

Table 1. Acute Respiratory Infections related indicators in Nigeria, Lagos and Jigawa, according to the literature review and secondary data analysis

Variable	Nigeria (Males, Females)	Jigawa (Males, Females)	Lagos (Males, Females)
Mortality			
Under-five mortality	120/1,000 livebirths (M: 126; F: 114)	192/1,000 livebirths	50/1,000 livebirths
Infant mortality	70/1,000 livebirths (M: 77; F: 63)	83/1,000 livebirths	45/1,000 livebirths
Neonatal mortality	39/1,000 livebirths (M: 44; F: 33)	37/1,000 livebirths	29/1,000 livebirths
Under-five ARI mortality	19.4%		
Post-neonatal ARI mortality	16.6%	16.3/1,000 livebirths (95% CI: 13.4-19.2)	9.2/1,000 livebirths (95% CI: 5.4-13)
Neonatal ARI mortality	2.5%	21.6/1,000 livebirths (95% CI: 18.9-24.3)	19.1/1,000 livebirths (95% CI: 15.1-23.1)
ARI morbidity			
Under-five ARI cases		14,988*	17,955*
Hypoxaemic ARI CFR			
Severe ARI CFR			
Chest-indrawing ARI CFR			
Fast-breathing ARI CFR			
Hypoxaemic ARI prevalence			
Severe ARI prevalence			
Chest-indrawing ARI prevalence			
Fast-breathing ARI prevalence			
Care-seeking and treatment			
Caregiver recognises at least one of fast and/or difficult breathing	39.0%	38.7%	31.4%
No treatment sought for ARI	15.7% (95%CI: 13.7-18) (M: 16.6; F: 14.7)	15.9% (95%CI: 7.8-29.9) (M: 15.8; F: 16.0)	4.5% (95%CI: 0.8-23) (M: 6.7; F: 2.5)
Treatment with antibiotics	35.5% (95%CI: 30.5-40.6) (M: 33.0; F: 38.1)	67.2%	64.0% (48.9-79.2)
Pulse oximetry availability			
Oxygen availability at secondary facility			
Risk factors			
HIV prevalence			
Malaria prevalence**	45.1% (M: 46.2; F: 43.9)	58.2%	1.9%
Diarrhoea preceding 2-weeks	14.5% (95%CI: 13.6-15.5) (M: 15.3; F: 13.8)	8.7% - 20.4% (95%CI: 15.4-25.3)	3% - 4.2% (95%CI: 1.6-6.8)
Solid fuel for cooking	80.6%	98.7%	3.3%
Improved source of drinking water	64.1%	79.4%	31% - 93.6%

Improved sanitation facility	46.8% (95%CI: 44.4-49.2)	24.5% (95%CI:14.5-34.6)	94.3% (95%CI 88.2-99.9) – 97% (95%CI 93-98)
Specific place for handwashing with water and soap present	12.4%	16.4% - 26.1%	20.0% - 24.8%
Nutrition			
Early breastfeeding within the first hour of life, in children 0-23 months	19.2% (95%CI: 17.5-21) (M: 18.4; F: 20.1)	8% (95%CI: 3.4-12.6) - 21.1%	3.4% (95%CI: 0.2-6.7) – 38%
Exclusive breastfeeding in children 0-5 months	27.2% (95%CI: 24.5-30) (M: 27.1; F: 27.3)	34.4%	63%
Minimum Acceptable Diet in children 6-23 months***	16.5% (95%CI: 15.1-17.9) (M: 16.4; F: 16.6)	5.1% - 13.9% (95%CI: 6.8-20.9)	18.3% (95%CI: 10.2-26.5)
Feeding during episodes of infection			52% less, 21% the same, 27% more
Children who received at least one dose of vitamin A supplement in the 6 months preceding the survey	40.8% (95%CI: 38.7-42.9) (M 40.8; F 40.8)	73.9% (95%CI: 63.8-84) - 84.3%	55.9% (95%CI: 48.4-63.4) – 76% (95%CI: 72-79)
Acute malnutrition (MUAC<125 mm and/or oedema)	4.7% (95%CI: 4.3-5.1) (M: 3.9; F: 5.5)	7.1% - 8.5% (95%CI: 5.9-12.1)	3.1% (95%CI: 1.8-5.4)
Immunization[^]			
PCV-10 Dose 1	64.4% (M 64.7, F 63.8)	31.9% (M 33.5, F 29.9)	79.2% (M 79.5, F 78.8)
PCV-10 Dose 2	49.7% (M 50.1, F 49.1)	14.5% (M 14.3, F 14.7)	66.5% (M 67.3, F 65.7)
PCV-10 Dose 3	37.5% (M 36.5, F 38.4)	7.9% (M 7.5, F 8.3)	54.3% (M 57.5, F 51.2)
Pentavalent Dose 1	69.9% (95%CI: 67.5-72.3) (M: 71.3; F: 68.5)	53.7% (95%CI: 43.4-64)	94.1% (95%CI: 87.6-100)
Pentavalent Dose 2	65.4% (95%CI: 62.9-68) (M: 66.5; F: 64.2)	49.5% (95%CI: 39.9-59.2)	94.1 (95%CI: 87.6-100)
Pentavalent Dose 3	57.2% (95%CI: 54.4-60) (M: 58.2; F: 56.2)	38.0% (95%CI: 29.5-46.5)	92.6 (95%CI: 83.7-100)
BCG	53.5% (M: 54; F: 53)	25.6%	93.0%
Rotavirus Dose 2			69% (95%CI: 65-73)

Grey shading indicates data represents the South-West or North-West region.

*The under-five population was obtained from the Nigeria National Population Estimates released in 2006 by the Nigerian National Bureau of Statistics, with projected populations in Lagos of 2,630,766, and in Jigawa of 1,215,689 in 2018.

**According to Rapid Diagnostic Test, in children 6-59 months' old

***The minimum acceptable diet indicator combines standards of dietary diversity and feeding frequency by breastfeeding status. Dietary diversity is calculated by using six food groups (excluding dairy products) at least four times a day and combining milk related products (formula milk, milk or yoghurt) at least two times/day.

[^]Either vaccination card or mother's report, in children 12-23 months

Table 2. Associations between household environment, caregiver characteristics, and child characteristics and ARI in Nigeria, Jigawa and Lagos, using the 2016/2017 Multiple Indicators Cluster Survey

Variables	NIGERIA (n=28,085)*			JIGAWA (n=1,399)*			LAGOS (n=1,054)*		
	Frequency (%)		aOR ³ (95% CI) N=25,991	Frequency (%)		aOR ³ (95% CI) N=1,308	Frequency (%)		aOR ³ (95% CI) N=972
	No ARI N=25,765	ARI N=2,207		No ARI N=1,333	ARI N=59		No ARI N=1,027	ARI N=37	
Household environment									
Cooking fuel									
Clean	5.2	3.2	1	0.3	-		30.47	32.61	1
Unclean	94.8	96.8	1.20 (0.83-1.73)	99.7	100		69.53	67.39	0.62 (0.14-2.77)
Crowding**									
Normal	19.9	18.0	1	10.4	14.1	1	41.54	62.70	1
Overcrowded	80.1	82.0	1.07 (0.91-1.27)	89.6	85.9	0.44 (0.17-1.18)	58.46	37.30	0.39 (0.13-1.14)
Wealth quintile									
Richest	18.1	14.2	1	5.8	2.8	1	83.33	80.44	1
Richer	18.4	17.5	1.00 (0.77-1.31)	6.0	8.5	1.35 (0.24-7.73)	14.85	18.21	0.33 (0.03-3.75)
Middle	19.7	21.0	1.10 (0.75-1.62)	8.7	5.5	0.20 (0.02-2.67)	1.81	1.35	1.05 (0.03-34.45)
Poorer	21.3	22.7	1.16 (0.77-1.74)	31.2	24.4	0.31 (0.05-2.00)			
Poorest	22.5	24.6	1.15 (0.77-1.72)	48.4	58.9	0.36 (0.06-2.38)	-	-	-
Type of residence									
Urban	30.4	30.9	1	15.8	12.6	1	95.42	94.32	1
Rural	69.6	69.1	0.76 (0.54-1.08)	84.2	87.4	0.85 (0.08-9.30)	4.58	5.68	2.13 (0.56-8.15)
Season									
Dry (Feb-Apr)	50.1	50.5	1	44.6	68.0	1	54.16	9.02	1
Rainy (May-Jul)	49.9	49.5	0.74 (0.60-0.91)*	55.4	32.0	0.21 (0.09-0.51)*	45.84	90.98	8.64 (1.79-41.72)*
Region									
North Central	16.7	13.6	1						
North East	20.4	33.8	1.79 (1.34-2.39)*						

North West	37.9	38.1	0.98 (0.74-1.30)						
South East	5.6	4.4	0.80 (0.59-1.08)						
South South	8.3	5.9	0.78 (0.58-1.07)						
South West	11.12	4.26	0.39 (0.27-0.58)*						
Caregiver characteristics									
Age									
15-19	4.2	5.7	1	4.8	9.1	1	66.6	78.7	1
20-34	67.4	68.6	0.75 (0.57-0.99)*	63.4	50.1	0.43 (0.15-1.25)			
35-44	24.6	23.2	0.73 (0.54-0.98)*	25.5	33.3	0.98 (0.31-3.10)	33.4	21.3	0.10 (0.01-1.87)
45-49	3.7	2.6	0.51 (0.33-0.80)*	6.4	7.5	0.60 (0.14-2.56)			
Education									
Secondary/higher	33.8	31.2	1	11.6	6.1	1	81.8	79.2	1
Primary	15.5	14.7	0.80 (0.61-1.05)	10.2	4.5	1.65 (0.13-20.38)	18.2	20.8	0.19 (0.03-1.19)
No education	29.2	26.9	0.63 (0.49-0.81)*	47.9	36.3	4.21 (0.45-39.72)			
Non-formal	21.6	27.2	0.78 (0.58-1.06)	30.4	53.1	6.39 (0.73-55.62)			
Religion									
Islam	66.7	75.3	1	90.5	97.5	1	65.8	32.6	1
Christianity	32.4	24.0	0.99 (0.80-1.22)	9.5	2.5	0.21 (0.04-1.19)	34.2	67.4	0.34 (0.17-0.68)*
Other	0.9	0.8	1.10 (0.55-2.21)	-	-	-			
Marital status									
Not married	3.5	3.2	1	1.1	-		4.78	-	
Married	96.5	96.8	1.00 (0.65-1.54)	98.9	100		95.22	100	
Knowledge ARI symptoms									
None of the symptoms	61.2	55.0	1	61.0	48.2	1	68.8	79.0	1
Only one	24.1	27.2	1.29 (1.10-1.51)*	31.7	44.3	1.99 (0.97-4.10)	19.3	5.5	0.39 (0.04-3.73)
The two	14.8	17.9	1.15 (0.90-1.47)	7.3	7.6	1.11 (0.31-4.06)	11.9	15.5	1.41 (0.27-7.44)
Child characteristics									
Age (months)									
24-59	61.1	61.6	1	58.5	59.5	1	61.3	59.6	1

12-23	19.6	21.1	0.96 (0.83-1.11)	22.0	21.7	1.35 (0.63-2.89)	20.8	30.1	0.41 (0.05-3.52)
2-11	16.3	16.7	1.01 (0.84-1.21)	19.5	18.8	0.76 (0.32-1.82)	17.9	10.2	0.37 (0.07-2.11)
0-1	3.0	0.7	0.29 (0.16-0.52)*						
Sex									
Male	50.5	51.9	1	51.0	41.7	1	49.7	48.2	1
Female	49.5	48.1	0.95 (0.84-1.08)	49.0	58.4	1.53 (0.89-2.64)	50.3	51.8	2.59 (0.68-9.83)
Diarrhoea in the last 2-weeks									
No	86.8	72.1	1	82.9	58.4	1	94.0	71.1	1
Yes	13.2	27.9	1.60 (1.32-1.94)*	17.1	41.7	2.55 (1.46-4.45)*	6.0	28.9	0.85 (0.13-5.40)
Fever in the last 2-weeks									
No	76.9	46.4	1	70.1	33.8	1	90.7	62.6	1
Yes	23.1	53.6	3.25 (2.81-3.76)*	29.9	66.2	7.18 (3.17-16.27)*	9.3	37.4	3.93 (0.94-16.42)

*Weighted estimated population; ** More than 5 members.

Underweight, stunting and wasting were not included due to missing data. Vaccine status was not included as complete vaccine status was missing for children under 1 year of age.

Table 3. Description of complete vaccination coverage in children aged 12-59 months by household environment and caregiver characteristics in Nigeria, Jigawa and Lagos State, using the data from the 2016-2017 Multiple Indicators Cluster Survey

	NIGERIA				JIGAWA				LAGOS			
	N ² =22,722				N ² =1,127				N ² =867			
	No vaccine	Incomplete	Complete	n	No vaccine	Incomplete	Complete	n	No vaccine	Incomplete	Complete	n
Wealth quintile												
Richest	1.5	44.1	54.3	4097	-	100	-	75	-	41.2	58.8	717
Richer	4.7	48.0	47.4	4160	6.1	63.9	30.0	63	4.6	42.6	52.8	132
Middle	10.7	52.5	37.1	4483	-	92.2	7.8	92	-	69.9	30.1	17
Poorer	24.3	48.1	27.6	4831	36.5	54.9	8.6	359	-	-	100	7
Poorest	43.8	40.9	15.4	5151	50.4	46.5	3.2	538	-	-	-	-
Education												
Secondary/tertiary	2.5	47.3	50.2	7562	5.2	85.9	8.8	133	-	40.1	59.9	702
Primary	8.3	48.8	42.9	3522	44.0	46.4	9.7	112	-	51.6	48.4	116
No education	27.5	49.2	23.3	6633	30.0	63.0	7.0	518	11.5	44.2	44.3	47
Non-formal	36.3	51.6	12.1	5003	49.3	47.6	3.2	364	-	100	-	2
Marital status												
Not married	3.4	42.2	54.5	748	55.6	44.4	-	8	-	51.0	49.0	46
Married	13.6	48.6	37.7	20165	31.8	61.8	6.4	1044	0.8	41.4	57.8	798
Knowledge of the two main ARI symptoms												
None of them	15.0	48.7	36.4	12954	28.6	68.5	2.9	617	-	48.1	51.9	579
One	13.1	47.5	39.5	5267	36.9	55.2	7.9	351	3.5	30.6	65.9	165
Both	5.6	49.2	45.2	3256	34.3	34.0	31.7	83	-	29.6	70.4	100
Sex of the child												
Male	12.8	50.2	37.0	11531	27.1	65.3	7.6	582	1.5	37.4	61.1	437
Female	13.2	46.7	40.2	11191	37.2	57.6	5.1	545	-	46.0	54.0	430
Children under-five in the household												

1	9.4	46.3	44.3	6437	31.2	64.6	4.2	243	-	37.7	62.3	394
2	12.4	48.7	39.0	9500	31.8	58.1	10.1	434	-	46.1	53.9	405
3	18.5	52.6	28.9	4042	36.5	59.2	4.3	260	10.9	41.4	47.7	67
4 or more	22.1	49.5	28.5	2740	23.3	73.7	3.0	190	-	-	-	1
Religion												
Christianity	4.3	46.0	49.8	7226	36.1	63.9	-	104	-	45.0	55.0	561
Islam	20.0	50.4	29.6	15299	31.3	61.5	7.2	1023	2.1	35.8	62.1	305
Other	4.6	51.9	43.4	195	-	-	-	-	-	-	100	1
Age of the mother												
15-19	24.1	49.7	26.2	720	54.2	45.8	-	48	-	10.0	90.0	8
20-34	12.2	49.1	38.7	14288	25.6	67.4	7.0	660	-	42.3	57.7	538
35-44	13.8	46.4	39.8	5496	51.5	45.2	3.4	267	2.6	45.0	52.4	276
45-49	18.2	43.5	38.2	845	21.5	65.1	13.4	77	-	12.8	87.2	21

¹Three recommended doses of Diphtheria, Pertussis, Tetanus, *Hemophilus Influenza* Type B and Hepatitis B or Pentavalent vaccine and a recommended single dose of Bacillus Calmette-Guérin or BCG vaccine; ²Weighted estimated population; ^aThe two main ARI symptoms are fast and difficult breathing; ^bOnly eligible 1-year olds or older