Supplementary Table 1. Coverage of MITS and analytic inclusion among CHAMPS-eligible (HDSS-detected) deaths, by site and age group — CHAMPS, 2016–2024

Site	Age group	Eligible HDSS-detected deaths, N	Enrolled in CHAMPS, n (%N)	MITS conducted, n (%N)	Included in analysis (MITS+DeCoDe), n (%N)
Bangladesh	Stillbirth	1722	1261 (73.2)	631 (36.6)	543 (31.5)
Bangladesh	Neonate	2635	1173 (44.5)	547 (20.8)	485 (18.4)
Bangladesh	Infant/Child	518	316 (61.0)	22 (4.2)	15 (2.9)
Ethiopia	Stillbirth	1323	1281 (96.8)	840 (63.5)	761 (57.5)
Ethiopia	Neonate	1126	1046 (92.9)	482 (42.8)	415 (36.9)
Ethiopia	Infant/Child	1052	994 (94.5)	176 (16.7)	142 (13.5)
Kenya	Stillbirth	512	484 (94.5)	434 (84.8)	381 (74.4)
Kenya	Neonate	530	497 (93.8)	435 (82.1)	380 (71.7)
Kenya	Infant/Child	807	723 (89.6)	648 (80.3)	558 (69.1)
Mali	Stillbirth	652	652 (100.0)	277 (42.5)	276 (42.3)
Mali	Neonate	629	629 (100.0)	306 (48.6)	305 (48.5)
Mali	Infant/Child	490	487 (99.4)	168 (34.3)	168 (34.3)
Mozambique	Stillbirth	876	841 (96.0)	600 (68.5)	561 (64.0)
Mozambique	Neonate	1131	1109 (98.1)	721 (63.7)	655 (57.9)
Mozambique	Infant/Child	871	850 (97.6)	320 (36.7)	299 (34.3)
Sierra Leone	Stillbirth	439	398 (90.7)	340 (77.4)	303 (69.0)
Sierra Leone	Neonate	575	504 (87.7)	422 (73.4)	374 (65.0)
Sierra Leone	Infant/Child	810	693 (85.6)	568 (70.1)	506 (62.5)
South Africa	Stillbirth	611	454 (74.3)	407 (66.6)	374 (61.2)
South Africa	Neonate	901	741 (82.2)	651 (72.3)	616 (68.4)
South Africa	Infant/Child	574	479 (83.4)	420 (73.2)	383 (66.7)

Supplementary Table 2. Most frequent causes of death by underlying or immediate/antecedent cause among stillbirths, neonates, and infants/children across CHAMPS sites — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.

	Underlying cause of death				Immediate/Antecedent cause of death			
	Stillbirth	Neonate	Infant/Child	Overall	Stillbirth	Neonate	Infant/Child	Overall
Cause of death	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**	**No. (%)**
Perinatal asphyxia/hypoxia	2376 (74.3)	1046 (32.4)	3 (0.1)	3425 (40.3)	153 (4.8)	174 (5.4)	1 (0.0)	328 (3.9)
Sepsis	121 (3.8)	320 (9.9)	100 (4.8)	541 (6.4)	26 (0.8)	872 (27.0)	670 (32.4)	1568 (18.4)
Neonatal preterm birth complications	7 (0.2)	1120 (34.7)	75 (3.6)	1202 (14.1)	14 (0.4)	472 (14.6)	27 (1.3)	513 (6.0)
Lower respiratory infections	2 (0.1)	84 (2.6)	188 (9.1)	274 (3.2)	0 (0.0)	305 (9.4)	596 (28.8)	901 (10.6)
Congenital birth defects	286 (8.9)	225 (7.0)	157 (7.6)	668 (7.9)	6 (0.2)	33 (1.0)	21 (1.0)	60 (0.7)
Malnutrition	0 (0.0)	6 (0.2)	431 (20.8)	437 (5.1)	0 (0.0)	3 (0.1)	135 (6.5)	138 (1.6)
Malaria	0 (0.0)	1 (0.0)	321 (15.5)	322 (3.8)	0 (0.0)	1 (0.0)	139 (6.7)	140 (1.6)
Meningitis/Encephalitis	1 (0.0)	13 (0.4)	11 (0.5)	25 (0.3)	4 (0.1)	237 (7.3)	145 (7.0)	386 (4.5)
Diarrheal Diseases	0 (0.0)	2 (0.1)	156 (7.5)	158 (1.9)	0 (0.0)	1 (0.0)	206 (9.9)	207 (2.4)
Other neonatal disorders	61 (1.9)	53 (1.6)	18 (0.9)	132 (1.6)	18 (0.6)	201 (6.2)	19 (0.9)	238 (2.8)
Congenital infection	87 (2.7)	99 (3.1)	8 (0.4)	194 (2.3)	7 (0.2)	87 (2.7)	4 (0.2)	98 (1.2)
Anemias	0 (0.0)	0 (0.0)	2 (0.1)	2 (0.0)	0 (0.0)	14 (0.4)	232 (11.2)	246 (2.9)
Neonatal aspiration syndromes	3 (0.1)	79 (2.4)	0 (0.0)	82 (1.0)	2 (0.1)	91 (2.8)	0 (0.0)	93 (1.1)
Other infections	6 (0.2)	16 (0.5)	44 (2.1)	66 (0.8)	2 (0.1)	18 (0.6)	85 (4.1)	105 (1.2)
Other respiratory disease	0 (0.0)	5 (0.2)	41 (2.0)	46 (0.5)	0 (0.0)	23 (0.7)	95 (4.6)	118 (1.4)
HIV	0 (0.0)	3 (0.1)	158 (7.6)	162 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Other endocrine, metabolic, blood, and immune disorders	0 (0.0)	3 (0.1)	11 (0.5)	14 (0.2)	0 (0.0)	12 (0.4)	105 (5.1)	117 (1.4)
Neonatal encephalopathy	0 (0.0)	29 (0.9)	2 (0.1)	31 (0.4)	0 (0.0)	91 (2.8)	1 (0.0)	92 (1.1)
Other	2 (0.1)	8 (0.2)	16 (0.8)	26 (0.3)	1 (0.0)	26 (0.8)	37 (1.8)	64 (0.8)
Injury	0 (0.0)	2 (0.1)	77 (3.7)	79 (0.9)	0 (0.0)	1 (0.0)	9 (0.4)	10 (0.1)
Other neurological disorders	0 (0.0)	2 (0.1)	13 (0.6)	15 (0.2)	0 (0.0)	12 (0.4)	21 (1.0)	33 (0.4)
Syphilis	27 (0.8)	13 (0.4)	4 (0.2)	44 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)
Liver disease	0 (0.0)	3 (0.1)	10 (0.5)	13 (0.2)	0 (0.0)	4 (0.1)	14 (0.7)	18 (0.2)
Sickle cell disorders	0 (0.0)	0 (0.0)	25 (1.2)	25 (0.3)	0 (0.0)	0 (0.0)	3 (0.1)	3 (0.0)
Poisoning	1 (0.0)	0 (0.0)	16 (0.8)	17 (0.2)	0 (0.0)	0 (0.0)	8 (0.4)	8 (0.1)
Tuberculosis	0 (0.0)	0 (0.0)	16 (0.8)	16 (0.2)	0 (0.0)	0 (0.0)	10 (0.5)	10 (0.1)
Kidney Disease	1 (0.0)	1 (0.0)	2 (0.1)	4 (0.0)	0 (0.0)	10 (0.3)	7 (0.3)	17 (0.2)
Heart Diseases	0 (0.0)	1 (0.0)	3 (0.1)	4 (0.0)	0 (0.0)	0 (0.0)	14 (0.7)	14 (0.2)
Placental complications	12 (0.4)	2 (0.1)	0 (0.0)	14 (0.2)	1 (0.0)	2 (0.1)	0 (0.0)	3 (0.0)
Cancer	1 (0.0)	0 (0.0)	14 (0.7)	15 (0.2)	0 (0.0)	0 (0.0)	2 (0.1)	2 (0.0)
Measles	0 (0.0)	1 (0.0)	8 (0.4)	9 (0.1)	0 (0.0)	0 (0.0)	5 (0.2)	5 (0.1)
Other nutritional deficiencies	0 (0.0)	0 (0.0)	11 (0.5)	11 (0.1)	0 (0.0)	0 (0.0)	3 (0.1)	3 (0.0)
Other disorders of fluid, electrolyte and acid-base balance	0 (0.0)	1 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)	2 (0.1)	10 (0.5)	12 (0.1)
Paralytic ileus and intestinal obstruction	0 (0.0)	0 (0.0)	6 (0.3)	6 (0.1)	0 (0.0)	2 (0.1)	7 (0.3)	9 (0.1)
Other immunodeficiencies	0 (0.0)	0 (0.0)	9 (0.4)	9 (0.1)	0 (0.0)	0 (0.0)	3 (0.1)	3 (0.0)
Undetermined	182 (5.7)	78 (2.4)	84 (4.1)	344 (4.0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	**3199 (100.0)**	**3230 (100.0)**	**2071 (100.0)**	**8500 (100.0)†**	**3199 (100.0)**	**3230 (100.0)**	**2071 (100.0)**	**8500 (100.0)†**

***** All causes of death implicated in at least ten deaths across all sites are shown by age group.

† Deaths could have multiple causes in the causal chain, therefore the sum is greater than the total.

Supplementary Table 3. Pathogens identified in infectious* deaths with ≥1 pathogen detected in the causal chain†, by causal-chain position (underlying vs immediate/antecedent) and age group — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.

	Underlying cause of death				Immediate/Antecedent cause of death			
Pathogen	Stillbirth No. (%)	Neonate No. (%)	Infant/Child No. (%)	Overall No. (%)	Stillbirth No. (%)	Neonate No. (%)	Infant/Child No. (%)	Overall No. (%)
Gram negative bacteria	**115 (56.7)**	**283 (67.4)**	**192 (23.6)**	**590 (41.1)**	**22 (62.9)**	**859 (89.9)**	**705 (67.0)**	**1586 (77.6)**
Klebsiella pneumoniae	15 (7.4)	152 (36.2)	78 (9.6)	245 (17.1)	8 (22.9)	483 (50.5)	417 (39.6)	908 (44.4)
Escherichia coli/Shigella spp.	54 (26.6)	61 (14.5)	49 (6.0)	164 (11.4)	17 (48.6)	134 (14.0)	198 (18.8)	349 (17.1)
Acinetobacter baumannii	0 (0)	30 (7.1)	6 (0.7)	36 (2.5)	0 (0)	298 (31.2)	88 (8.4)	386 (18.9)
Pseudomonas aeruginosa	1 (0.5)	20 (4.8)	2 (0.2)	23 (1.6)	0 (0)	72 (7.5)	81 (7.7)	153 (7.5)
*Haemophilus influenzae (*HIAT detected; Hib target not detected)§	5 (2.5)	8 (1.9)	32 (3.9)	45 (3.1)	0 (0)	8 (0.8)	105 (10.0)	113 (5.5)
Salmonella spp.	1 (0.5)	6 (1.4)	10 (1.2)	17 (1.2)	0 (0)	27 (2.8)	35 (3.3)	62 (3.0)
Enterobacter cloacae	4 (2.0)	12 (2.9)	1 (0.1)	17 (1.2)	0 (0)	24 (2.5)	16 (1.5)	40 (2.0)
Moraxella catarrhalis	0 (0)	5 (1.2)	7 (0.9)	12 (0.8)	0 (0)	2 (0.2)	41 (3.9)	43 (2.1)
Treponema pallidum	29 (14.3)	14 (3.3)	4 (0.5)	47 (3.3)	0 (0)	0 (0)	0 (0)	0 (0)
Ureaplasma spp.	13 (6.4)	12 (2.9)	0 (0)	25 (1.7)	0 (0)	15 (1.6)	2 (0.2)	17 (0.8)
Serratia marcescens	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	36 (3.8)	4 (0.4)	40 (2.0)
Pantoea spp.	0 (0)	6 (1.4)	0 (0)	6 (0.4)	0 (0)	21 (2.2)	1 (0.1)	22 (1.1)
Haemophilus influenzae (Hib target detected by TAC [HITB])§	0 (0)	0 (0)	6 (0.7)	6 (0.4)	0 (0)	0 (0)	16 (1.5)	16 (0.8)
Klebsiella spp.	0 (0)	0 (0)	1 (0.1)	1 (0.1)	0 (0)	7 (0.7)	7 (0.7)	14 (0.7)
Neisseria meningitidis	0 (0)	0 (0)	3 (0.4)	3 (0.2)	0 (0)	4 (0.4)	7 (0.7)	11 (0.5)
Campylobacter jejuni	0 (0)	0 (0)	4 (0.5)	4 (0.3)	0 (0)	0 (0)	7 (0.7)	7 (0.3)
Aeromonas spp.	0 (0)	0 (0)	1 (0.1)	1 (0.1)	0 (0)	3 (0.3)	6 (0.6)	9 (0.4)
Bordetella pertussis	0 (0)	2 (0.5)	6 (0.7)	8 (0.6)	0 (0)	0 (0)	3 (0.3)	3 (0.1)
Shigella spp.	0 (0)	1 (0.2)	2 (0.2)	3 (0.2)	0 (0)	1 (0.1)	7 (0.7)	8 (0.4)
Klebsiella oxytoca	1 (0.5)	1 (0.2)	0 (0)	2 (0.1)	1 (2.9)	3 (0.3)	4 (0.4)	8 (0.4)
Bordetella spp.	0 (0)	1 (0.2)	4 (0.5)	5 (0.3)	0 (0)	1 (0.1)	2 (0.2)	3 (0.1)
Burkholderia cepacia	0 (0)	2 (0.5)	0 (0)	2 (0.1)	0 (0)	4 (0.4)	2 (0.2)	6 (0.3)
Proteus mirabilis	0 (0)	1 (0.2)	0 (0)	1 (0.1)	0 (0)	3 (0.3)	4 (0.4)	7 (0.3)
Vibrio cholerae	0 (0)	1 (0.2)	3 (0.4)	4 (0.3)	0 (0)	1 (0.1)	3 (0.3)	4 (0.2)
Citrobacter freundii	0 (0)	2 (0.5)	0 (0)	2 (0.1)	0 (0)	0 (0)	4 (0.4)	4 (0.2)
Morganella morganii	0 (0)	2 (0.5)	0 (0)	2 (0.1)	0 (0)	0 (0)	3 (0.3)	3 (0.1)
Serratia liquefaciens	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (0.5)	0 (0)	5 (0.2)
Other¶	6 (3.0)	16 (3.8)	15 (1.8)	37 (2.6)	0 (0)	26 (2.7)	38 (3.6)	64 (3.1)
Gram positive bacteria	**94 (46.3)**	**122 (29.0)**	**140 (17.2)**	**356 (24.8)**	**18 (51.4)**	**195 (20.4)**	**431 (41.0)**	**644 (31.5)**
Streptococcus pneumoniae	3 (1.5)	22 (5.2)	77 (9.5)	102 (7.1)	2 (5.7)	20 (2.1)	258 (24.5)	280 (13.7)
Staphylococcus aureus	2 (1.0)	16 (3.8)	14 (1.7)	32 (2.2)	1 (2.9)	39 (4.1)	89 (8.5)	129 (6.3)
Streptococcus agalactiae	51 (25.1)	47 (11.2)	3 (0.4)	101 (7.0)	4 (11.4)	35 (3.7)	9 (0.9)	48 (2.3)
Streptococcus spp.	11 (5.4)	11 (2.6)	14 (1.7)	36 (2.5)	4 (11.4)	20 (2.1)	38 (3.6)	62 (3.0)
Enterococcus faecalis	21 (10.3)	5 (1.2)	4 (0.5)	30 (2.1)	3 (8.6)	29 (3.0)	28 (2.7)	60 (2.9)
Enterococcus faecium	1 (0.5)	3 (0.7)	10 (1.2)	14 (1.0)	0 (0)	32 (3.3)	27 (2.6)	59 (2.9)
Streptococcus pyogenes	1 (0.5)	10 (2.4)	5 (0.6)	16 (1.1)	2 (5.7)	8 (0.8)	21 (2.0)	31 (1.5)
Mycobacterium tuberculosis	0 (0)	0 (0)	16 (2.0)	16 (1.1)	0 (0)	0 (0)	8 (0.8)	8 (0.4)
Enterococcus spp.	3 (1.5)	2 (0.5)	2 (0.2)	7 (0.5)	3 (8.6)	6 (0.6)	3 (0.3)	12 (0.6)
Coagulase negative Staphylococcus	3 (1.5)	1 (0.2)	0 (0)	4 (0.3)	0 (0)	5 (0.5)	2 (0.2)	7 (0.3)

Staphylococcus spp.	0 (0)	3 (0.7)	0 (0)	3 (0.2)	0 (0)	5 (0.5)	4 (0.4)	9 (0.4)
Listeria monocytogenes	1 (0.5)	6 (1.4)	0 (0)	7 (0.5)	0 (0)	4 (0.4)	0 (0)	4 (0.2)
Viridans streptococcus	1 (0.5)	1 (0.2)	0 (0)	2 (0.1)	0 (0)	1 (0.1)	6 (0.6)	7 (0.3)
Other¶	6 (3.0)	6 (1.4)	2 (0.2)	14 (1.0)	0 (0)	12 (1.3)	3 (0.3)	15 (0.7)
Virus	**26 (12.8)**	**39 (9.3)**	**305 (37.5)**	**370 (25.8)**	**2 (5.7)**	**27 (2.8)**	**258 (24.5)**	**287 (14.0)**
Cytomegalovirus	23 (11.3)	17 (4.0)	30 (3.7)	70 (4.9)	1 (2.9)	6 (0.6)	109 (10.4)	116 (5.7)
Human Immunodeficiency Virus	0 (0)	3 (0.7)	155 (19.1)	158 (11.0)	0 (0)	0 (0)	0 (0)	0 (0)
Adenovirus	0 (0)	0 (0)	42 (5.2)	42 (2.9)	1 (2.9)	0 (0)	50 (4.8)	51 (2.5)
Respiratory syncytial virus	0 (0)	6 (1.4)	15 (1.8)	21 (1.5)	0 (0)	7 (0.7)	28 (2.7)	35 (1.7)
Rotavirus A	0 (0)	0 (0)	17 (2.1)	17 (1.2)	0 (0)	0 (0)	11 (1.0)	11 (0.5)
Rhinovirus	0 (0)	0 (0)	4 (0.5)	4 (0.3)	0 (0)	1 (0.1)	14 (1.3)	15 (0.7)
Parainfluenza virus type 3	0 (0)	0 (0)	2 (0.2)	2 (0.1)	0 (0)	2 (0.2)	13 (1.2)	15 (0.7)
Measles	1 (0.5)	1 (0.2)	7 (0.9)	9 (0.6)	0 (0)	1 (0.1)	8 (0.8)	9 (0.4)
Rotavirus non-typable	0 (0)	0 (0)	11 (1.4)	11 (0.8)	0 (0)	0 (0)	4 (0.4)	4 (0.2)
Influenza A	0 (0)	0 (0)	2 (0.2)	2 (0.1)	0 (0)	0 (0)	10 (1.0)	10 (0.5)
SARS-CoV-2	0 (0)	3 (0.7)	2 (0.2)	5 (0.3)	0 (0)	3 (0.3)	4 (0.4)	7 (0.3)
Parvovirus B19	1 (0.5)	1 (0.2)	4 (0.5)	6 (0.4)	0 (0)	1 (0.1)	4 (0.4)	5 (0.2)
Enterovirus	0 (0)	1 (0.2)	3 (0.4)	4 (0.3)	0 (0)	1 (0.1)	4 (0.4)	5 (0.2)
Human metapneumovirus	0 (0)	1 (0.2)	4 (0.5)	5 (0.3)	0 (0)	0 (0)	4 (0.4)	4 (0.2)
Norovirus GII	0 (0)	0 (0)	7 (0.9)	7 (0.5)	0 (0)	0 (0)	2 (0.2)	2 (0.1)
Influenza B	0 (0)	0 (0)	3 (0.4)	3 (0.2)	0 (0)	1 (0.1)	3 (0.3)	4 (0.2)
Parainfluenza virus type 1	0 (0)	0 (0)	1 (0.1)	1 (0.1)	0 (0)	0 (0)	6 (0.6)	6 (0.3)
Norovirus GI	0 (0)	0 (0)	3 (0.4)	3 (0.2)	0 (0)	0 (0)	3 (0.3)	3 (0.1)
Other¶	1 (0.5)	7 (1.4)	26 (3.2)	34 (2.4)	0 (0)	5 (0.5)	28 (2.7)	33 (1.6)
Fungus	**0 (0)**	**12 (2.9)**	**12 (1.5)**	**24 (1.7)**	**0 (0)**	**57 (6.0)**	**98 (9.3)**	**155 (7.6)**
Candida albicans	0 (0)	6 (1.4)	1 (0.1)	7 (0.5)	0 (0)	28 (2.9)	27 (2.6)	55 (2.7)
Pneumocystis jirovecii	0 (0)	0 (0)	11 (1.4)	11 (0.8)	0 (0)	0 (0)	43 (4.1)	43 (2.1)
Candida spp.	0 (0)	4 (1.0)	0 (0)	4 (0.3)	0 (0)	7 (0.7)	16 (1.5)	23 (1.1)
Candida parapsilosis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (0.6)	6 (0.6)	12 (0.6)
Candida auris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (0.6)	4 (0.4)	10 (0.5)
Candida glabrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (0.7)	0 (0)	7 (0.3)
Other¶	0 (0)	6 (1.4)	0 (0)	6 (0.4)	0 (0)	5 (0.5)	4 (0.4)	9 (0.4)
Parasite	**1 (0.5)**	**7 (1.7)**	**281 (34.6)**	**289 (20.1)**	**0 (0)**	**2 (0.2)**	**140 (13.3)**	**142 (7.0)**
Plasmodium falciparum	1 (0.5)	4 (1.0)	279 (34.3)	284 (19.8)	0 (0)	1 (0.1)	130 (12.4)	131 (6.4)
Other¶	0 (0)	3 (0.7)	2 (0.2)	5 (0.3)	0 (0)	1 (0.1)	10 (1.0)	11 (0.5)
Total	**203 (100.0)**	**420 (100.0)**	**813 (100.0)**	**1436 (100.0)**	**35 (100.0)**	**956 (100.0)**	**1052 (100.0)**	**2043 (100.0)****

***** Infectious deaths were defined as deaths in which infectious causes were identified in the causal chain of death (sepsis, meningitis/encephalitis, lower respiratory infections, upper respiratory infections, diarrheal diseases with pathogens identified, malaria, HIV, measles, rabies, syphilis, tuberculosis, congenital infections, other specified infections).

† Denominators for the Underlying columns are restricted to infectious deaths with ≥1 pathogen identified as an underlying cause (position-specific). Denominators for the Immediate/Antecedent columns are restricted to infectious deaths with ≥1 pathogen identified as an immediate or antecedent cause (position-specific).

§ CHAMPS TAC includes a pan–*H. influenzae* assay (HIAT) that detects encapsulated (a–f) and non-encapsulated strains and a Hib-target assay (HITB) intended for type b (with rare cross-reactivity with type a). HITB positivity does not exclude mixed types; HIAT positivity without HITB does not distinguish non-encapsulated from non-b encapsulated strains. Therefore, results are reported as “Hib target detected by TAC” or “HIAT detected; Hib target not detected,” rather than definitive serotype.

¶ Individual pathogens with fewer than five detections are summarized as “Other.”

** Deaths could have multiple pathogens in the causal chain, therefore the sum is greater than the total.

Supplementary Table 4. Main maternal conditions* associated with stillbirths by CHAMPS site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.

Maternal condition	Bangladesh No. (%)	Ethiopia No. (%)	Kenya No. (%)	Mali No. (%)	Mozambique No. (%)	Sierra Leone No. (%)	South Africa No. (%)	Overall No. (%)
M1: Complications of placenta, cord, and membranes	**128 (23.6)**	**139 (18.3)**	**101 (26.5)**	**112 (40.6)**	**173 (30.8)**	**91 (30.0)**	**147 (39.3)**	**891 (27.9)**
Placental complications	85 (15.7)	90 (11.8)	42 (11.0)	92 (33.3)	89 (15.9)	61 (20.1)	80 (21.4)	539 (16.8)
Chorioamnionitis and membrane complications	20 (3.7)	20 (2.6)	40 (10.5)	10 (3.6)	50 (8.9)	18 (5.9)	62 (16.6)	220 (6.9)
Umbilical cord complications	22 (4.1)	22 (2.9)	16 (4.2)	10 (3.6)	30 (5.3)	8 (2.6)	4 (1.1)	112 (3.5)
Prolapsed cord	1 (0.2)	7 (0.9)	3 (0.8)	0 (0)	4 (0.7)	4 (1.3)	1 (0.3)	20 (0.6)
M2: Maternal complications of pregnancy	**39 (7.2)**	**39 (5.1)**	**23 (6.0)**	**36 (13.0)**	**12 (2.1)**	**12 (4.0)**	**7 (1.9)**	**168 (5.3)**
Multiple gestation	10 (1.8)	20 (2.6)	4 (1.0)	22 (8)	2 (0.4)	10 (3.3)	4 (1.1)	72 (2.3)
Premature rupture of membranes	5 (0.9)	15 (2.0)	6 (1.6)	6 (2.2)	5 (0.9)	1 (0.3)	1 (0.3)	39 (1.2)
Other factor (M2)	5 (0.9)	3 (0.4)	12 (3.1)	7 (2.5)	1 (0.2)	1 (0.3)	0 (0)	29 (0.9)
Uterine fluid disorders	18 (3.3)	1 (0.1)	0 (0)	1 (0.4)	4 (0.7)	0 (0)	0 (0)	24 (0.8)
Cervical insufficiency and pelvic anomalies	1 (0.2)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)	2 (0.5)	4 (0.1)
M3: Other complications of labor and delivery	**44 (8.1)**	**61 (8)**	**46 (12.1)**	**21 (7.6)**	**113 (20.1)**	**49 (16.2)**	**11 (2.9)**	**345 (10.8)**
Obstructed labor and fetal malpresentation	5 (0.9)	40 (5.3)	12 (3.1)	14 (5.1)	48 (8.6)	39 (12.9)	2 (0.5)	160 (5.0)
Other factor (M3)	28 (5.2)	9 (1.2)	10 (2.6)	3 (1.1)	58 (10.3)	9 (3)	4 (1.1)	121 (3.8)
Uterine rupture	10 (1.8)	10 (1.3)	6 (1.6)	2 (0.7)	6 (1.1)	1 (0.3)	2 (0.5)	37 (1.2)
Obstructed labor	1 (0.2)	1 (0.1)	14 (3.7)	1 (0.4)	0 (0)	0 (0)	0 (0)	17 (0.5)
Preterm labor or delivery	0 (0)	1 (0.1)	4 (1.0)	1 (0.4)	0 (0)	0 (0)	3 (0.8)	9 (0.3)
Cesarean delivery	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	1 (0)
M4: Maternal medical and surgical conditions	**197 (36.3)**	**109 (14.3)**	**97 (25.5)**	**48 (17.4)**	**94 (16.8)**	**62 (20.5)**	**141 (37.7)**	**748 (23.4)**
Maternal hypertension	98 (18.0)	96 (12.6)	72 (18.9)	33 (12)	84 (15)	52 (17.2)	102 (27.3)	537 (16.8)
Maternal infection	30 (5.5)	3 (0.4)	7 (1.8)	4 (1.4)	2 (0.4)	3 (1.0)	22 (5.9)	71 (2.2)
Other factor (M4)	33 (6.1)	1 (0.1)	4 (1.0)	1 (0.4)	8 (1.4)	1 (0.3)	6 (1.6)	54 (1.7)
Maternal diabetes	24 (4.4)	6 (0.8)	4 (1.0)	6 (2.2)	0 (0)	0 (0)	6 (1.6)	46 (1.4)
HIV	0 (0)	0 (0)	6 (1.6)	0 (0)	0 (0)	4 (1.3)	2 (0.5)	12 (0.4)
Maternal injury and accident	5 (0.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.5)	7 (0.2)
Maternal nutritional disorders	3 (0.6)	0 (0)	1 (0.3)	1 (0.4)	0 (0)	0 (0)	0 (0)	5 (0.2)
Maternal circulatory and respiratory diseases	2 (0.4)	1 (0.1)	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	4 (0.1)
Sickle cell disorders	0 (0)	0 (0)	1 (0.3)	1 (0.4)	0 (0)	1 (0.3)	0 (0)	3 (0.1)
Anemias	0 (0)	0 (0)	2 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.1)
Heart Diseases	1 (0.2)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.1)
Obesity	0 (0)	0 (0)	0 (0)	2 (0.7)	0 (0)	0 (0)	0 (0)	2 (0.1)
Other endocrine, metabolic, blood, and immune disorders	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	2 (0.1)
Liver disease	0 (0)	1 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
M5: No maternal condition	**105 (19.3)**	**403 (53)**	**84 (22)**	**44 (15.9)**	**155 (27.6)**	**82 (27.1)**	**53 (14.2)**	**926 (28.9)**
Other	**30 (5.5)**	**10 (1.3)**	**30 (7.9)**	**15 (5.4)**	**14 (2.5)**	**7 (2.3)**	**15 (4.0)**	**121 (3.8)**
Total	**543 (100.0)**	**761 (100.0)**	**381 (100.0)**	**276 (100.0)**	**561 (100.0)**	**303 (100.0)**	**374 (100.0)**	**3199 (100.0)†**

* Subcategories within M1–M4 reflect CHAMPS standard reporting groupings mapped to ICD-PM maternal-condition groups. ICD-PM entries related to procedures (e.g., "surgical procedure/other medical procedures") are not shown separately because procedures are not tabulated as maternal-condition subcategories in this report.

† Each death was assigned one main maternal condition in the causal chain, as determined by the CHAMPS DeCoDe panel.

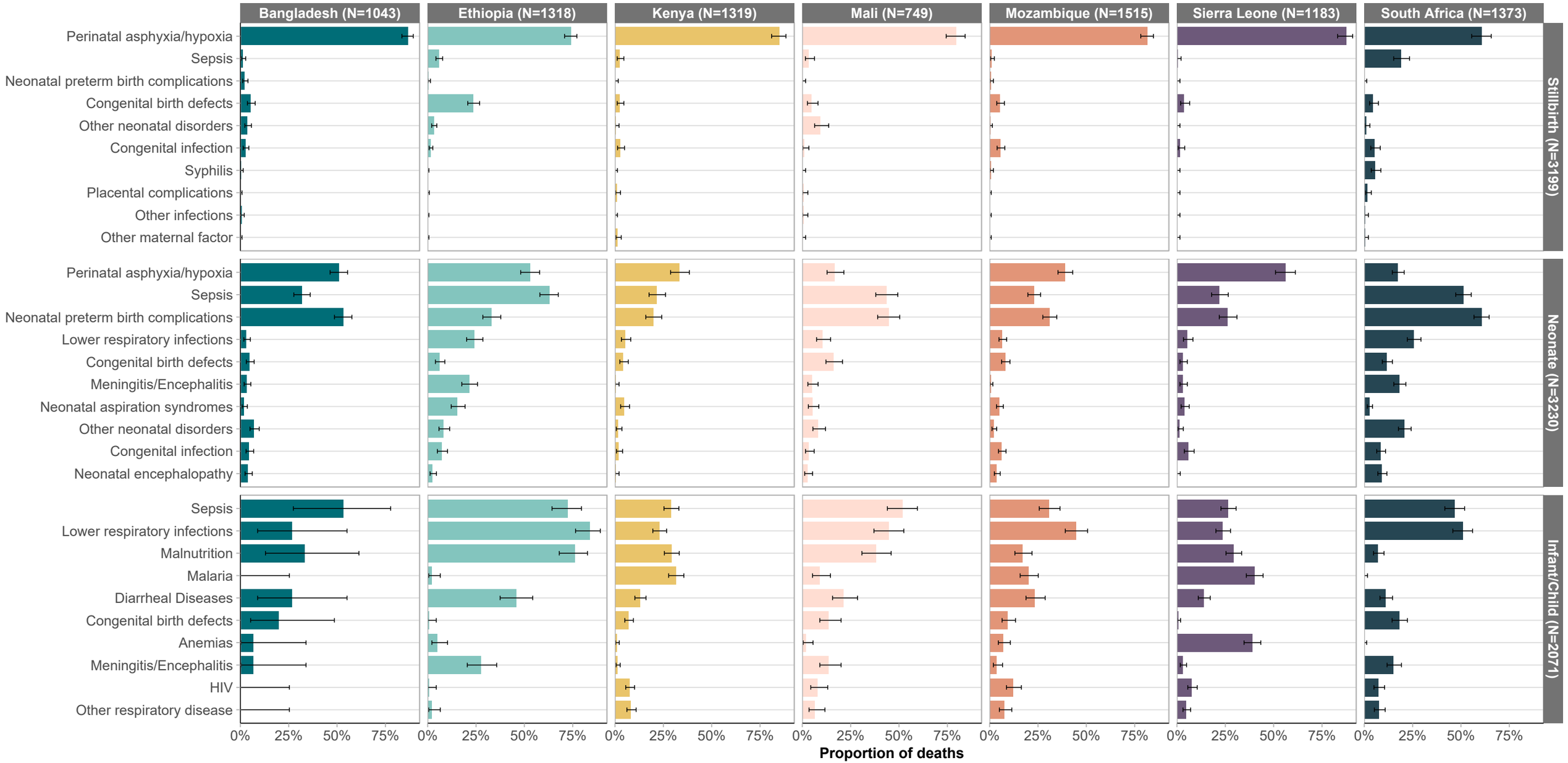
Supplementary Table 5. Main maternal conditions* associated with neonatal deaths by CHAMPS site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024

Maternal condition	Bangladesh No. (%)	Ethiopia No. (%)	Kenya No. (%)	Mali No. (%)	Mozambique No. (%)	Sierra Leone No. (%)	South Africa No. (%)	Overall No. (%)
M1: Complications of placenta, cord, and membranes	**27 (5.6)**	**30 (7.2)**	**26 (6.8)**	**31 (10.2)**	**67 (10.2)**	**39 (10.4)**	**89 (14.4)**	**309 (9.6)**
Placental complications	15 (3.1)	20 (4.8)	16 (4.2)	14 (4.6)	32 (4.9)	24 (6.4)	56 (9.1)	177 (5.5)
Chorioamnionitis and membrane complications	6 (1.2)	5 (1.2)	3 (0.8)	16 (5.2)	20 (3.1)	7 (1.9)	29 (4.7)	86 (2.7)
Umbilical cord complications	6 (1.2)	3 (0.7)	6 (1.6)	1 (0.3)	14 (2.1)	6 (1.6)	4 (0.6)	40 (1.2)
Prolapsed cord	0 (0)	2 (0.5)	1 (0.3)	0 (0)	1 (0.2)	2 (0.5)	0 (0)	6 (0.2)
M2: Maternal complications of pregnancy	**89 (18.4)**	**88 (21.2)**	**39 (10.3)**	**63 (20.7)**	**65 (9.9)**	**34 (9.1)**	**77 (12.5)**	**455 (14.1)**
Multiple gestation	27 (5.6)	48 (11.6)	18 (4.7)	43 (14.1)	24 (3.7)	20 (5.3)	47 (7.6)	227 (7)
Premature rupture of membranes	47 (9.7)	37 (8.9)	14 (3.7)	11 (3.6)	37 (5.6)	12 (3.2)	13 (2.1)	171 (5.3)
Other factor (M2)	5 (1.0)	2 (0.5)	5 (1.3)	6 (2.0)	2 (0.3)	1 (0.3)	0 (0)	21 (0.7)
Uterine fluid disorders	8 (1.6)	1 (0.2)	1 (0.3)	0 (0)	2 (0.3)	0 (0)	0 (0)	12 (0.4)
Cervical insufficiency and pelvic anomalies	2 (0.4)	0 (0)	1 (0.3)	3 (1.0)	0 (0)	1 (0.3)	17 (2.8)	24 (0.7)
M3: Other complications of labor and delivery	**81 (16.7)**	**26 (6.3)**	**87 (22.9)**	**40 (13.1)**	**125 (19.1)**	**62 (16.6)**	**47 (7.6)**	**468 (14.5)**
Obstructed labor and fetal malpresentation	17 (3.5)	13 (3.1)	12 (3.2)	10 (3.3)	37 (5.6)	44 (11.8)	5 (0.8)	138 (4.3)
Other factor (M3)	39 (8.0)	10 (2.4)	23 (6.1)	6 (2.0)	81 (12.4)	15 (4.0)	17 (2.8)	191 (5.9)
Uterine rupture	1 (0.2)	1 (0.2)	2 (0.5)	0 (0)	3 (0.5)	0 (0)	1 (0.2)	8 (0.2)
Obstructed labor	2 (0.4)	0 (0)	5 (1.3)	3 (1.0)	1 (0.2)	1 (0.3)	0 (0)	12 (0.4)
Preterm labor or delivery	22 (4.5)	2 (0.5)	45 (11.8)	21 (6.9)	1 (0.2)	2 (0.5)	24 (3.9)	117 (3.6)
Cesarean delivery	0 (0)	0 (0)	0 (0)	0 (0)	2 (0.3)	0 (0)	0 (0)	2 (0.1)
M4: Maternal medical and surgical conditions	**97 (20)**	**39 (9.4)**	**46 (12.1)**	**28 (9.2)**	**51 (7.8)**	**66 (17.6)**	**157 (25.5)**	**484 (15)**
Maternal hypertension	34 (7.0)	36 (8.7)	22 (5.8)	12 (3.9)	37 (5.6)	46 (12.3)	107 (17.4)	294 (9.1)
Maternal infection	23 (4.7)	0 (0)	12 (3.2)	12 (3.9)	10 (1.5)	5 (1.3)	16 (2.6)	78 (2.4)
Other factor (M4)	24 (4.9)	1 (0.2)	1 (0.3)	3 (1.0)	2 (0.3)	1 (0.3)	16 (2.6)	48 (1.5)
Maternal diabetes	13 (2.7)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	7 (1.1)	21 (0.7)
HIV	0 (0)	0 (0)	8 (2.1)	0 (0)	0 (0)	11 (2.9)	10 (1.6)	29 (0.9)
Maternal injury and accident	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
Maternal nutritional disorders	2 (0.4)	0 (0)	0 (0)	0 (0)	1 (0.2)	1 (0.3)	0 (0)	4 (0.1)
Maternal circulatory and respiratory diseases	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.2)	0 (0)	0 (0)	1 (0)
Sickle cell disorders	0 (0)	0 (0)	0 (0)	1 (0.3)	0 (0)	2 (0.5)	0 (0)	3 (0.1)
Anemias	0 (0)	0 (0)	3 (0.8)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.1)
Heart Diseases	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Obesity	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Other endocrine, metabolic, blood, and immune disorders	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Liver disease	0 (0)	1 (0.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0)
M5: No maternal condition	**175 (36.1)**	**223 (53.7)**	**154 (40.5)**	**114 (37.4)**	**335 (51.1)**	**161 (43)**	**189 (30.7)**	**1351 (41.8)**
Other	**16 (3.3)**	**9 (2.2)**	**28 (7.4)**	**29 (9.5)**	**12 (1.8)**	**12 (3.2)**	**57 (9.3)**	**163 (5.0)**
Total	**485 (100.0)**	**415 (100.0)**	**380 (100.0)**	**305 (100.0)**	**655 (100.0)**	**374 (100.0)**	**616 (100.0)**	**3230 (100.0)†**

* Subcategories within M1–M4 reflect CHAMPS standard reporting groupings mapped to ICD-PM maternal-condition groups. ICD-PM entries related to procedures (e.g., "surgical procedure/other medical procedures") are not shown separately because procedures are not tabulated as maternal-condition subcategories in this report.

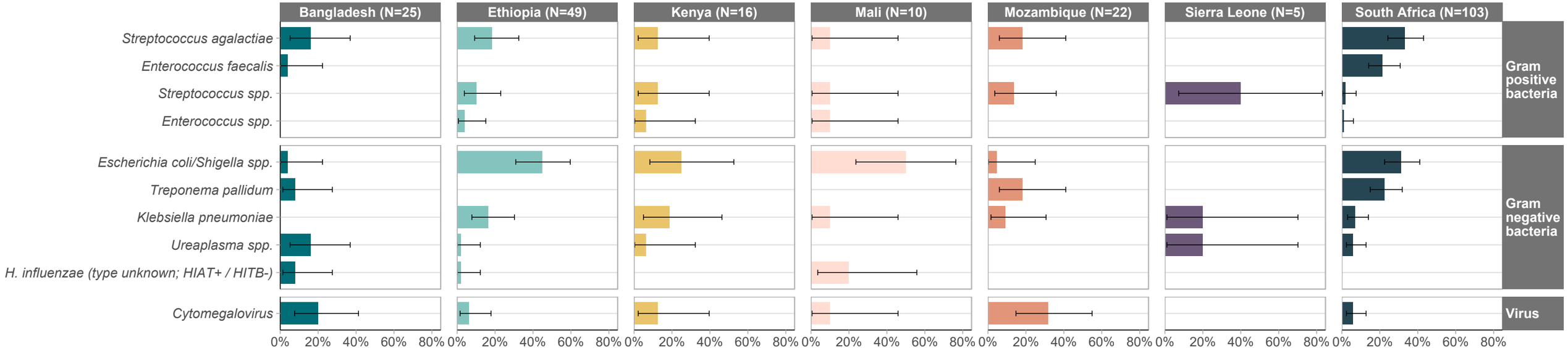
† Each death was assigned one main maternal condition in the causal chain, as determined by the CHAMPS DeCoDe panel.

Supplementary Figure 1. Leading causes of stillbirths and under-five deaths by age group and site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



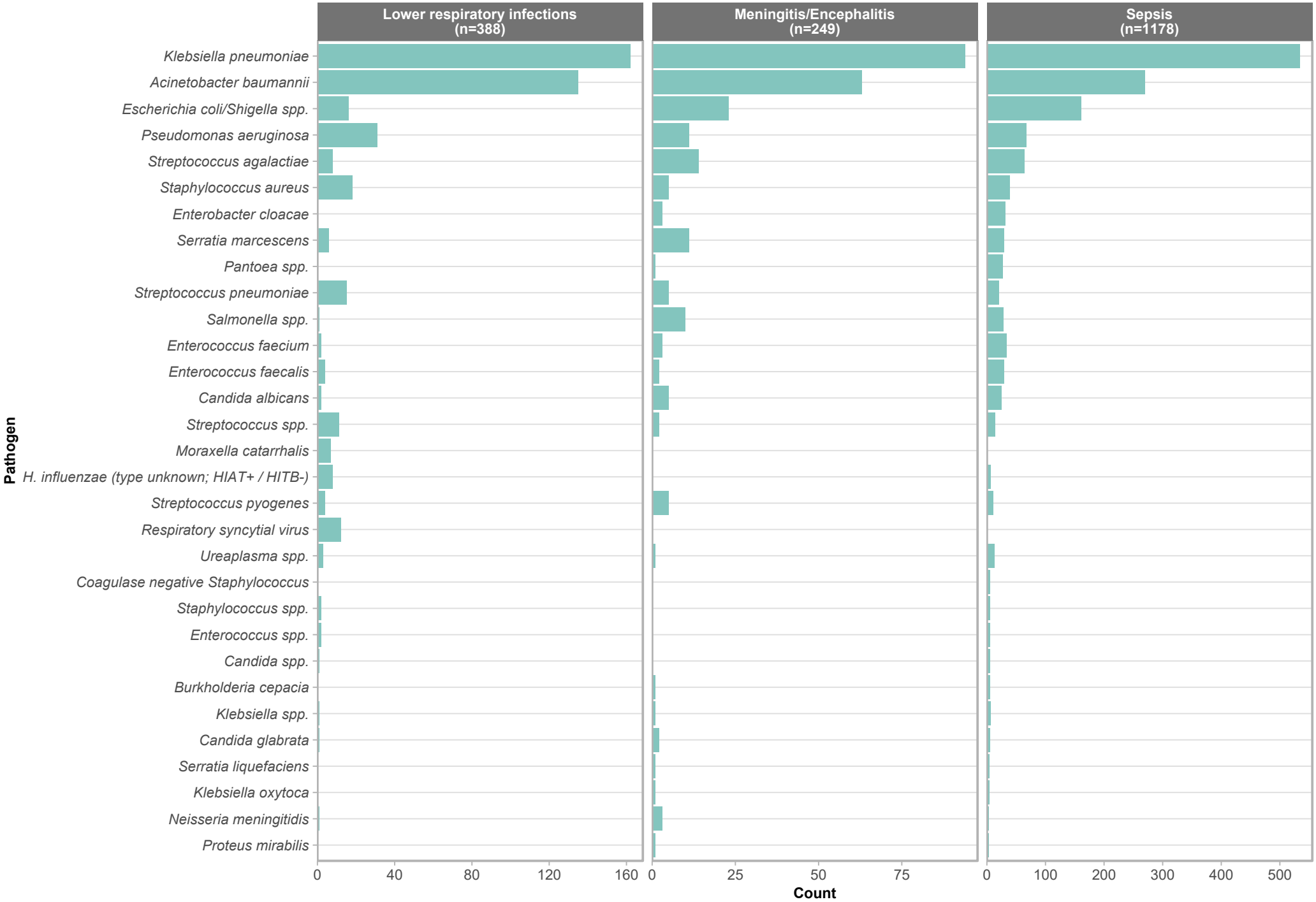
Bars show the proportion of stillbirths in which each cause was assigned at any position in the causal chain (underlying, antecedent/morbidity, or immediate) by DeCoDe panels; causes are not mutually exclusive and percentages may sum to >100% within a site. Horizontal lines indicate 95% CIs. Causes are ranked by overall frequency across all sites.

Supplementary Figure 2. Leading pathogens identified in infectious stillbirths with ≥1 pathogen detected in the causal chain, by CHAMPS site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



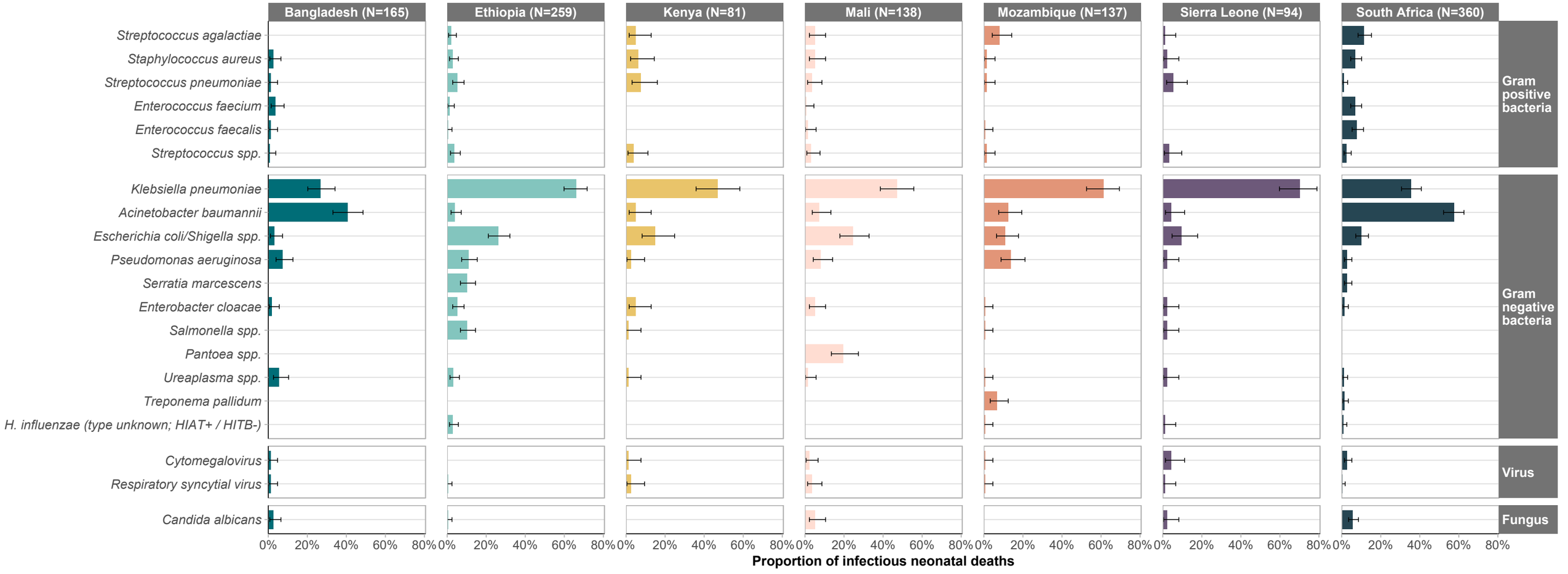
Bars represent the proportion of infectious deaths at each site in which each of the top 10 pathogens (ranked by overall frequency across all sites) was detected; horizontal lines indicate 95% confidence intervals. Pathogens are grouped by taxonomic class (Gram-positive bacteria, Gram-negative bacteria, virus, fungus, parasite).

Supplementary Figure 3. Pathogens identified anywhere in the causal chain of death among neonates, by infectious syndrome — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



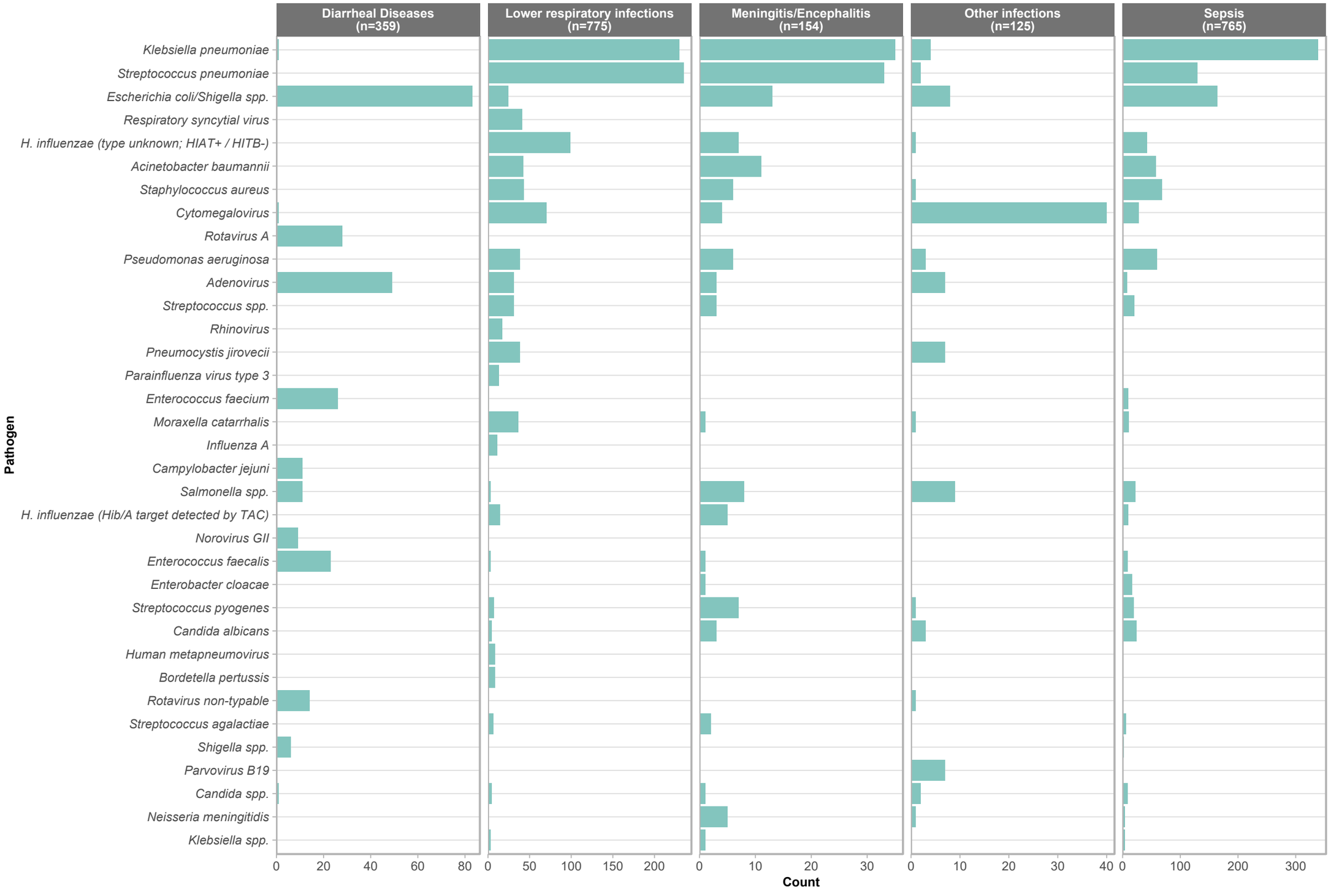
The figure shows the frequency of pathogens detected in the causal chain of deaths attributed to diarrheal diseases, lower respiratory infections, meningitis/encephalitis, sepsis, and other infections among neonates (<28 days) across CHAMPS sites. Bars represent the total number of pathogen identifications across all contributing positions in thecausal chain (underlying, intermediate, and immediate causes).

Supplementary Figure 4. Leading pathogens identified in infectious neonatal deaths (0–27 days) with ≥1 pathogen detected in the causal chain, by CHAMPS site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



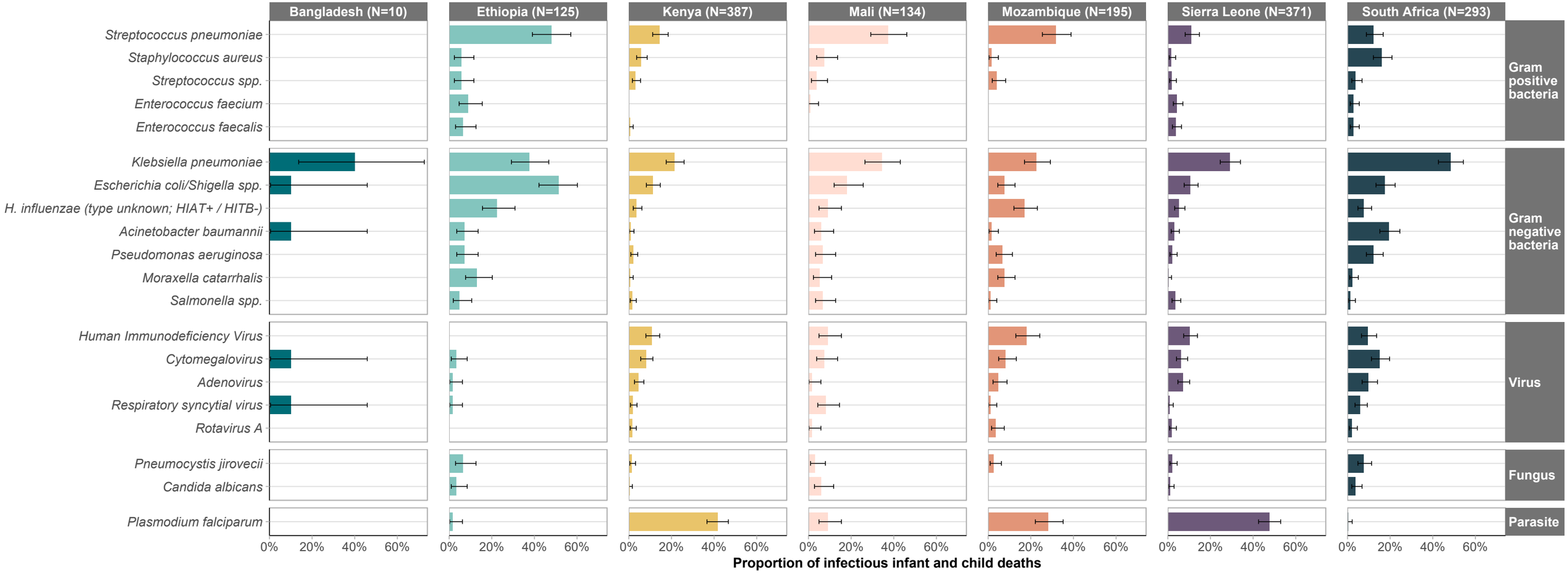
Bars represent the proportion of infectious deaths at each site in which each of the top 20 pathogens (ranked by overall frequency across all sites) was detected; horizontal lines indicate 95% confidence intervals. Pathogens are grouped by taxonomic class (Gram-positive bacteria, Gram-negative bacteria, virus, fungus, parasite).

Supplementary Figure 5. Pathogens identified anywhere in the causal chain of death among infants and children, by infectious syndrome — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



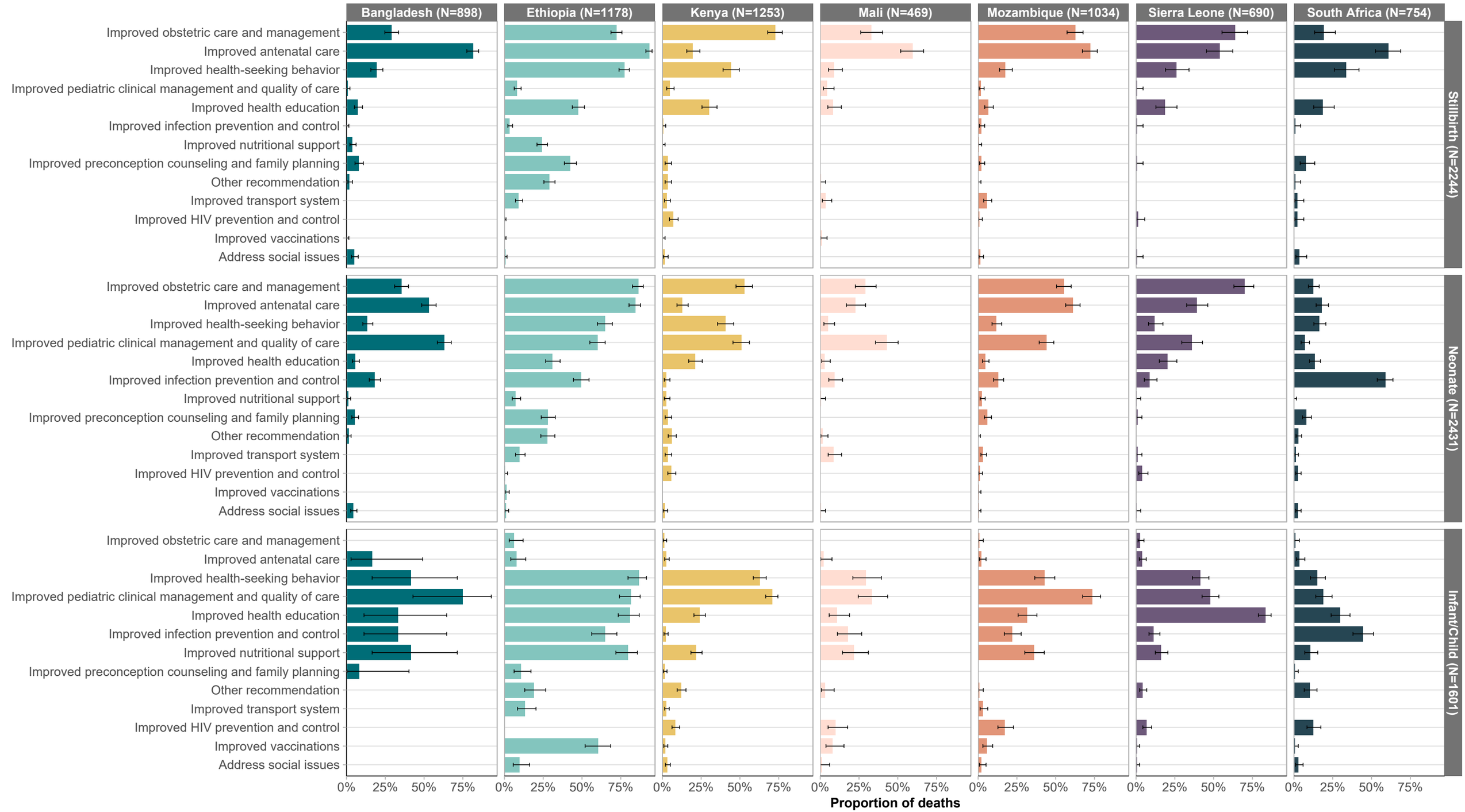
The figure shows the frequency of pathogens detected in the causal chain of deaths attributed to diarrheal diseases, lower respiratory infections, meningitis/encephalitis, sepsis, and other infections among infant and child deaths (<5 years) across CHAMPS sites. Bars represent the total number of pathogen identifications across all contributing positions in the causal chain (underlying, intermediate, and immediate causes).

Supplementary Figure 6. Leading pathogens identified in infectious infant and child deaths (ages 1–59 months) with ≥1 pathogen detected in the causal chain, by CHAMPS site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



Bars represent the proportion of infectious deaths at each site in which each of the top 20 pathogens (ranked by overall frequency across all sites) was detected; horizontal lines indicate 95% confidence intervals. Pathogens are grouped by taxonomic class (Gram-positive bacteria, Gram-negative bacteria, virus, fungus, parasite).

Supplementary Figure 7. Distribution of documented health care system improvement recommendations, by category, age group, and site — Child Health and Mortality Prevention Surveillance (CHAMPS), 2016–2024.



Within each site–age group stratum, percentages represent the proportion of deaths for which a given recommendation category was selected; multiple categories could be selected for a single death, so percentages do not sum to 100%. This figure is restricted to deaths with documented preventability recommendations; denominators for each site and age group are shown in the panel labels.