth to Adolescence

Prevalence of Anaemia among children and adolescents

More than **1/4** children aged 1-4 years was anaemic in Arunachal Pradesh (**28%**), lower than national average (**41%**)
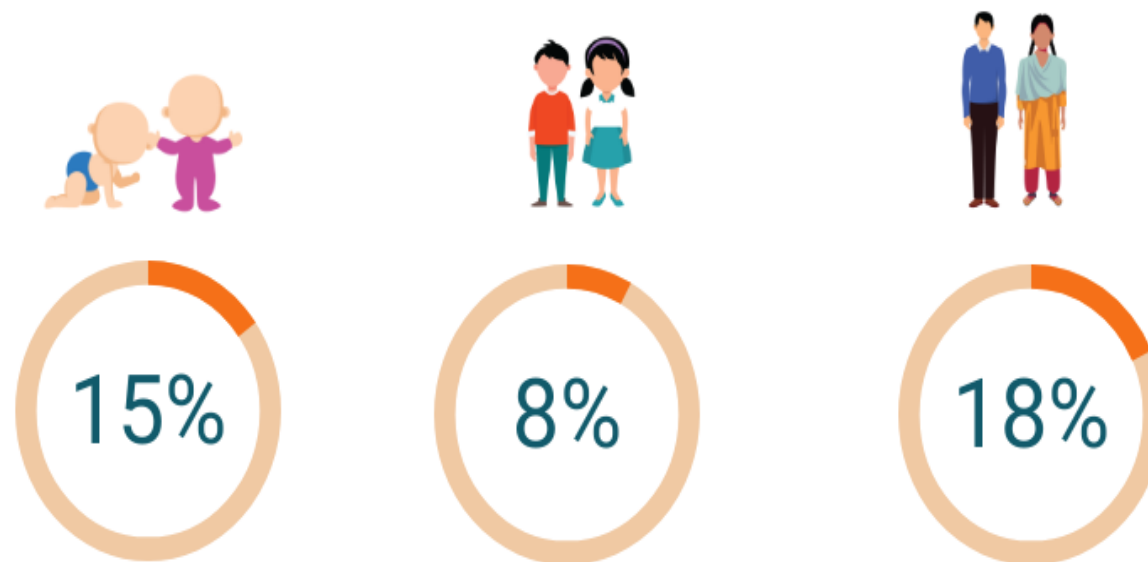
Prevalence of anaemia among adolescents aged 10-19 years (**26%**) was similar to the children aged 1-9 years (**25-28%**)

■ 1-4 Years ■ 5-9 Years ■ 10-19 Years

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)

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Nagaland	Sikkim	Tripura
1-4 Years	40.5	28.3	33.7	10.0	32.9	24.4	8.0	33.0	33.0
5-9 Years	23.5	25.2	34.6	6.5	31.3	14.4	9.4	23.3	41.1
10-19 Years	28.4	26.4	36.9	10.5	31.8	17.9	8.4	25.8	41.4

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Birth to Adolescence
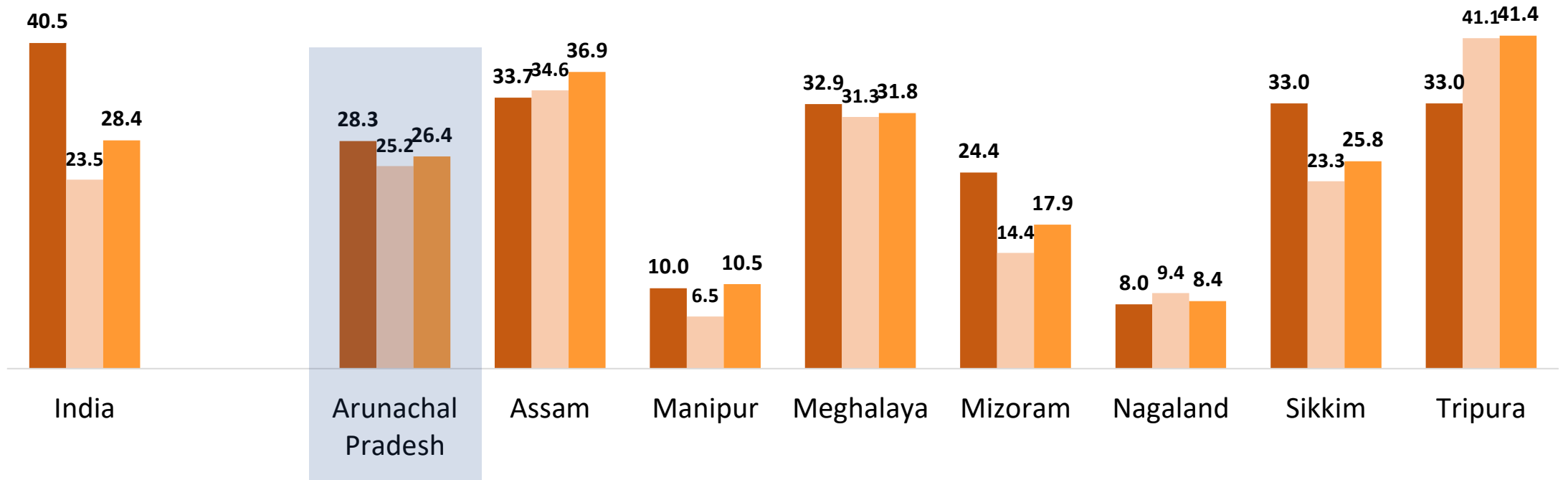
Prevalence of Anaemia among adolescents (10-19 years)

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

In Arunachal Pradesh, as in many other northeastern states, adolescent girls were significantly more likely than adolescent boys to be anaemic

Legend: ■ Male ■ Female

State	Male	Female
India	17.5	39.6
Arunachal Pradesh	19.2	34.6
Assam	32.0	42.5
Manipur	9.7	11.3
Meghalaya	22.4	43.4
Mizoram	11.0	24.9
Nagaland	9.6	7.3
Sikkim	13.7	37.6
Tripura	29.3	54.5

CNNS
Birth to Adolescence
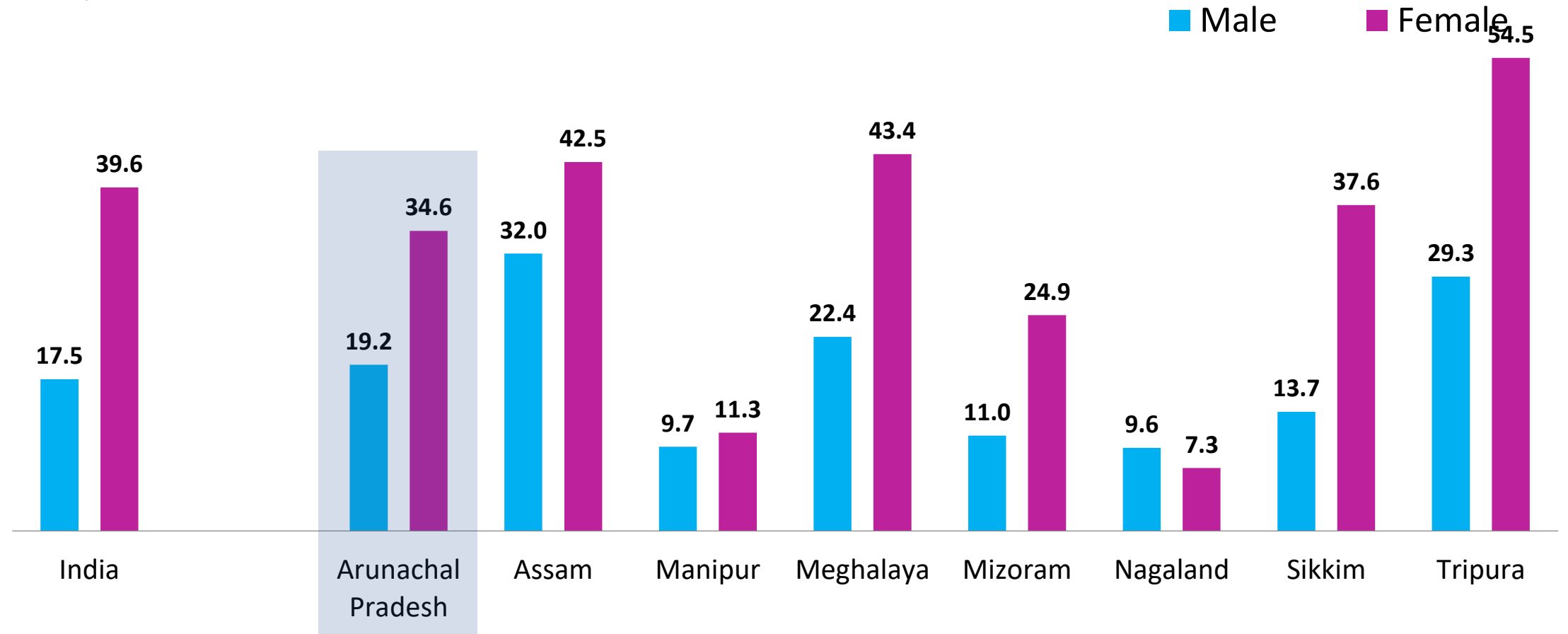
Iron deficiency measured by serum ferritin among children and adolescents

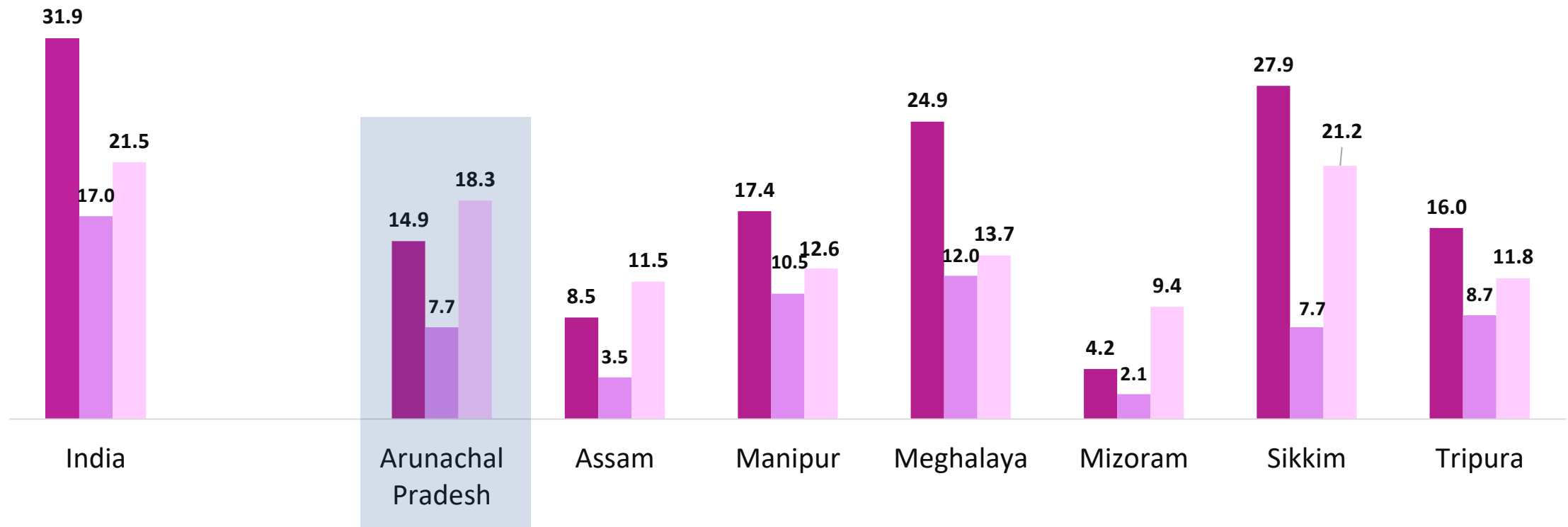**15%** of children aged 1-4 years had iron deficiency in Arunachal Pradesh, which is half of the national average (**32%**); prevalence was highest among adolescents aged 10-19 years (**18%**)

Unlike many other states, adolescents from Arunachal Pradesh (**19%**) had higher prevalence of iron deficiency than children aged 1-4 years (**15%**)

■ 1-4 Years   ■ 5-9 Years   ■ 10-19 Years

Cut Offs (WHO)
1-4 years: SF <12 µg/l;
≥5 years: SF <15 µg/l
(high CRP excluded)

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Sikkim	Tripura
1-4 Years	31.9	14.9	8.5	17.4	24.9	4.2	27.9	16.0
5-9 Years	17.0	7.7	3.5	10.5	12.0	2.1	7.7	8.7
10-19 Years	21.5	18.3	11.5	12.6	13.7	9.4	21.2	11.8

CiNNS
Birth to Adolescence

Arunachal Pradesh key findings: Vitamin A and Vitamin D deficiency

A

Vitamin A deficiency was moderately high (15%) in children aged 1-9 years indicating the need for policy review

Children aged 1-9 years were found to have higher levels of Vitamin A deficiency than adolescents (10%)

D

Vitamin D deficiency ranged from 7% to 22% 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

CNNS
Birth to Adolescence

Vitamin A deficiency among children and adolescents

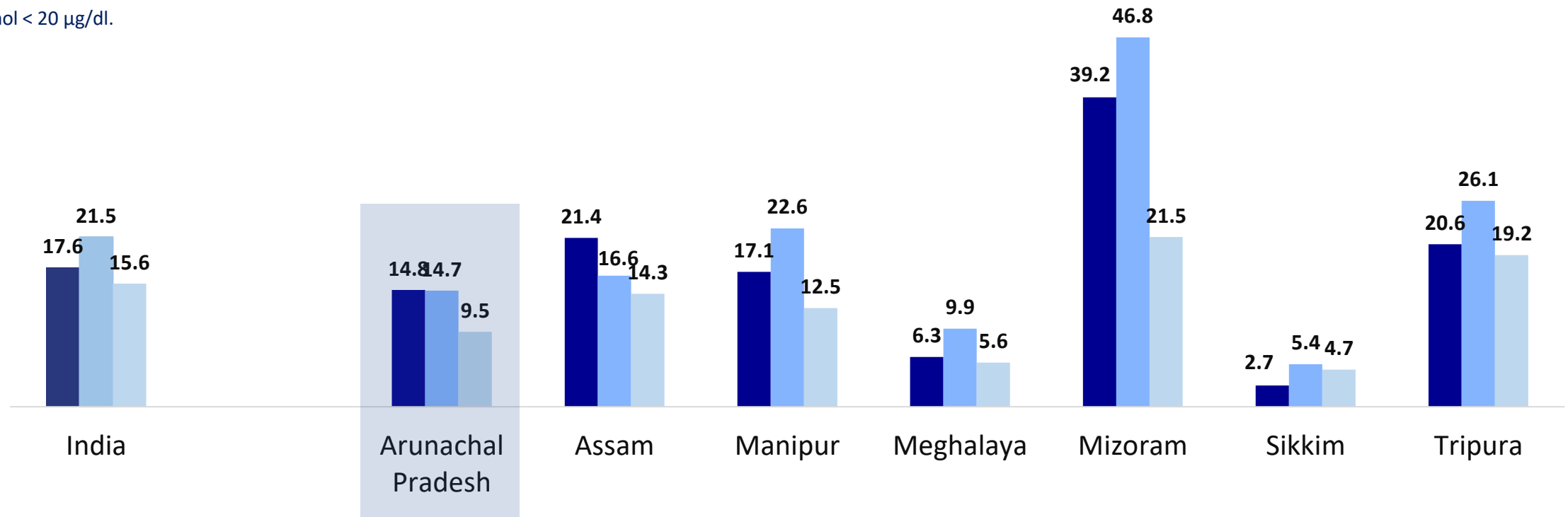**10-15%** children and adolescents had Vitamin A deficiency in Arunachal Pradesh.

Prevalence of Vitamin A deficiency in all age groups did not show any particular pattern among northeastern states with Mizoram reporting highest prevalence (**22-47%**)

■ 1-4 Years ■ 5-9 Years ■ 10-19 Years

Cut Offs (WHO)
1-19 Years: Serum retinol < 20 µg/dl.
(High CRP excluded)

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Sikkim	Tripura
1-4 Years	17.6	14.8	21.4	17.1	6.3	39.2	2.7	20.6
5-9 Years	21.5	14.7	16.6	22.6	9.9	46.8	5.4	26.1
10-19 Years	15.6	9.5	14.3	12.5	5.6	21.5	4.7	19.2

Birth to Adolescence
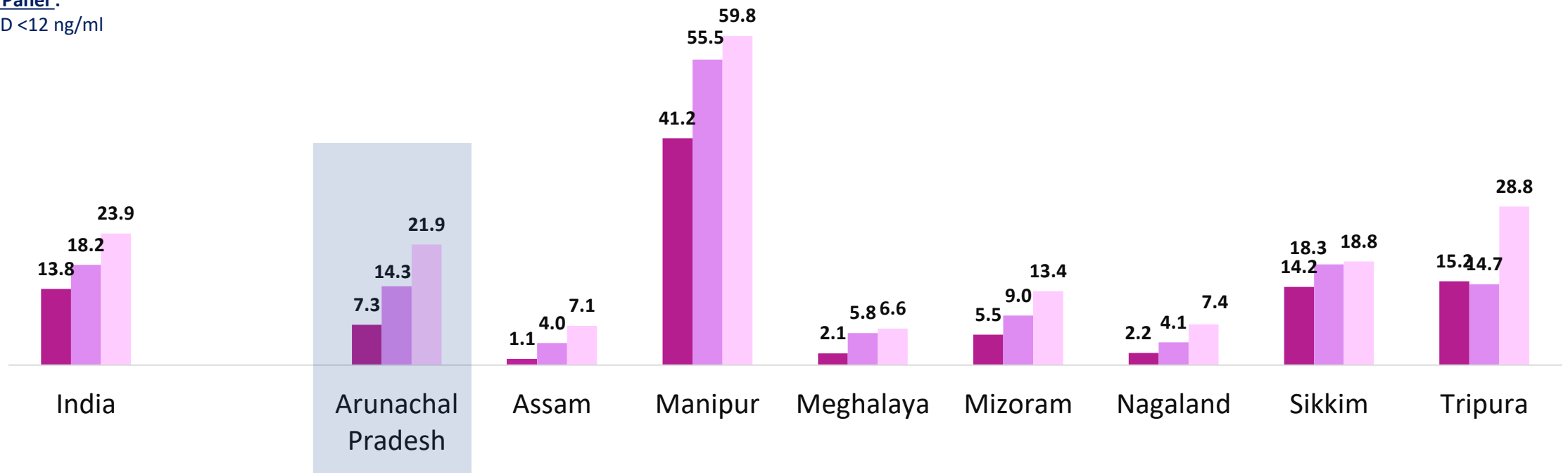
Vitamin D deficiency increases with age

7-22% children and adolescents had Vitamin D deficiency in Arunachal Pradesh; Vitamin D deficiency increased sharply with age.

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

■ 1-4 Years   ■ 5-9 Years   ■ 10-19 Years

Cut Off (IOM) Vit D Expert Panel :
Serum 25-hydroxy vitamin D <12 ng/ml

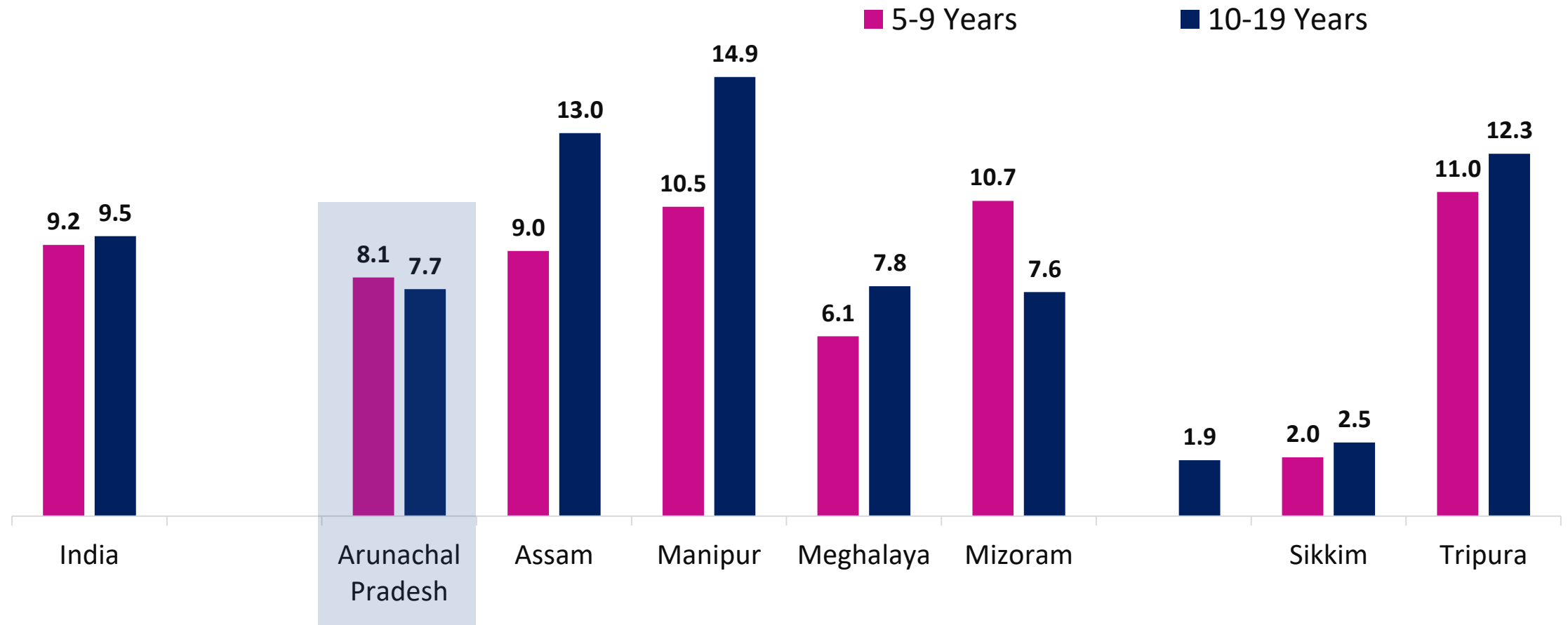|	1-4 Years	5-9 Years	10-19 Years
India	13.8	18.2	23.9
Arunachal Pradesh	7.3	14.3	21.9
Assam	1.1	4.0	7.1
Manipur	41.2	55.5	59.8
Meghalaya	2.1	5.8	6.6
Mizoram	5.5	9.0	13.4
Nagaland	2.2	4.1	7.4
Sikkim	14.2	18.3	18.8
Tripura	15.2	14.7	28.8

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8% of school-age children and 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.

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Birth to Adolescence

Risk of diabetes among school-age children and adolescents

Based on Glycosylated hemoglobin (HbA1c), **8%** of children and adolescents had increased risk of diabetes in Arunachal Pradesh, slightly less than national average (**9-10%**)

Legend: ■ 5-9 Years ■ 10-19 Years

	India	Arunachal Pradesh	Assam	Manipur	Meghalaya	Mizoram	Sikkim	Tripura
5-9 Years	9.2	8.1	9.0	10.5	6.1	10.7	2.0	11.0
10-19 Years	9.5	7.7	13.0	14.9	7.8	7.6	2.5	12.3

(Sikkim also shows value 1.9 for one bar)

Birth to Adolescence

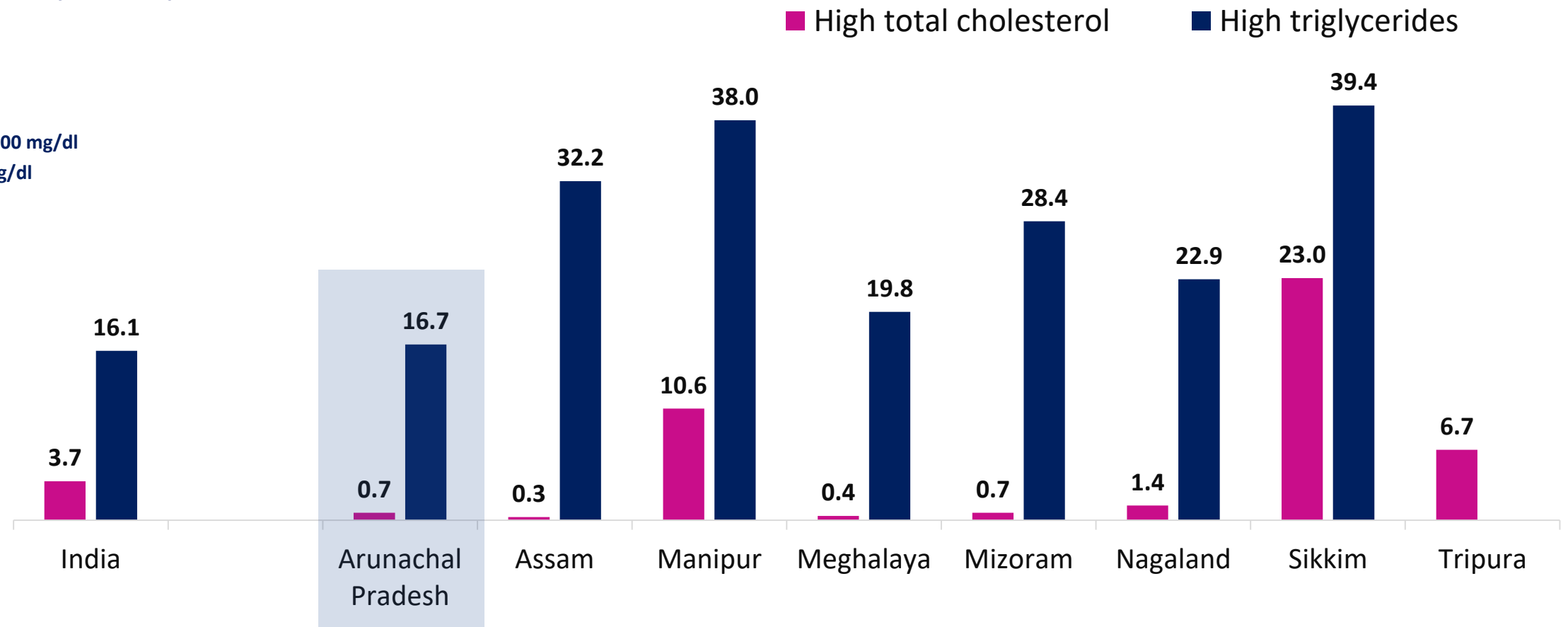# High total cholesterol and high triglycerides among adolescents

Elevated risk of NCDs in Arunachal Pradesh among adolescents – **1%** had high total cholesterol and **17%** with high level of triglycerides

Prevalence of high total cholesterol and high triglycerides were highest in Sikkim among the northeastern states, followed by Manipur

Legend: ■ High total cholesterol   ■ High triglycerides

Cut Offs:
Total cholesterol >= 200 mg/dl
Triglycerides > 130 mg/dl

State	High total cholesterol	High triglycerides
India	3.7	16.1
Arunachal Pradesh	0.7	16.7
Assam	0.3	32.2
Manipur	10.6	38.0
Meghalaya	0.4	19.8
Mizoram	0.7	28.4
Nagaland	1.4	22.9
Sikkim	23.0	39.4
Tripura	6.7	

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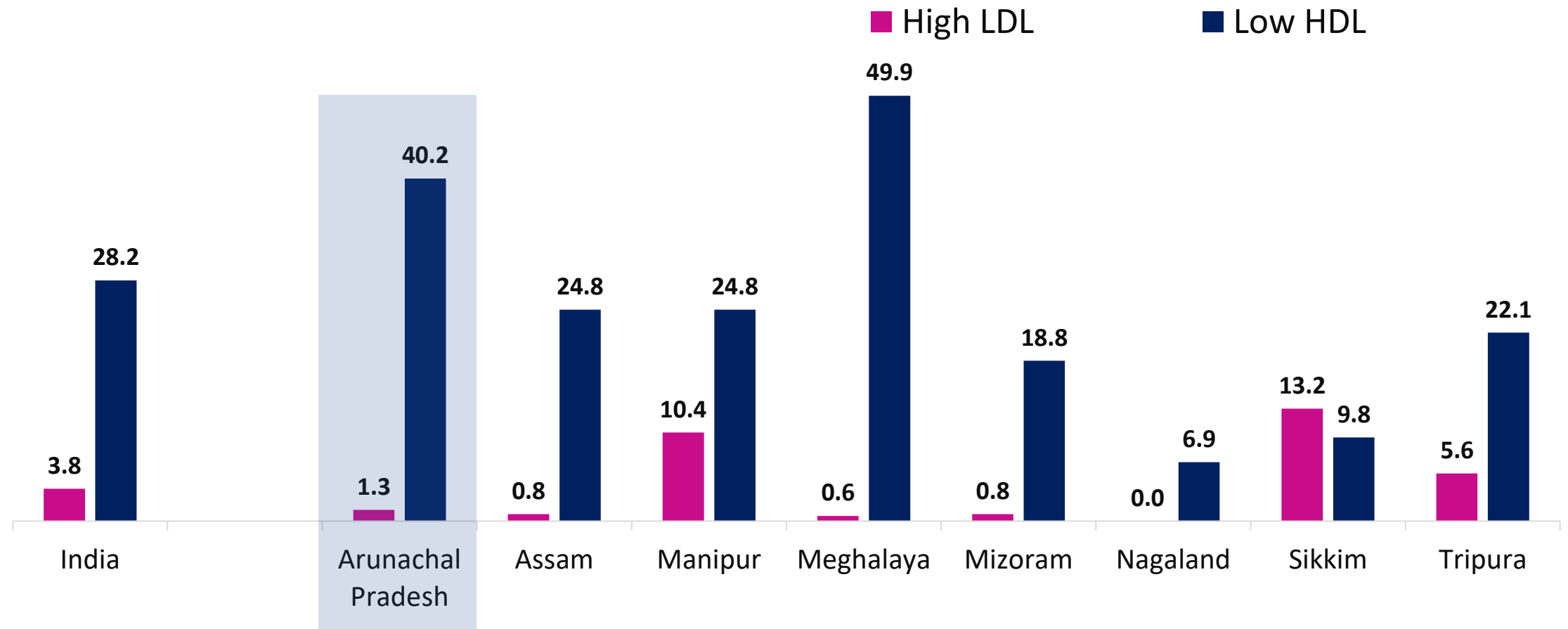# High LDL and low HDL among adolescents

Risk of NCDs among adolescents in Arunachal Pradesh – **1%** had high level of LDL and **40%** had low level of HDL

Among northeastern states, prevalence of low HDL was highest in Meghalaya (50%), followed by Arunachal Pradesh (**40%**), Assam and Manipur (**25%**)

■ High LDL   ■ Low HDL

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

State	High LDL	Low HDL
India	3.8	28.2
Arunachal Pradesh	1.3	40.2
Assam	0.8	24.8
Manipur	10.4	24.8
Meghalaya	0.6	49.9
Mizoram	0.8	18.8
Nagaland	0.0	6.9
Sikkim	13.2	9.8
Tripura	5.6	22.1

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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.

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