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Learning Lab Session 3B

Methods for estimating beneficiary populations targeted by health and nutrition interventions

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CGIAR

Scaling up of health and nutrition interventions in the first 1,000 days is associated with substantial reductions in child undernutrition and mortality

Multiple studies have tracked the uptake of these interventions from preconception to early childhood in LMICs

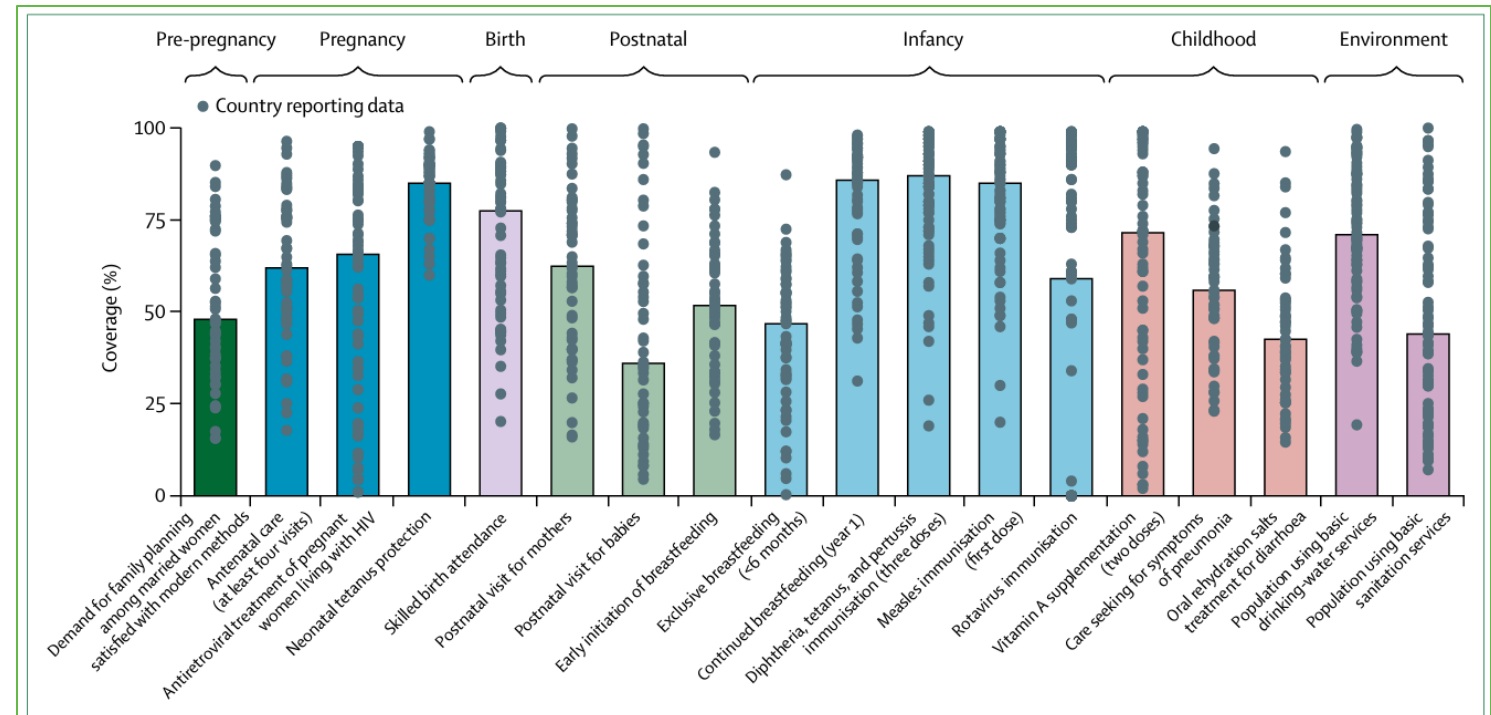


Figure 1: Coverage of interventions across the continuum of care based on the most recent data since 2012 in Countdown countries with available data. Bars show median national coverage of interventions, whereas the dots show country-specific data.

Source: Boerma T, Requejo J, Victora CG, et al. Countdown to 2030: tracking progress towards universal coverage for reproductive, maternal, newborn, and child health. *The Lancet* Publishing Group; 2018. p. 1538–1548.

What is used to measure uptake of interventions?

$$\text{Coverage} = \frac{\text{Number of individuals who received an intervention}}{\text{Number of individuals eligible for intervention}} \times 100$$

- Coverage is a measure widely used to track uptake
- Guidance available on estimation of coverage using individual and household data
- DHS and MICs are typically used to assess coverage

Our intention is to teach you to estimate populations eligible for and covered by health and nutrition interventions in LMICs

Through this workshop, you will (hopefully!) learn the following:

1. Identify and specify definitions of health and nutrition interventions delivered across the continuum of care in a country
2. Estimate populations (sizes) eligible for identified interventions
3. Estimate populations (sizes) covered by interventions

We will be using the illustration of India, but the method can be easily applied to other countries!



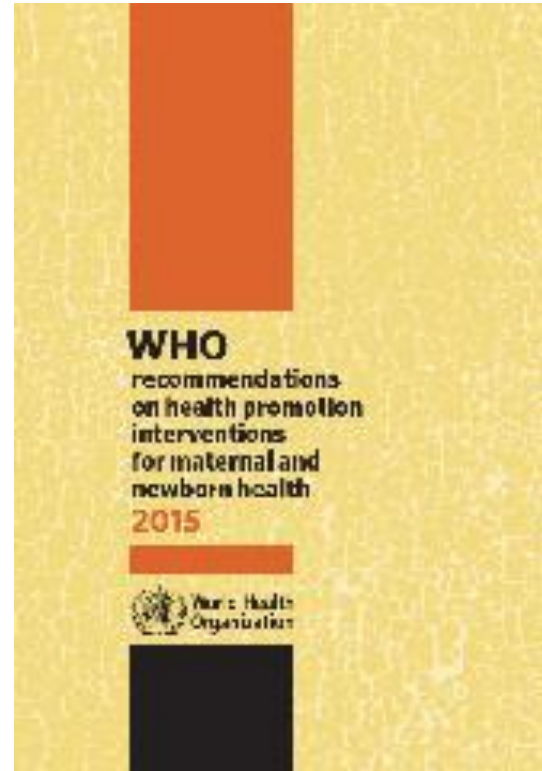
Aim 1: How do we identify health and nutrition interventions delivered in the first 1,000 days in a country?



Step 1: Identify globally recommended health and nutrition interventions



Essential Nutrition Actions: Mainstreaming Nutrition Through the Life-Course (WHO 2019)



WHO Recommendations on Health Promotion Interventions for Maternal and Newborn Health 2015 (WHO 2015)



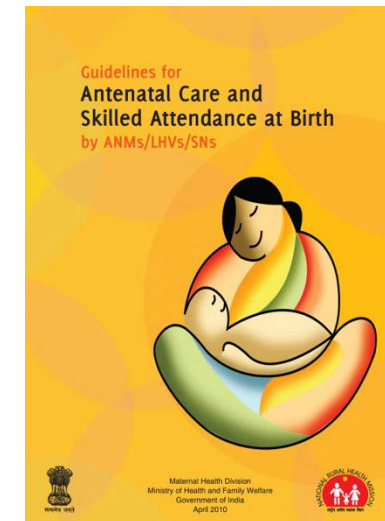
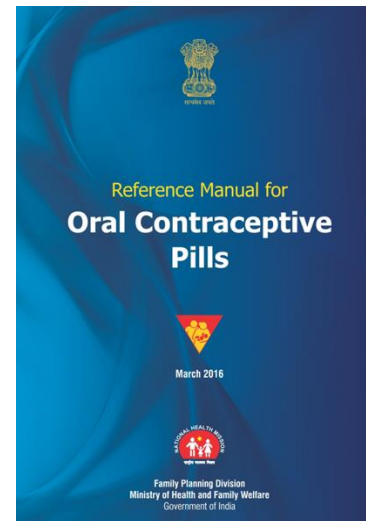
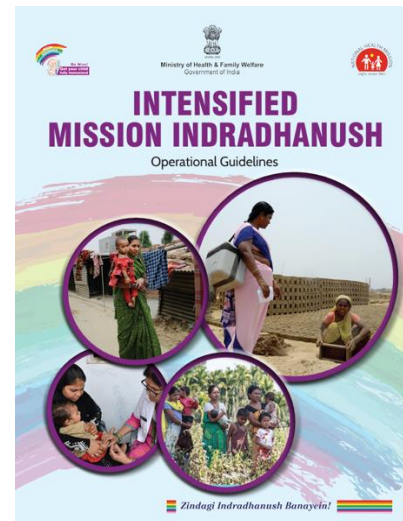
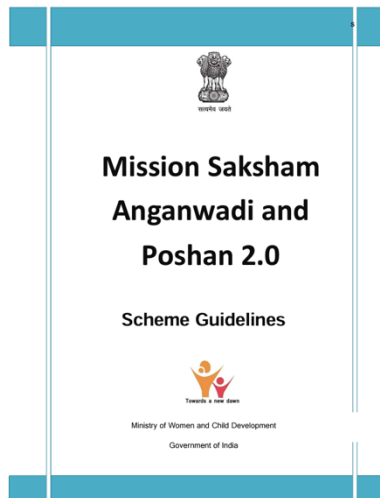
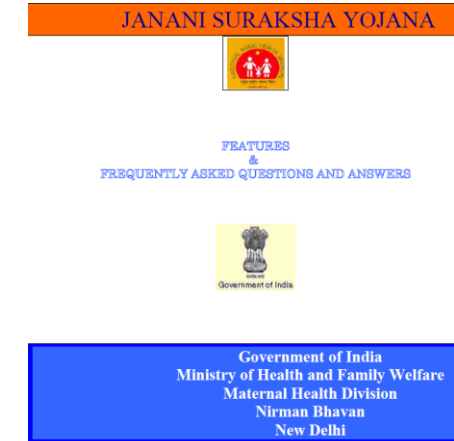
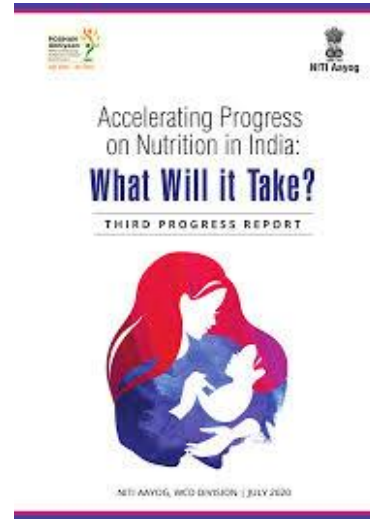
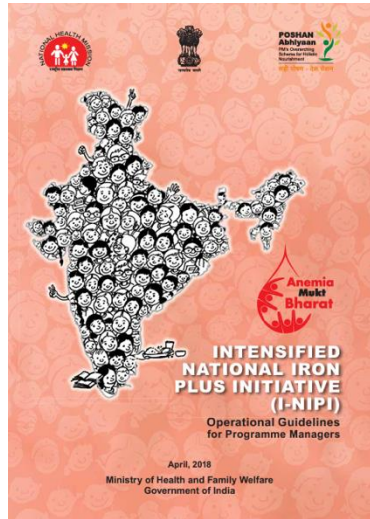
The Global Strategy for Women's, Children's and Adolescents' Health 2016–2020 (EWEC 2016)



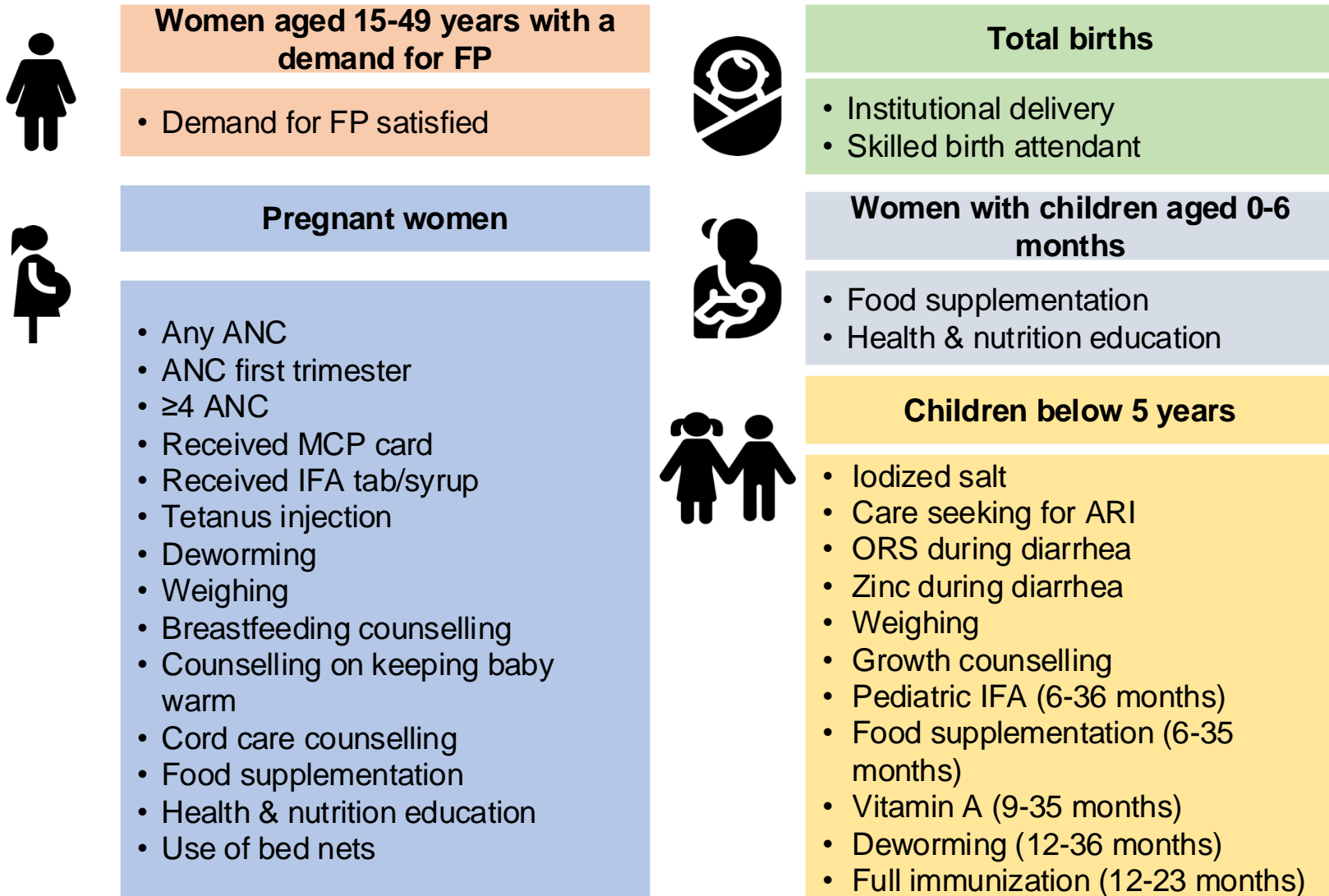
Recommended interventions across the life course

Life stage	Interventions	
Preconception	1 IFA supplementation 2 Deworming	3 Family planning
Pregnancy	4 Any ANC 5 ≤ 4 ANC visits 6 ANC first trimester 7 Food supplementation 8 IFA supplementation	9 Vitamin A supplementation 10 Deworming 11 Tetanus injection 12 Counselling 13 Weighing
Delivery and postnatal	14 Institutional birth 15 Skilled birth attendant 16 Delayed cord clamping 17 Assessment of birth weight	18 Postnatal care for babies 19 Postnatal care for women 20 IFA supplementation 21 Food supplementation
Early childhood	22 Food supplementation 23 Iron-containing MNP 24 IFA supplementation 25 Zinc during diarrhea 26 ORS during diarrhea	27 Vitamin A supplementation 28 Deworming 29 Growth monitoring 30 Counselling on nutritional status 31 Full immunization

Step 2: Review of programmatic guidelines to understand which interventions are being implemented at the country-level



Example: Health and nutrition interventions delivered in India organized by intended beneficiary group



Defining numerator and denominator for coverage

Intervention: 4 or more ANC visits



Numerator: Number of pregnant women who received 4 or more ANC visits during pregnancy



Denominator: Number of pregnant women

How do we operationalize this using DHS data?

NO.	QUESTIONS AND FILTERS	LAST BIRTH NAME _____
417	इस गर्भावस्था के लिए जब आपको पहली बार प्रसवपूर्व देखभाल मिली, तब आप कितने महीने से गर्भवती थीं? How many months pregnant were you when you first received antenatal care for this pregnancy?	MONTHS ... <input type="text"/> <input type="text"/> DON'T KNOW 98
418	इस गर्भावस्था के दौरान आपको कितनी बार प्रसवपूर्व देखभाल मिली? How many times did you receive antenatal care during this pregnancy?	NUM. OF TIMES ... <input type="text"/> <input type="text"/> DON'T KNOW 98

```
*Any wom_anc (DHS guide used)
//construction changed to match DHS guide
desc midx m14 m13
gen wom_ancany_skill=0 if midx==1 //denominator- had birth in last five years
replace wom_ancany_skill=1 if (midx==1) & (m2a==1|m2b==1)
la value wom_ancany_skill yesno
lab var wom_ancany_skill "Women aged 15-49 years received any ANC for their last pregnancy from a skilled provider"
svy:tab wom_ancany_skill //85.1
```

*. >=4 wom anc visits

```
*****
/*Percentage of women (15-49 years) attended by any trained provider 4 or more times during pregnwom_ancy*/
//definition changed to mach programmatic guidelines
tab m14, m
recode m14 (0 =0 "No wom_anc") (1/3= 1 "1-3 wom_anc") (4/95=2 " 4 +") (98=0), gen(wom_anc)
svy :ta wom_anc //checked, 92.6% national report
label var wom_anc "Women aged 15-49 years received any ANC for their last pregnancy from any provider"
```

```
recode m14 (0/3=0 "No") (4/95=1 "Yes") (98=0), gen(wom_anc4)
label var wom_anc4 "Women aged 15-49 years who received 4 or more antenatal care (ANC) visits from any provider"
svy :ta wom_anc4 //checked, 58.5% national report
svy: mean wom_anc4
```

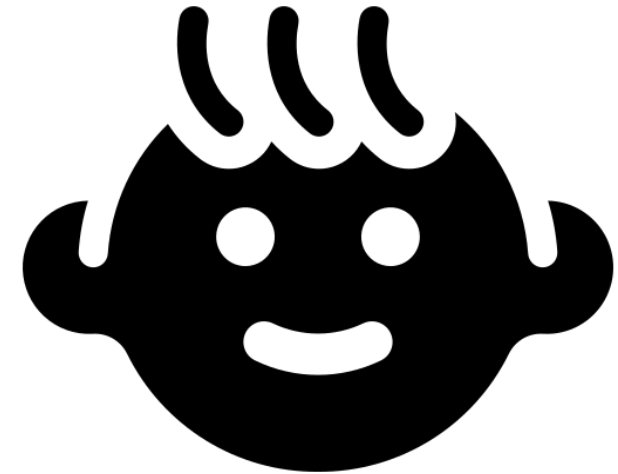
```
recode m14 (0/3=0 "No") (4/95=1 "Yes") (98=0), gen(wom_anc_4skilled)
label var wom_anc_4skilled "Women aged 15-49 years who received 4 or more antenatal care (ANC) visits from skilled provider"
replace wom_anc_4skilled=0 if wom_ancany_skill==0
svy :ta wom_anc_4skilled
```

Defining numerator and denominator for coverage

Intervention: Full immunization



Numerator: Number of children aged 12-23 months who received all basic vaccinations



Denominator: Number of children aged 12-23 months

How do we operationalize this using DHS data?

509

(1) COPY VACCINATION DATE FOR EACH VACCINE FROM THE CARD.
 (2) WRITE '44' IN 'DAY' COLUMN IF CARD SHOWS THAT A VACCINATION WAS GIVEN, BUT NO DATE IS RECORDED.
 (3) IF ONLY PART OF DATE IS SHOWN ON CARD, RECORD '98' OR '9998' FOR 'DON'T KNOW' IN THE COLUMNS FOR WHICH INFORMATION IS NOT GIVEN.

	LAST BIRTH			NEXT-TO-LAST BIRTH			SECOND-FROM-LAST BIRTH		
	DAY	MONTH	YEAR	DAY	MONTH	YEAR	DAY	MONTH	YEAR
BCG									
POLIO 0 (POLIO GIVEN AT BIRTH)									
POLIO 1									
POLIO 2									
POLIO 3									
DPT 1									
DPT 2									
DPT 3									
fIPV 1									
fIPV 2									
HEPATITIS B 0 (GIVEN AT BIRTH)									
HEPATITIS B 1									

DHS collects information using vaccination card and mother's recall

```
*****
*Full immunization
*****

//Recode for BCG
ta h2,m nol
recode h2 (0 8.=0)(1 2 3=1),gen(ch_bcg)
label var ch_bcg "Children aged 0-<60 months who received BCG"
svy:ta ch_bcg if (ch_age>11& ch_age<24) //95.3

//Recode for Measles
ta h9,m nol
recode h9 (0 8.=0)(1 2 3 4=1),gen(ch_measles)
label var ch_measles "Children aged 0-<60 months who received measles"
svy:ta ch_measles if (ch_age>11& ch_age<24) //87.6

//Recode for Polio 1,2,3
des h4 h6 h8
fre h4 h6 h8 //(1) vaccination date on card, (2) reported by mother, (3) vaccination marked on card, (8) Don't know
gen ch_polio123=0 if h4<=9 & h6<=9 & h8<=9
replace ch_polio123=1 if (h4==1|h4==2|h4==3) & (h6==1|h6==2|h6==3) & (h8==1|h8==2|h8==3)
label value ch_polio123 yesno
label var ch_polio123 "Children aged 0-<60 months who received all polio vaccine"
svy:ta ch_polio123 if (ch_age>11& ch_age<24)

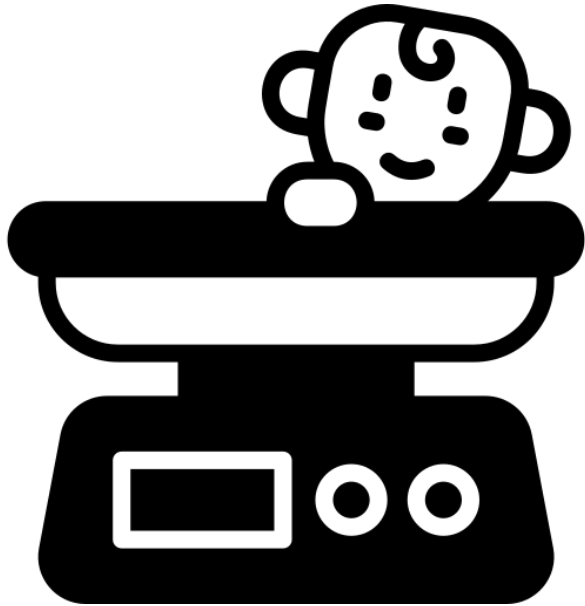
//Recode for DPT 1,2,3
desc h3 h5 h7
fre h3 h5 h7
gen ch_dpt123=0 if h3<=9 & h5<=9 & h7<=9
replace ch_dpt123=1 if (h3==1|h3==2|h3==3) & (h5==1|h5==2|h5==3) & (h7==1|h7==2|h7==3)
label value ch_dpt123 yesno
label var ch_dpt123 "Children aged 0-<60 months who received all DPT vaccine"
svy:ta ch_dpt123 if (ch_age>11& ch_age<24)

//Full immunization
gen ch_fullimmu=1 if (ch_bcg==1 & ch_measles==1 & ch_polio123==1 & ch_dpt123==1)
replace ch_fullimmu=0 if (ch_bcg==0|ch_measles==0|ch_polio123==0|ch_dpt123==0)
label var ch_fullimmu "Children aged 0-<60 months who received all basic vaccinations"
clonevar ch_12to23_fullimmu = ch_fullimmu if (ch_age>11& ch_age<24)
label var ch_12to23_fullimmu "Children aged 12-23 months who received all basic vaccinations"
```

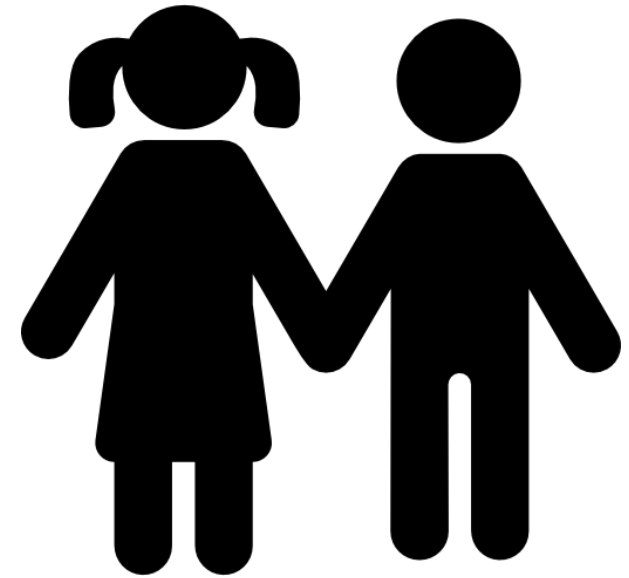
513B	पोलियो की खुराक, जिसकी बूँदें मुँह में पिलाई जाती हैं, पल्स पोलियो अभियान में पिलाई गई खुराक सहित? Polio vaccine, that is, drops in the mouth, including vaccine received in a Pulse Polio campaign?	YES 1 NO 2 (SKIP TO 513E) ← DON'T KNOW 8	YES 1 NO 2 (SKIP TO 513E) ← DON'T KNOW 8	YES 1 NO 2 (SKIP TO 513E) ← DON'T KNOW 8
513C	क्या पोलियो की पहली खुराक जन्म के पहले दो सप्ताहों के अंदर दी गई थी या बाद में? Was the first polio vaccine received in the first two weeks after birth or later?	FIRST 2 WEEKS ... 1 LATER 2	FIRST 2 WEEKS ... 1 LATER 2	FIRST 2 WEEKS ... 1 LATER 2
513D	पोलियो की खुराक कितनी बार दी गई थी? How many times was the oral polio vaccine given? IF MORE THAN 7, RECORD '7'.	NUMBER OF TIMES ... <input type="text"/>	NUMBER OF TIMES ... <input type="text"/>	NUMBER OF TIMES ... <input type="text"/>

Defining numerator and denominator for coverage

Intervention: Weighing during childhood



Numerator: Number of children who were weighed



Denominator: Number of children below five years

How do we operationalize this using DHS data?

563	पिछले 12 महीनों में (NAME) का वजन कितनी बार आंगनवाड़ी/आई.सी.डी. एस. केन्द्र में लिया गया? In the last 12 months, how often has (NAME)'s weight been measured by the anganwadi/ICDS centre?	NOT AT ALL 0 (GO TO 565) ← AT LEAST ONCE A MONTH . . . 1 AT LEAST ONCE IN 3 MONTHS . 2 LESS OFTEN . . 3 DON'T KNOW . . 8 (GO TO 565) ←
-----	---	--

```
//1.12 Weighed-early childhood
```

```
fre s563
```

```
gen ch_weigh_icds=0 if ch_any_icds!=. & b5 ==1
```

```
replace ch_weigh_icds=1 if inrange(s563, 1, 3) & b5 ==1
```

```
label define ch_weigh_icds 0"No" 1"Yes"
```

```
label value ch_weigh_icds ch_weigh_icds
```

```
lab var ch_weigh_icds "Child was weighed at AWC/ICDS centre in the last 12 months"
```

```
svy: tab ch_weigh_icds
```



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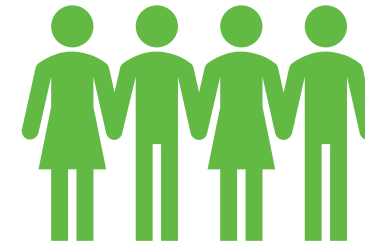
Can coverage estimates alone be used to track an intervention? What other data might be required?



Can coverage estimates alone be used to evaluate the scale of resource gaps in the delivery of an intervention?



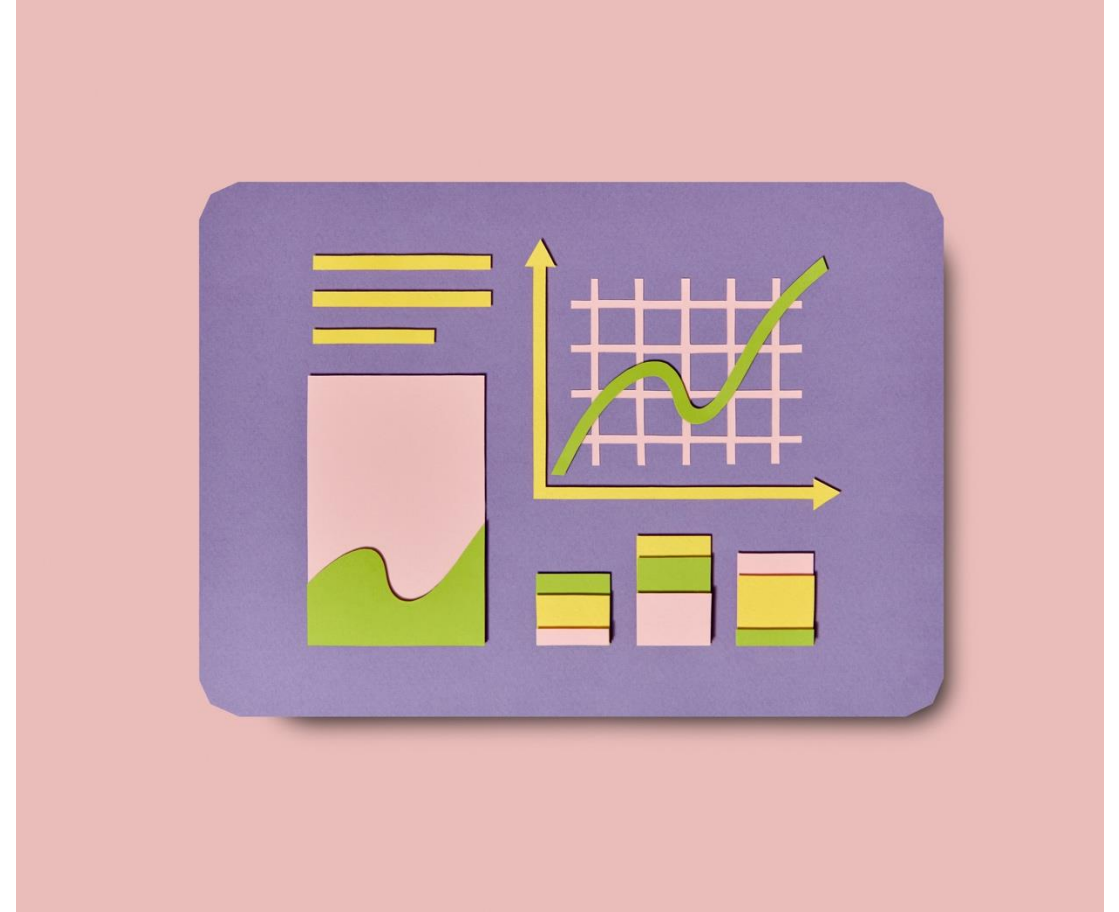
Improvements in coverage might not necessarily reflect increased utilization of an intervention



Health and nutrition surveys select a population representative subsample from the total eligible population

Can we use health system data and censuses to measure populations eligible for an intervention?

- Health system data used in high income countries and are linked to health facilities
 - Data in LMICs could suffer from data quality issues
 - Might not capture all beneficiaries eligible for an intervention
- Infrequent collection of census data and vital statistics may underreport fertility and mortality



Aim 2: How to estimate populations eligible for interventions?



Method for estimating number of pregnant women



*Number of women that had a pregnancy that resulted in birth
= Number of live births – number of multiple births + number of stillbirths*


Estimating number of women with a birth

$$B_l = (1 - s) * B_t$$

$$B_t = \frac{B_l}{(1 - s)}$$

Data sources: World Population Prospects

- Total population
- Crude birth rate (per 1,000 population)

											
Index	Variant	Region, subregion, country or area *	Notes	Location code	ISO3 Alpha-code	ISO2 Alpha-code	SDMX code**	Type	Parent code	Year	Total Population, as of 1 July (thousands)
7702	Estimates	India		356	IND	IN	356	Country/Area	5501	2015	1 322 867
7707	Estimates	India		356	IND	IN	356	Country/Area	5501	2020	1 396 387

Data sources: Demographic Health Survey

- % of children aged 0-12 months who are second or thirdborn in multiple births
- % of pregnancies that ended in stillbirth

212	213	214
आपके (पहले/अगले) बच्चे का नाम क्या रखा गया था?	क्या (NAME) लड़का है या लड़की है?	क्या इनमें से कोई जुड़वा बच्चे थे?
What name was given to your (first/next) baby?	Is (NAME) a boy or a girl?	Were any of these births twins?
BIRTH HISTORY NUMBER AND NAME		
01	BOY 1 GIRL 2	SING 1 MULT 2

234	<p>क या उस गर्भ का स्वतः गर्भपात हो गयाया गर्भपात कराया गया था, या बच्चा मृत पैदा हुआ था? Did that pregnancy end in a miscarriage, an abortion, or a stillbirth?</p> <p>C CIRCLE RESPONSE CODE AND ENTER 'M' FOR MISCARRIAGE, 'A' FOR ABORTION, OR 'S' FOR STILLBIRTH IN COLUMN 1 OF THE CALENDAR IN MONTH IN WHICH PREGNANCY WAS TERMINATED.</p>	<p>MISCARRIAGE 1 ABORTION 2 STILLBIRTH 3</p>
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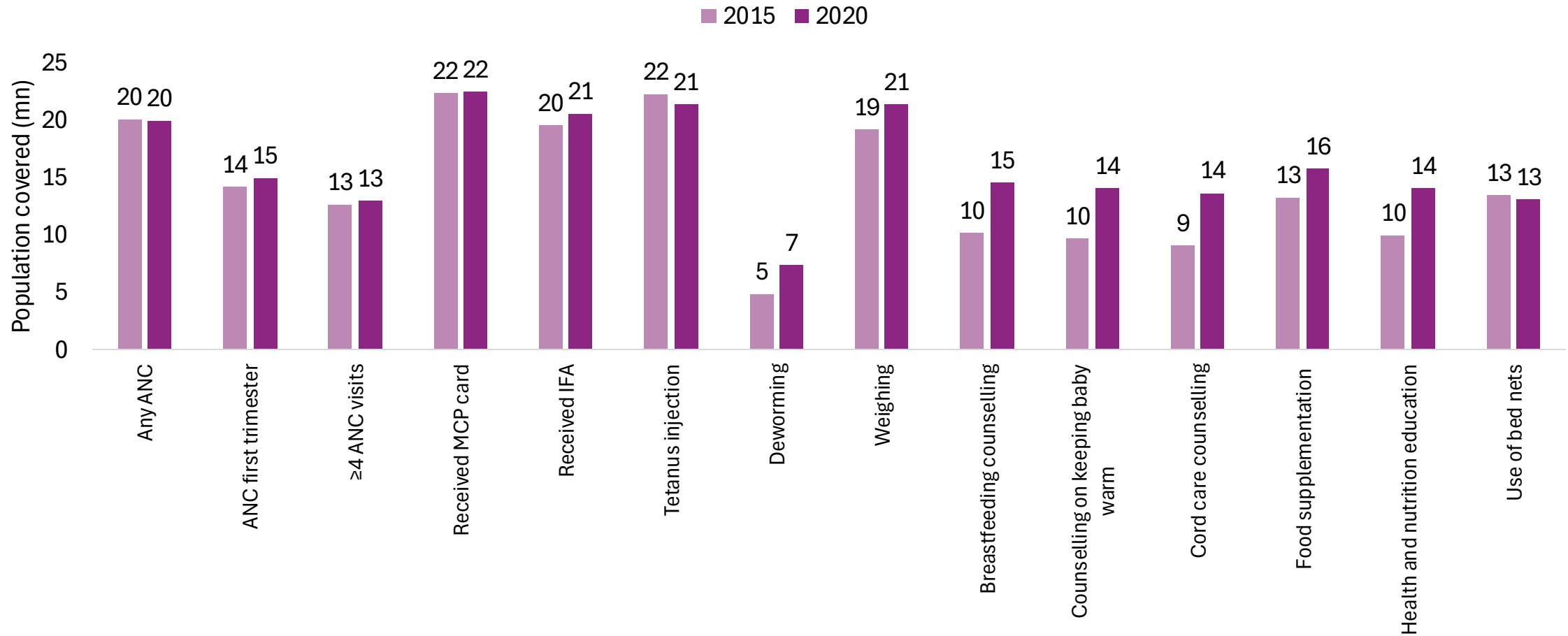
Illustration: Estimating number of women that had a pregnancy that resulted in a birth in 2015 and 2020 for India

	2015	2020
Step 1: Estimating number of live births		
Crude birth rate (per 1,000) (1)	18.8	16.6
Total population (in millions) (2)	1,322.9	1,396.4
Number of live births (in millions) (3)	24.8	23.1
<i>Obtained by multiplying (1) and (2) and dividing by 1,000</i>		

Illustration: Estimating number of pregnant women who had 4 or more ANC visits

	2015	2020
Number of women who had a pregnancy that resulted in a birth (in millions)	24.9 (24.9, 25.0)	23.3 (23.3, 23.3)
Percentage of women who received 4 or more ANC visits	50.7 (50.2, 51.1)	55.2 (54.8, 55.6)
Number of women who received 4 or more ANC visits	12.6 (12.5, 12.7)	12.9 (12.6, 13.0)

Illustration: Number of pregnant covered by health and nutrition interventions in 2015 and 2020



Method for estimating number of children aged below five years

- **Problem:** The WPP only provides data on infant mortality rate and under five mortality rate. **What about the mortality rate for cohorts born in between?**
- Can we linearly interpolate the mortality rates for the in between cohorts using the infant and under five mortality rates?
 - Death rates differ across cohorts with mortality being higher among younger children and decreasing thereafter
 - **Solution:** Assume proportional equivalence between DHS and WPP mortality rates!

Method for estimating number of children aged below five years

Cumulative mortality rates were estimated for birth cohorts older than 11 months by extrapolating patterns in the mortality rates from DHS to the infant mortality rate from the WPP

*Cumulative cohort specific mortality rates in NFHS
≈ Cumulative cohort specific mortality rates in WPP*

This might not be clear. Don't worry it will become clearer when we walk through the illustration!



Data sources: World Population Prospects

- Infant mortality rate (per 1,000)
- Under five mortality rate (per 1,000)
- Total population
- Crude birth rate (per 1,000)



Index	Variant	Region, subregion, country or area *	Notes	Location code	ISO3 Alpha-code	ISO2 Alpha-code	SDMX code**	Type	Parent code	Year	Infant Mortality Rate (infant deaths per 1,000 live births)	Live Births Surviving to Age 1 (thousands)	Under-Five Deaths, under age 5 (thousands)	Under-Five Mortality (deaths under age 5 per 1,000 live births)
7702	Estimates	India		356	IND	IN	356	Country/Area	5501	2015	34.7	24,091.441	1 087	43
7707	Estimates	India		356	IND	IN	356	Country/Area	5501	2020	26.6	22,595.171	763	33



Data sources: Demographic Health Survey

- Mean mortality rate for birth cohorts born in the five years preceding the survey
- *syncmrates* package on Stata estimates mortality rates using synthetic cohort approach

Cohort (age in months)	2015	2020
0-11	41.4 (39.1, 43.7)	33.4 (31.2, 35.6)
12-23	3.1 (2.5, 3.7)	2.3 (1.7, 2.9)
24-35	2.0 (1.4, 2.5)	0.8 (0.5, 1.1)
36-47	2.1 (1.6, 2.7)	1.7 (1.2, 2.2)
48-59	1.5 (1.0, 2.0)	1.1 (0.7, 1.2)
U5MR	50.2 (45.6, 54.6)	39.3 (35.3, 43.0)



For the illustration, we will focus on the example of 2020.

Step 1: Estimating each cohort's contribution to the cumulative/under five mortality rate

Cohort (age in months)	DHS mean mortality rate	Contribution to DHS U5MR
0-11	33.4 (31.2, 35.6)	0.85 (0.82, 0.90)
12-23	2.3 (1.7, 2.9)	0.06 (0.05, 0.07)
24-35	0.8 (0.5, 1.1)	0.02 (0.01, 0.03)
36-47	1.7 (1.2, 2.2)	0.04 (0.03, 0.06)
48-59	1.1 (0.7, 1.2)	0.03 (0.02, 0.03)
U5MR	39.3 (35.3, 43.0)	

Step 3: Estimate cohort mortality rate by applying contribution rate to U5MR from WPP

Cohort (age in months)	Contribution to DHS U5MR	Estimated cohort mortality rate
0-11	0.85 (0.82, 0.90)	WPP=28.3
12-23	0.06 (0.05, 0.07)	1.9 (1.5, 2.0)
24-35	0.02 (0.01, 0.03)	0.7 (0.3, 0.8)
36-47	0.04 (0.03, 0.06)	1.4 (0.8, 1.4)
48-59	0.03 (0.02, 0.03)	1.0 (0.6, 1.0)
U5MR		WPP=33.0

Step 4: Sum cohort mortality rates to obtain cumulative mortality rate by cohort

Cohort (age in months)	Estimated cohort mortality rate	Estimated cumulative mortality rate
0-11	WPP=28.3	28.3
12-23	1.9 (1.5, 2.0)	30.2 (29.8, 30.3)
24-35	0.7 (0.3, 0.8)	30.9 (30.1, 31.1)
36-47	1.4 (0.8, 1.4)	32.3 (30.9, 32.5)
48-59	1.0 (0.6, 1.0)	33.3 (31.5, 33.5)
U5MR	WPP=33.0	

Step 5: Estimate number of live births in each cohort

Cohort (age in months)	Total population (in millions)	Crude birth rate (per 1,000)	Number of live births (in millions)
0-11	1390.0	16.6	23.1
12-23	1376.3	17.0	23.6
24-35	1361.7	17.7	24.2
36-47	1346.6	17.9	24.3
48-59	1330.6	18.5	24.8

Step 6: Estimate number of living children in each birth cohort

Cohort (age in months)	Estimated cumulative mortality rate	Number of live births (in millions)	Number of deaths (in millions)	Number of living children (in millions)
0-11	28.3	23.1	0.7	22.5
12-23	30.2 (29.8, 30.3)	23.6	0.7 (0.7, 0.7)	22.9 (22.2, 22.9)
24-35	30.9 (30.1, 31.1)	24.2	0.7 (0.7, 0.8)	23.4 (23.4, 23.4)
36-47	32.3 (30.9, 32.5)	24.3	0.8 (0.8, 0.8)	23.5 (23.5, 23.5)
48-59	33.3 (31.5, 33.5)	24.8	0.8 (0.8, 0.8)	24.0 (24.0, 24.0)

Using the number of living children in each cohort, we can estimate the beneficiary groups for interventions targeting children



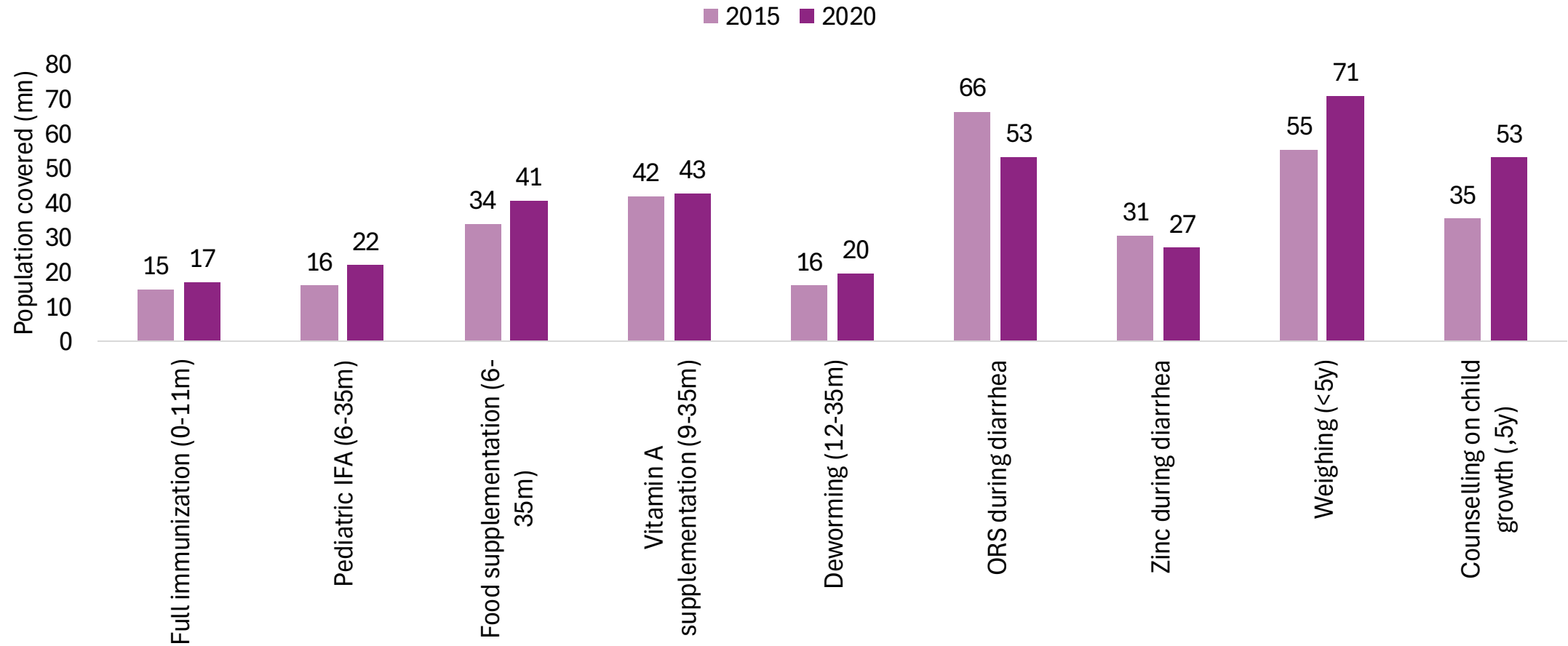
Illustration: Estimating number of children aged 0-11 months projected to be fully immunized in the year

	2015	2020
Number of children aged 0-11 months	24.0	22.5
Percentage of children who are fully immunized	63.0 (62.4, 63.7)	76.5 (75.9, 77.1)
Number of children projected to be fully immunized	15.1 (15.0, 15.3)	17.2 (17.1, 17.3)

Illustration: Estimating number of children weighed

	2015	2020
Number of children below five years (in millions)	122.8 (121.9, 123.0)	116.2 (115.5, 116.3)
Percentage of children who were weighed	45.0 (44.5, 45.4)	60.9 (60.4, 61.4)
Number of children who were weighed (in millions)	55.3 (54.2, 55.8)	70.8 (69.8, 71.4)

Illustration: Number of children covered by health and nutrition interventions in 2015 and 2020



Final exercise!

You are approached by the Minister of Health and Nutrition from the country Nutria who wishes to understand why the HMIS data for her country is reporting a declining number of individuals accessing antenatal care despite the coverage estimate between 2020 and 2024 increasing from 50 to 60%.

- What data could you use to resolve the discrepancy observed by the minister?
- What demographic trends could be driving the decline in the population accessing the intervention?
- Why is coverage increasing despite the decline in access?
- What would you recommend to the Minister?

Workshop summary

- We examined how to identify health and nutrition interventions delivered in a country using globally recommended nutrition actions
- We familiarized ourselves with how to estimate coverage using DHS surveys
- We estimated populations eligible for and covered by interventions during pregnancy and early childhood
 - The sheet which was circulated also contains methods for estimating total births, women with children aged 0-6 months, and women with a demand for family planning.



Thank you!

TARGET 3-8

3 GOOD HEALTH
AND WELL-BEING



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