

# Supplementary information

## Maternal colonisation with *Streptococcus agalactiae* and associated stillbirth and neonatal disease in coastal Kenya

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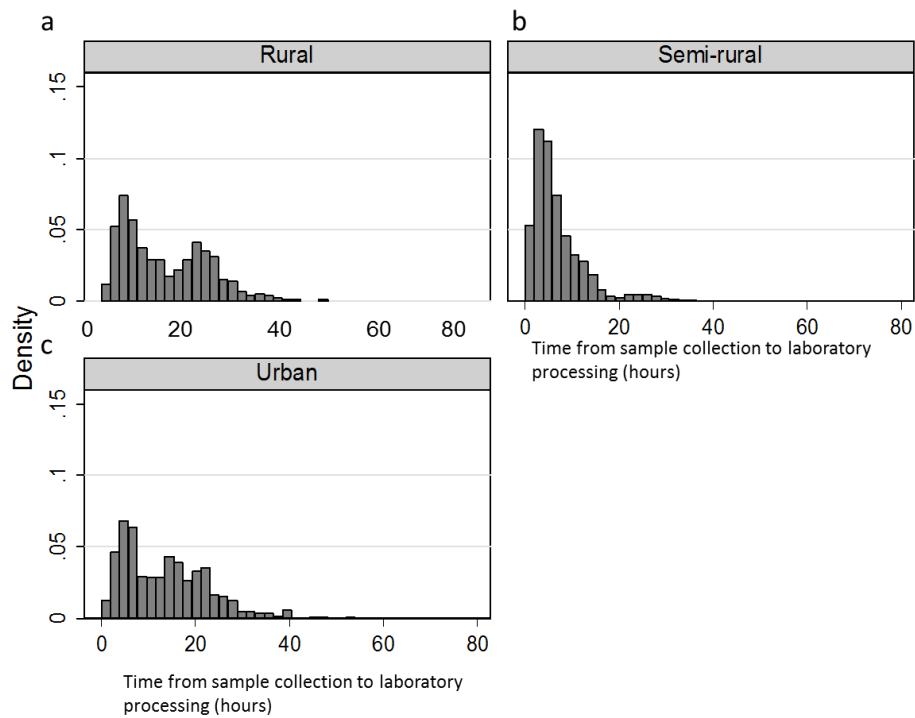
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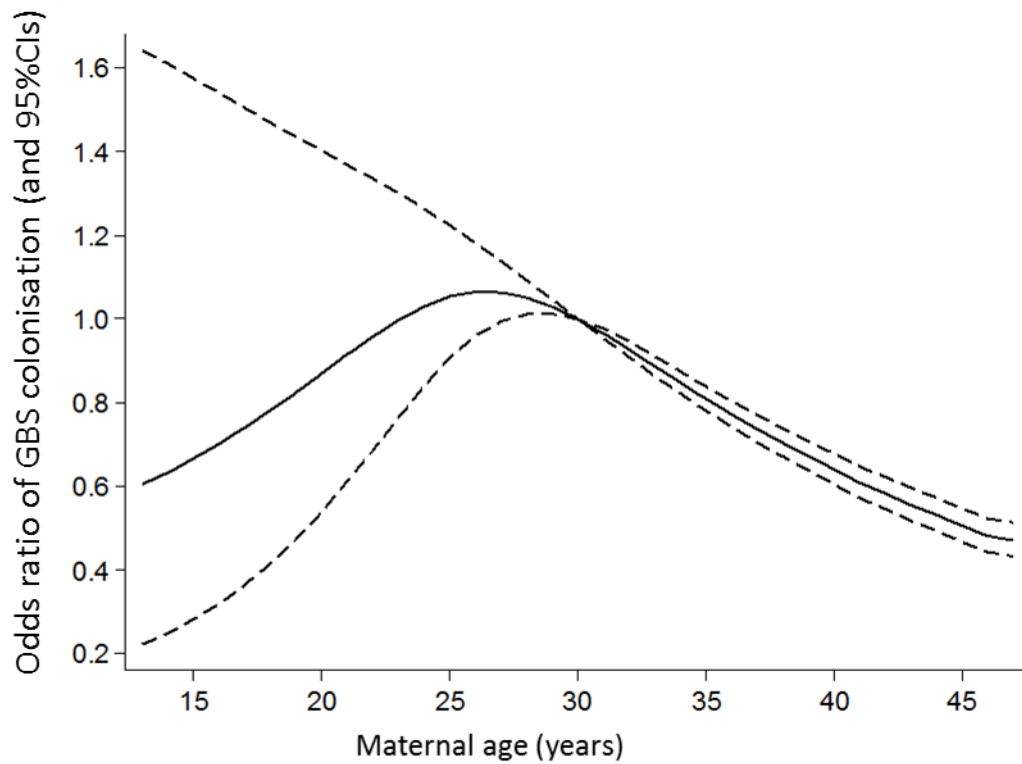
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**Figure S1 Time from recto-vaginal swab sampling to laboratory processing by study site.**



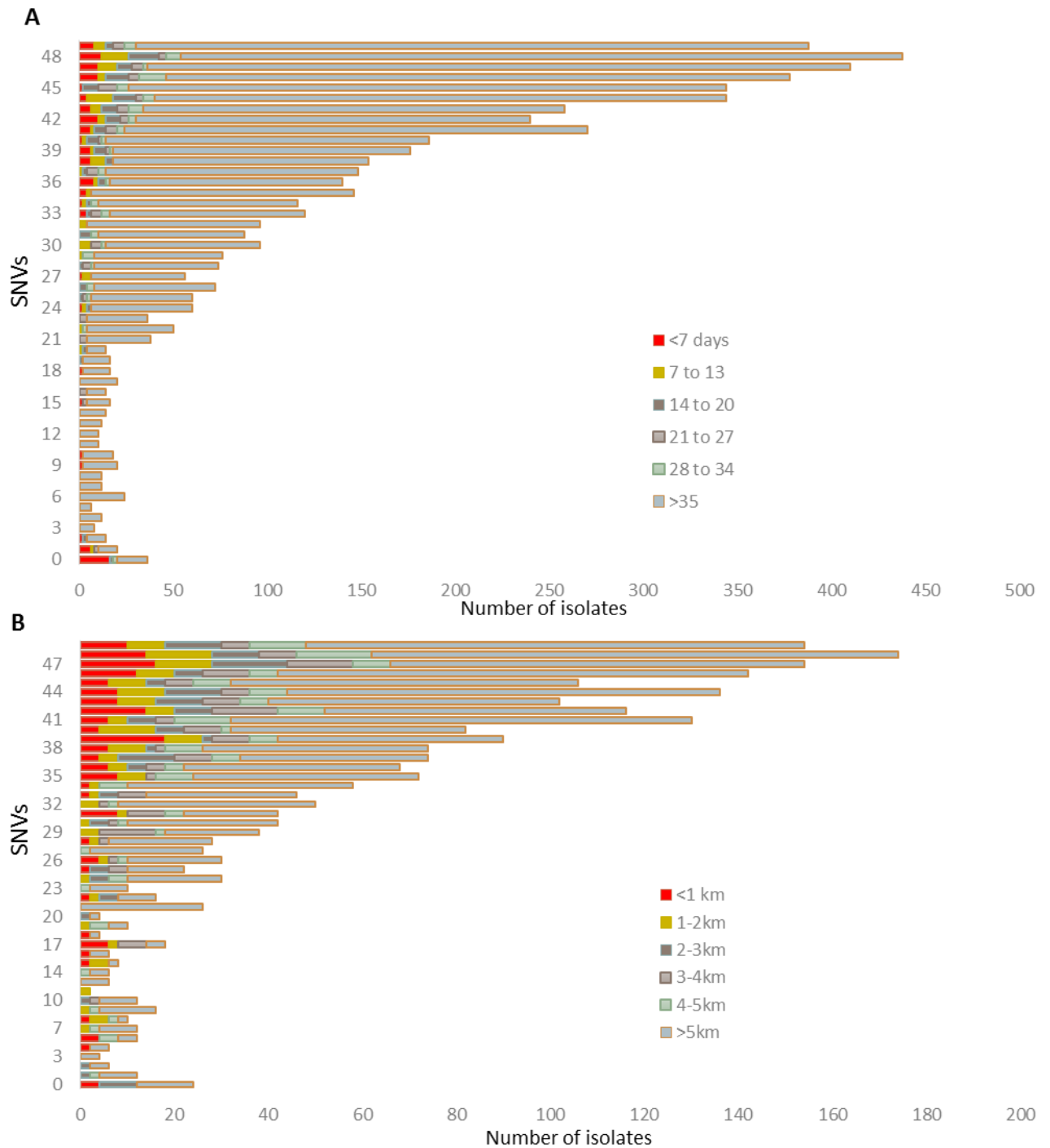
**a**, Time from sample collection to laboratory processing for the rural site (Bamba and Ganze health facilities), **b**, Time from sample collection to laboratory processing for the semi-rural site (Kilifi County Hospital) **c**, Time from sample collection to laboratory processing for the urban site (Coast Provincial Hospital). The times from collection to processing varied due to transportation, with the semi-rural site being in close proximity to the laboratory compared to the rural and urban sites (Kruskal-Wallis test  $p < 0.001$ ). In total, 7832 (98.3%) recto-vaginal swabs were processed within 48h. There was no evidence of association between GBS isolation and time until processing across all sites (OR=1.00 (95%CI 0.99-1.00)  $p=0.6$ ), across rural and urban sites (OR=0.99 (95%CI 0.98-1.00)) or each site individually: rural (0.99 (0.95-1.02),  $p=0.5$ ); semi-rural (OR=1.00 (0.98-1.01),  $p=0.5$ ); urban (OR 0.99 (0.98-1.01),  $p=0.2$ ).

**Figure S2: Non-linear relationships between maternal age and GBS colonisation**



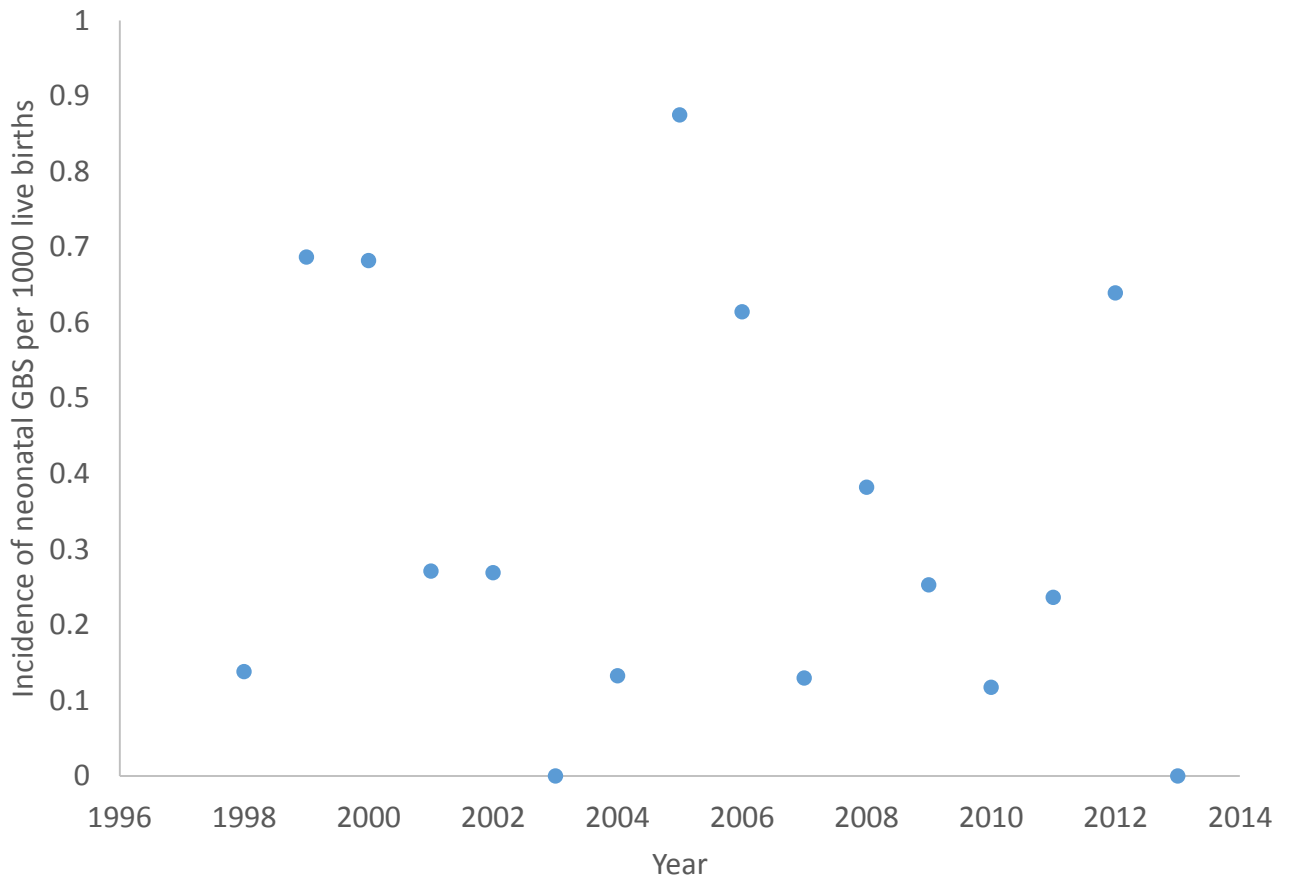
The association between maternal age (x axis) and odds ratio for GBS colonisation (y-axis) is non-linear, peaking in the mid to late 20s. Odds ratios are from the adjusted complete case model for the association between maternal age and GBS colonisation, with dotted lines to illustrate 95% confidence intervals.

**Figure S3: Pairwise comparison of Single Nucleotide Variants (SNVs) between maternal GBS colonising isolates**



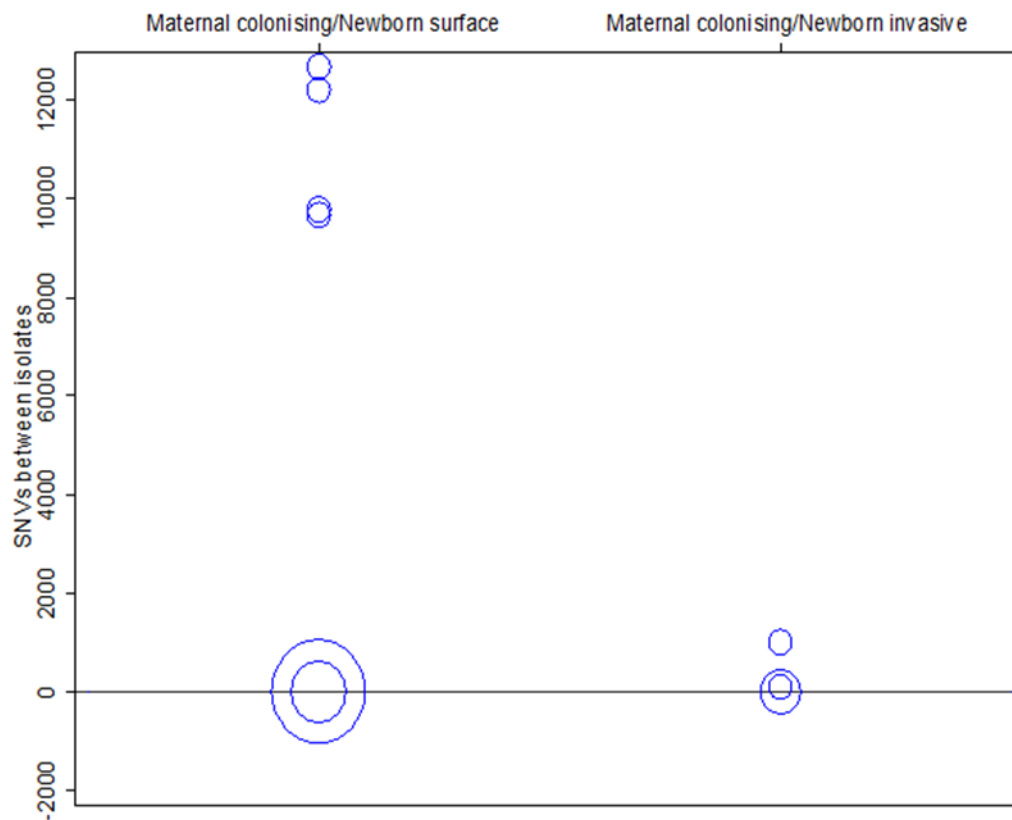
**a** Number of *Streptococcus agalactiae* isolates (x axis) compared to all other isolates in terms of number of single nucleotide variants (SNVs, includes only those <50 SNVs) coloured according to the number of days between dates of maternal admission. **b** Number of *Streptococcus agalactiae* isolates (x axis) compared to all other isolates in terms of number of SNVs (includes only those <50 SNVs), coloured according to the by distance in kilometres between household locations. Includes only isolates from residents of Kilifi Health and Demographic Surveillance Study (KHDSS) where geographical data (latitude and longitude of residence) are known.

**Figure S4: Incidence of neonatal GBS disease in Kilifi Health and Demographic Surveillance Site by year.**



The incidence of invasive neonatal GBS disease per 1000 live births (y axis) is given for each year (x axis). This is based on the number of neonates admitted to Kilifi County Hospital with invasive GBS disease (sepsis and/or meningitis) in each year (numerator) and the number of live births in Kilifi Health and Demographic Surveillance Site (denominator) for each year (1998-2013)

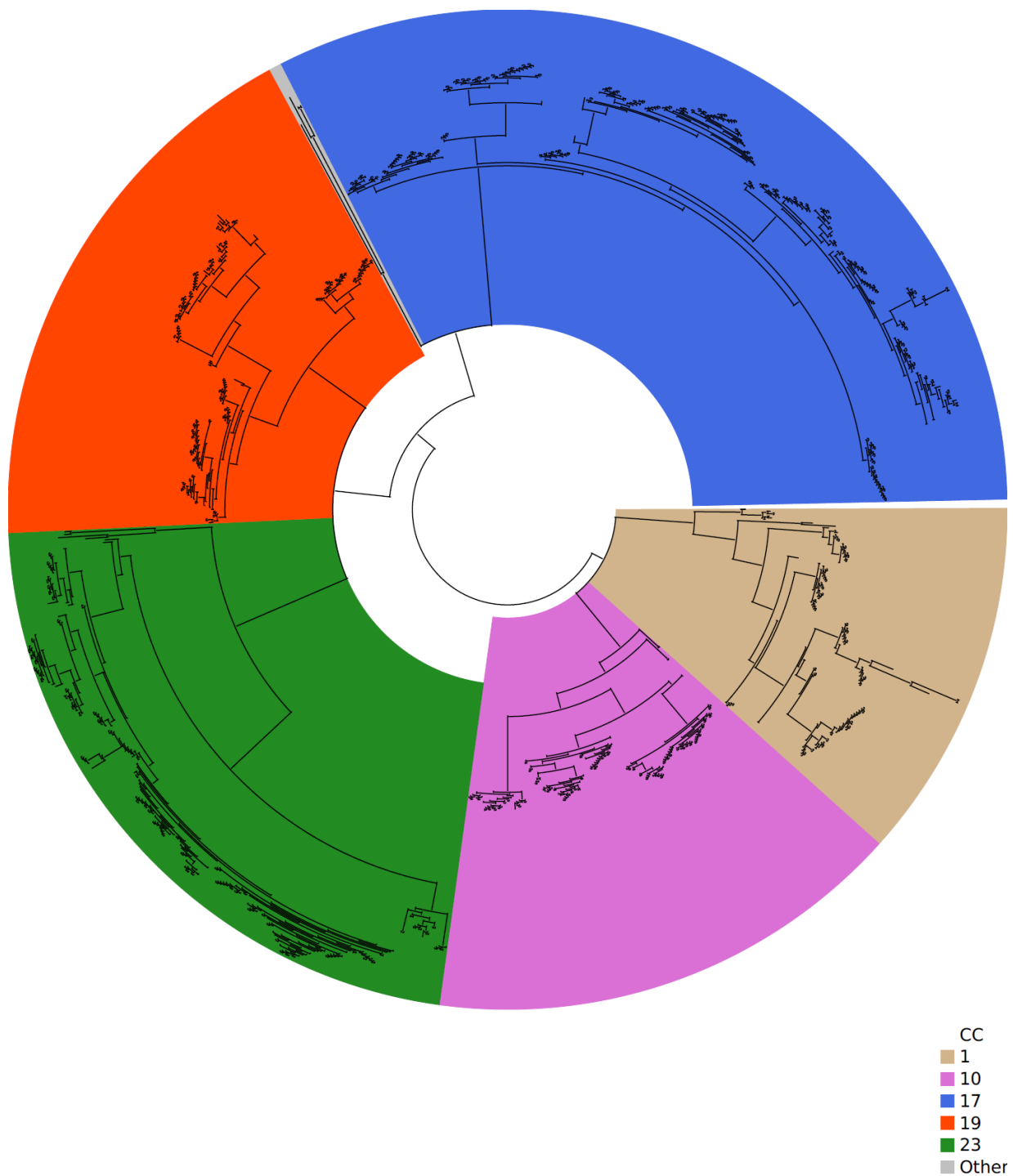
**Figure S5: Pairwise comparison of Single Nucleotide Variants (SNVs) between maternal and newborn dyads in Kilifi County Hospital (2012-13)**



Maternal-newborn dyads are compared for maternal colonising GBS isolates and newborn surface GBS isolates as well as maternal colonising GBS isolates and newborn invasive GBS isolates. The size of the circles corresponds to the number of maternal-newborn dyads with this number of SNVs between isolate pairs. A clear bimodal distribution is seen comparing maternal colonising GBS isolates and newborn surface GBS isolates.



**Figure S6: Single maximum likelihood phylogeny for GBS isolates in the study**



Single maximum likelihood phylogeny tree for all GBS isolates in the study to illustrate how the clonal complexes (as coloured) were visually partitioned on long, deep branches, corresponding to previously described clonal complexes.<sup>1</sup> Each ST belongs to a single clonal complex and each clonal complex is monophyletic.

**Table S1: Definitions**

<b>Acronym</b>	<b>Term</b>	<b>Definition or description</b>
CAMP	Christie, Atkins, and Munch-Peterson	Christie, Atkins, and Munch-Peterson test for Group B Streptococcus
CPGH	Coast Provincial General Hospital	Provincial Hospital in Mombasa, Kenya
CTX	Co-trimoxazole	Trimethoprim/sulfamethoxazole combination antibiotic
EOS	Early onset sepsis	Sepsis in days 0-6 of life
EOD	Early onset disease	Invasive bacterial disease in days 0-6 of life
IAP	Intrapartum antibiotic prophylaxis	Administration of intravenous antibiotics ante-partum to prevent early onset GBS disease.
KCH	Kilifi County Hospital	A rural county hospital on the coast of Kenya
KHDSS	Kilifi Health and Demographic Surveillance Site	Area of demographic and health surveillance around Kilifi County Hospital, in coastal Kenya <sup>2</sup>
LIM	LIM Broth	Todd Hewitt with CNA
LOS	Late onset sepsis	Sepsis from days 7-27 days of life
LOD	Late onset disease	Invasive bacterial disease in days 7-27 of life
	Low birthweight (or very low birth weight)	<2500g (<1500g)
MLST	Multi-locus sequence typing	Method of typing organisms based on gene loci of 7 house-keeping genes
MUAC	Mid-upper arm circumference	Measurement taken around circumference of upper arm, at the mid-point between the acromion and olecranon.
pSBI	Possible Serious Bacterial Infection	Presence of any one of: a history of difficulty feeding, history of convulsions, movement only when stimulated, respiratory rate of 60 breaths per minute or more, severe chest in-drawing, temperature of 37.5 °C or more, or below 35.5 °C. <sup>3</sup>
	Preterm (or very preterm)	≥32 <37 weeks (<32 weeks' gestation); measured by last menstrual period when available (fundal height if not).
	Rural	Area where the residents came to a health facility from almost entirely rural households; in Ganze there is no urban population and in Bamba only 1,307/35,852 (3.6%)
	Semi-rural	Area where the residents came to a health facility from a mixture of rural and urban households; in Kilifi 30,394/74,050 (41.0%) residents are in the urban population.
SES	Socio-economic status	Measure of household or individual prosperity
SNP	Single Nucleotide Polymorphism	Genetic variation in a DNA sequence that occurs when a single nucleotide in a genome is altered
	Stillbirth; ante-partum and post-partum	Born over 28 weeks gestation with no signs of life; may be separated into ante-partum (skin broken) and intra-partum (skin intact).
UKNEQAS	United Kingdom National External Quality Assessment Service for Microbiology	United Kingdom National External Quality Assessment Service for Microbiology <a href="http://ukneqasmicro.org.uk/">http://ukneqasmicro.org.uk/</a> ; provider of external quality assurance for microbiology laboratories
	Urban	Area where the residents came to a health facility from almost entirely urban households; Mombasa county is considered fully urbanised.
VDRL	Venereal Disease Research Laboratory	Screening test for syphilis detecting anti-cardiolipin antibodies (IgG, IgM or IgA)
WGS	Whole Genome Sequencing	Next Generation Sequencing platforms, which allow entire genome sequencing.

**Table S2: Studies of maternal GBS Colonisation in sub-Saharan Africa**

<b>Author</b>	<b>Country</b>	<b>N</b>	<b>Time of sample taking</b>	<b>Site of sample</b>	<b>GBS prevalence reported</b>
Cutland et al <sup>4</sup>	South Africa	3964	Ante-natal or labour	Low vaginal swab	21%
Mavenyengwa et al <sup>5</sup>	Zimbabwe	1037	20, 26 weeks' and delivery	Vaginal and rectal swabs	47%, 24% 21%
Joachim et al <sup>6</sup>	Tanzania	300	>37 weeks'	High vaginal and rectal swabs	23%
Suara et al <sup>7</sup>	The Gambia	196	Delivery	Vaginal and rectal swabs	22%
Uhiara et al <sup>8</sup>	Nigeria	100	Delivery	High vaginal and perineal swabs	14%
Dawodu et al <sup>9</sup>	Nigeria	225	Delivery	Low vaginal swab	20%
Onile et al <sup>10</sup>	Nigeria:	388	N/A	Posterior and lateral vaginal swab	19%
Schmidt et al <sup>11</sup>	Ethiopia	200	Post-partum	Vaginal and rectal swabs	9%
De Steenwinkel et al <sup>12</sup>	Mozambique	113	35-37 weeks'	Rectovaginal swab	2%

**Table S3: Sample size calculations****2a) Power to detect maternal risk factors for GBS colonisation**

Risk factor (exposure)	Assumption Mothers (%) with risk factor at delivery*	Power (%) to detect odds ratios (ORs)		
		OR 1.5	OR 2.0	OR 4.0
Maternal age over 35 years	8.3	>90%	>90%	>90%
Not married	10.2	>90%	>90%	>90%
No education	25.3	>90%	>90%	>90%
Grand multiparity (≥5 previous births)	6.5	>90%	>90%	>90%
HIV infection	5.1	>90%	>90%	>90%
Syphilis infection (VDRL positive)	1.8	52%	>90%	>90%
Anaemia (haemoglobin <8g/dl at delivery)	10.6	>90%	>90%	>90%

\*From pilot data in Kilifi County Hospital for maternal admissions 2002-2006, and assuming recruitment of 8000 mothers (5500 from KCH, 2000 from CPGH and 500 from rural sites), over at least one calendar year at all sites with 20% prevalence of maternal GBS colonisation ( $\alpha=0.05$ ).

**2b) Power to detect an association between maternal GBS colonisation and adverse perinatal outcomes**

Perinatal outcomes	Assumption Deliveries (%) with adverse outcome*	Power (%) to detect odds ratios (ORs)		
		OR 1.5	OR 2.0	OR 4.0
Neonatal admission (<7 days)	4.7	>90%	>90%	>90%
Neonatal culture positive GBS disease	0.5	<50%	<50%	<50%
Stillbirth	7.0	>90%	>90%	>90%
Birth weight <2500g	17.4	>90%	>90%	>90%
Perinatal death	9.0	>90%	>90%	>90%

\*From pilot data in Kilifi County Hospital for maternal admissions 2002-2006, and assuming recruitment of 8000 mothers (5500 from KCH, 2000 from CPGH and 500 from rural sites), over at least one calendar year at all sites with 20% prevalence of maternal GBS colonisation ( $\alpha=0.05$ ).

**2c) Precision and power for other estimates**

	Sample size	Assumptions	Precision or Power
Prevalence of maternal GBS colonisation	8000	20% maternal GBS colonisation ( $\alpha=0.05$ )	+/- 1% precision
Transmission to neonatal surface colonisation	1000	20% maternal GBS colonisation ( $\alpha=0.05$ )	+/- 10% precision
Incidence of neonatal disease	60	Incidence ~0.5/1000	+/- 0.12 /1000 precision
Association between stillbirth and isolation of GBS from a sterile site	168 stillbirths and 336 controls	OR 5 ( $\alpha=0.05$ )	80% power

**Table S4 Characteristics of women attending for delivery in KCH, CPGH, or rural sites who were recruited or excluded 2011-2013**

Variable	Category	Total	Included		Excluded		P*
			N	(%)	N	%	
		<b>N=9513</b>	<b>N=7967</b>			<b>N=1546</b>	
Age in quartiles	<21.5	1932	1676	(21.0)	256	(16.6)	<0.001
	21.5-25.3	1931	1664	(20.9)	267	(17.3)	
	25.4-29.9	1964	1658	(20.8)	306	(19.8)	
	≥30	2016	1672	(21.0)	344	(22.3)	
	Missing	1670	1297	(16.3)	373	(24.1)	
Education	None	1382	1147	(14.4)	235	(15.2)	0.3
	Primary	5258	4433	(55.6)	825	(53.4)	
	Secondary	1864	1561	(19.6)	303	(19.6)	
	Tertiary	691	562	(7.1)	129	(8.3)	
	Missing	318	264	(3.3)	54	(3.5)	
Married	Yes	8641	7245	(90.9)	1396	(90.3)	0.7
	No	713	589	(7.4)	124	(8.0)	
	Missing	159	133	(1.7)	26	(1.7)	
Mijikenda ethnicity	No	2603	2226	(27.9)	377	(24.4)	0.013
	Yes	6757	5617	(70.5)	1140	(73.7)	
	Missing	153	124	(1.6)	29	(1.9)	
Parity (> 28 weeks)	0	3493	2987	(37.5)	506	(32.7)	<0.002
	1-4	3271	2550	(32.0)	721	(46.6)	
	≥5	1624	1340	(16.8)	284	(18.4)	
	Missing	125	90	(1.1)	35	(2.3)	
Emergency referral	No	8420	7104	(89.2)	1316	(85.1)	<0.001
	Yes	894	705	(8.8)	189	(12.2)	
	Missing	199	158	(2.0)	41	(2.7)	

\*p values are from the chi2 test across all categories for each variable

**Table S5: Exposures associated with maternal GBS colonisation: univariable analyses**

Please see separate file.

**Table S6: Association between maternal GBS colonisation and gestational age, in three sites in coastal Kenya**  
6a) univariable analyses (complete case)

		Post- dates (>42wks)			Preterm (≥32 wks <37 wks)			Very preterm (<32 wks)		
		mOR##	CI	p	mOR##	CI	p	mOR##	CI	p
<b>GBS</b>	Negative	1			1			1		
	Positive	1.09	(1.04-1.14)	<0.001	0.93	(0.92-0.95)	<0.001	0.64	(0.39-1.04)	0.072
<b>GBS negative</b> §	Temperature									
	<36.5	1.01	(0.93-1.09)	0.9	1.08	(0.99-1.19)	0.085	0.90	(0.88-0.92)	<0.001
	36.5-37.5	1			1			1		
<b>GBS positive</b> §	Temperature									
	<36.5	1.11	(0.96-1.29)	0.3	1.04	(0.93-1.16)	0.7	0.69	(1.37-1.29)	0.4
	36.5-37.5	1.19	(1.04-1.38)	0.014	0.84	(0.65-1.10)	0.2	0.63	(0.38-1.02)	0.060
<b>Age in quartiles</b>	>37.5	1.48	(0.98-2.21)	0.06	1.79	(0.91 -3.51)	0.089	1.25	(0.49-3.20)	0.6
	<21.5	1.10	(0.78-1.55)	0.6	1.31	(1.20-1.43)	<0.001	1.62	(0.83-3.12)	0.2
	21.5-25.3	1.09	(0.85-1.38)	0.9	1.11	(0.98-1.27)	0.1	1.06	(0.84-1.33)	0.6
	25.4-29.9	1			1			1		
	≥30	1.06	(1.03-1.09)	0.9	1.12	(0.84-1.49)	0.4	0.97	(0.85-1.10)	0.6
<b>Parity</b>	0	1.17	(1.06-1.28)	0.001	1.03	(0.87-1.21)	0.7	1.18	(0.93-1.50)	0.2
	1-4	1			1			1		
<b>Sex</b>	≥5	1.36	(1.22-1.51)	<0.001	1.56	(1.50-1.64)	<0.001	1.88	(1.74-2.03)	<0.001
	Female	1			1			1		
<b>Education</b>	Male	0.93	(0.71-1.22)	0.6	0.98	(0.89-1.08)	0.7	0.91	(0.81-1.03)	0.1
	None	1.37	(1.19-1.58)	<0.001	1.24	(1.16-1.33)	<0.001	1.50	(0.92-2.46)	0.1
	1°	1			1			1		
	2°	0.69	(0.57-0.84)	<0.001	0.63	(0.54-0.75)	<0.001	0.34	(0.15-0.76)	0.008
	3°	0.89	(0.60-1.31)	0.6	0.43	(0.25-0.72)	0.002	0.42	(0.35-0.50)	<0.001
<b>Socio-economic status</b>	V low	1.03	(0.83-1.27)	0.8	1.10	(1.04-1.17)	0.002	1.33	(0.99-1.78)	0.056
	Low	1			1			1		
	Med	0.79	(0.75-0.83)	<0.001	0.73	(0.70-0.76)	<0.001	0.65	(0.55-0.77)	<0.001
<b>Nutritional status (MUAC)</b>	High	0.75	(0.58-0.97)	0.027	0.66	(0.47-0.54)	0.018	0.74	(0.54-1.03)	0.079
	≤23.9	1.18	(0.90-1.54)	0.2	1.17	(1.12-1.22)	<0.001	1.32	(0.91-1.90)	0.1
	24-25.9	1			1			1		
	26-27.9	1.01	(0.90-1.13)	0.9	0.91	(0.80-1.04)	0.2	0.85	(0.79-0.92)	<0.001
<b>HIV status</b>	≥28	1.05	(0.96-1.16)	0.3	0.77	(0.69-0.86)	<0.001	0.47	(0.41-0.55)	<0.001
	No	1			1			1		
	Yes, no CTX	0.69	(0.64-0.75)	<0.001	1.24	(0.98-1.56)	0.074	1.14	(0.57-2.27)	0.7
<b>Obst. Comp.</b>	Yes, on CTX	1.44	(1.21-1.73)	<0.001	1.00	(0.68-1.47)	0.9	0.95	(0.77-1.17)	0.6
	No	1			1			1		
<b>Multiple delivery</b>	Yes	0.98	(0.85-1.13)	0.8	1.42	(1.22-1.65)	<0.001	2.10	(1.18-3.74)	0.011
	No	1			1			1		
<b>Multiple delivery</b>	Yes	1.43	(0.96-2.13)	0.080	2.29	(1.68-3.13)	<0.001	2.96	(1.71-5.14)	<0.001

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

##exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§ Interaction tests for high temperature for postdates p=0.6, preterm p=0.4 and very preterm p=0.

6b) multivariable analyses (N=4993)

		Post- dates (>42wks)			Preterm (≥32 wks <37 wks)			Very preterm (<32 wks)			
		mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	
<b>GBS negative<sup>§</sup></b>	<b>Temperature</b>	<36.5	1.06	(0.96-1.19)	0.3	1.19	(1.08-1.95)	0.001	0.97	(0.88-1.07)	0.6
		36.5-37.5	1			1		1			
		>37.5	1.32	(0.80-2.20)	0.3	1.39	(0.99-1.95)	0.057	1.44	(0.59-3.52)	0.4
<b>GBS positive<sup>§</sup></b>	<b>Temperature</b>	<36.5	1.03	(0.83-1.28)	0.8	1.08	(0.88-1.31)	0.5	0.75	(0.36-1.54)	0.4
		36.5-37.5	1.25	(0.98-1.60)	0.073	1.06	(0.80-1.40)	0.7	0.80	(0.44-1.35)	0.4
		>37.5	1.82	(0.56-5.74)	0.8	0.63	(0.16-2.50)	0.5	1.00	(0.24-4.16)	0.9
<b>Age in quartiles</b>		<21.5	1.00	(0.62-1.61)	0.9	1.27	(0.99-1.65)	0.060	1.53	(0.94-2.52)	0.090
		21.5-25.3	0.86	(0.46-1.60)	0.6	1.21	(1.00-1.47)	0.048	1.09	(0.89-1.33)	0.4
		25.4-29.9	1			1		1			
		≥30	0.79	(0.65-0.97)	0.024	1.02	(0.69-1.49)	0.9	0.78	(0.56-1.10)	0.2
		0	1.12	(0.74-0.70)	0.6	0.95	(0.68-1.32)	0.7	1.06	(0.74-1.50)	0.8
<b>Parity</b>		1-4	1			1		1			
		≥5	1.28	(1.11-1.47)	0.001	1.29	(1.07-1.56)	0.009	1.85	(1.13-3.03)	0.014
<b>Sex</b>		Female	1			1		1			
		Male	0.91	(0.68-1.23)	0.6	1.01	(0.85-1.21)	0.9	0.83	(0.80-0.86)	<0.001
		None	1.38	(1.29-1.47)	<0.001	1.17	(1.06-1.28)	0.001	1.42	(0.84-2.38)	0.2
<b>Education</b>		1°	1			1		1			
		2°	0.81	(0.76-0.85)	<0.001	0.74	(0.62-0.89)	0.001	0.41	(0.24-0.70)	0.001
		3°	0.97	(0.59-1.61)	0.9	0.57	(0.38-0.85)	0.006	0.55	(0.34-0.90)	0.017
		V low	1.00	(0.69-1.45)	0.9	0.88	(0.83-0.92)	<0.001	1.19	(0.76-1.84)	0.4
<b>Socio-economic status</b>		Low	1			1		1			
		Med	0.86	(0.70-1.04)	0.1	0.73	(0.65-0.82)	<0.001	0.90	(0.74-1.09)	0.3
		High	0.86	(0.80-0.92)	<0.001	0.93	(0.75-1.16)	0.5	1.53	(1.34-1.74)	<0.001
<b>Nutritional status (mid-upper arm circumference in cm)</b>		≤23.9	1.06	(0.73-1.54)	0.7	1.06	(1.01-1.11)	0.016	1.19	(0.60-2.36)	0.6
		24-25.9	1			1		1			
		26-27.9	1.20	(1.01-1.42)	0.034	0.92	(0.81-1.04)	0.2	0.89	(0.74-1.07)	0.2
		≥28	1.32	(1.13-1.55)	0.001	0.91	(0.82-1.02)	0.1	0.61	(0.57-0.65)	<0.001
<b>HIV status</b>		No	1			1		1			
		Yes, no CTX	0.96	(0.82-1.14)	<0.001	1.19	(1.01-1.39)	0.033	1.11	(0.49-2.51)	0.8
		Yes, on CTX	1.56	(1.29-1.89)	<0.001	1.11	(0.78-1.58)	0.6	1.15	(1.06-1.24)	0.001
<b>Obst. Comp.</b>		No	1			1		1			
		Yes	1.08	(0.84-1.39)	0.7	1.46	(1.33-1.60)	<0.001	2.10	(1.26-3.51)	0.004
<b>Multiple delivery</b>		No	1			1		1			
		Yes	1.52	(1.30-1.77)	<0.001	2.81	(1.59-4.94)	<0.001	2.10	(1.39-3.18)	<0.001

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

## exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§ Interaction tests for high temperature for postdates p=0.6, preterm p=0.4 and very preterm p=0.6



6c) imputed multivariable analyses (N=7408)

		Post- dates (>42wks)			Preterm (≥32 wks <37 wks)			Very preterm (<32 wks)			
		mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	
<b>GBS negative<sup>§</sup></b>	<b>Temperature</b>	<36.5	1.03	(0.93-1.14)	0.6	1.11	(1.03-1.19)	0.004	0.92	(0.84-1.01)	0.065
		36.5-37.5	1			1		1			
		>37.5	1.36	(0.84-2.20)	0.2	1.56	(0.86-2.84)	0.1	1.02	(0.44-2.36)	0.9
<b>GBS positive<sup>§</sup></b>	<b>Temperature</b>	<36.5	1.10	(1.00-1.22)	0.058	1.10	(0.93-1.30)	0.3	0.75	(0.47-1.21)	0.2
		36.5-37.5	1.17	(1.00-1.40)	0.049	0.91	(0.69-1.21)	0.5	0.65	(0.40-1.06)	0.083
		>37.5	1.48	(0.40-5.49)	0.6	0.55	(0.17-1.75)	0.3	2.31	(0.68-7.79)	0.177
<b>Age in quartiles</b>		<21.5	1.03	(0.89-1.22)	0.6	1.24	(0.99-1.54)	0.056	1.59	(1.01-2.50)	0.045
		21.5-25.3	0.99	(0.66-1.54)	0.9	1.12	(0.92-1.36)	0.4	1.13	(0.89-1.43)	0.3
		25.4-29.9	1			1		1			
		≥30	0.94	(0.70-1.24)	0.6	0.96	(0.73-1.26)	0.8	0.78	(0.67-0.90)	0.001
			0	1.21	(1.06-1.38)	0.004	0.98	(0.76-1.25)	0.8	0.99	(0.78-1.24)
<b>Parity</b>		1-4	1			1		1			
		≥5	1.18	(1.02-1.36)	0.026	1.43	(1.21-1.68)	<0.001	1.73	(1.16-2.58)	0.007
			Female	1		1		1			
<b>Sex</b>		Male	0.91	(0.71-1.17)	0.5	0.96	(0.87-1.06)	0.4	0.89	(0.79-1.00)	0.046
		None	1.41	(1.19-1.58)	<0.001	1.13	(1.02-1.25)	0.024	1.40	(0.85-2.29)	0.2
			1°	1		1		1			
<b>Education</b>		2°	0.71	(0.63-0.80)	<0.001	0.71	(0.63-0.80)	<0.001	0.38	(0.19-0.76)	0.006
		3°	0.92	(0.73-1.15)	0.5	0.51	(0.32-0.82)	0.005	0.53	(0.42-0.66)	<0.001
			V low	0.91	(0.71-1.17)	0.5	0.91	(0.83-1.00)	0.062	1.02	(0.69-1.51)
<b>Socio-economic status</b>		Low	1			1		1			
		Med	0.84	(0.78-0.91)	<0.001	0.84	(0.81-0.88)	<0.001	0.91	(0.80-1.01)	0.1
		High	0.83	(0.72-0.95)	0.008	0.87	(0.69-1.08)	0.2	1.35	(1.03-0.78)	0.032
			≤23.9	1.11	(0.84-1.46)	0.5	1.10	(1.03-1.17)	0.003	1.24	(0.91-1.90)
<b>Nutritional status (mid-upper arm circumference in cm)</b>		24-25.9	1			1		1			
		26-27.9	1.06	(0.94-1.21)	0.3	0.95	(0.82-1.10)	0.5	0.90	(0.80-1.01)	0.086
		≥28	1.21	(1.07-1.36)	0.002	0.89	(0.79-0.99)	0.034	0.60	(0.50-0.71)	<0.001
			No	1		1		1			
<b>HIV status</b>		Yes, no CTX	0.74	(0.61-0.88)	0.001	1.28	(0.96-1.70)	0.089	1.31	(0.67-2.55)	0.4
		Yes, on CTX	1.60	(1.25-2.04)	<0.001	1.11	(0.81-1.51)	0.5	1.09	(0.83-1.42)	0.5
			No	1		1		1			
<b>Obst. Comp.</b>		Yes	0.97	(0.87-1.08)	0.6	1.39	(1.27-1.54)	<0.001	2.14	(1.25-3.69)	0.006
			No	1		1		1			
<b>Multiple delivery</b>		Yes	1.42	(0.91-2.22)	0.1	2.08	(1.53-2.81)	<0.001	2.46	(1.60-3.79)	<0.001

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

## exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§ Interaction tests for high temperature for postdates p=0.7, preterm p=0.3 and very preterm p=0.019

**Table S7: Associations between maternal GBS colonisation and birth weight in three sites in coastal Kenya**

7a) univariable analyses (complete case)

		High birth weight (>3500g)			Low birth weight (1500 – 2499g)			Very low birth weight (<1500g)		
		mOR <sup>##</sup>	CI (95%)	p	mOR <sup>##</sup>	CI (95%)	p	mOR <sup>##</sup>	CI (95%)	p
<b>GBS</b>	Negative	1			1			1		
	Positive	1.00	(0.65-1.54)		1.03	(0.88-1.21)		0.50	(0.25-1.00)	0.050
<b>GBS negative<sup>§</sup></b>	Temp eratu re									
	<36.5	1.07	(0.23-9.69)	0.3	0.93	(0.85-1.02)	0.09	0.86	(0.57-1.28)	<0.001
	>37.5	0.70	(0.24-2.03)	0.5	1.20	(0.78-1.85)	0.4	0.48	(0.19-1.24)	0.1
<b>GBS positive<sup>§</sup></b>	temp eratu re									
	<36.5	0.97	(0.65-1.45)	0.9	1.09	(1.95-1.25)	0.037	0.24	(0.05-1.10)	0.4
	>37.5	1.37	(0.38-5.00)	0.6	1.12	(0.19-6.54)	0.9	24.7	(8.6-70.9)	<0.001
<b>Age in quartiles</b>	<21.5	0.53	(0.50-0.57)	<0.001	1.36	(1.18-1.55)	<0.001	1.36	(0.80-2.31)	0.3
	21.5-25.3	0.88	(0.72-1.06)	0.2	1.16	(0.99-1.37)	0.067	1.19	(0.95-1.48)	0.1
	25.4-29.9	1			1			1		
	≥30	1.12	(1.06-1.18)	<0.001	1.17	(1.12-1.22)	<0.001	0.91	(0.63-1.31)	0.6
<b>Pregnancy no. (&gt; 28 wks)</b>	First	0.66	(0.50-0.86)	0.002	1.52	(1.38-1.66)	<0.001	1.11	(0.98-1.26)	0.098
	2 <sup>nd</sup> -4 <sup>th</sup>	1			1			1		
	≥5	0.89	(0.63-1.26)	<0.001	1.23	(1.11-1.34)	<0.001	1.29	(0.93-1.78)	0.1
<b>Sex</b>	Female	1			1			1		
	Male	1.63	(0.35-1.97)	<0.001	0.89	(0.78-1.01)	0.064	1.15	(0.77-1.71)	0.5
<b>Education</b>	None	0.91	(0.65-1.27)	0.6	0.90	(0.71-1.16)	0.4	0.73	(0.47-1.13)	0.2
	1 <sup>o</sup>	1			1			1		
	2 <sup>o</sup>	1.64	(1.44-1.87)	<0.001	1.05	(0.71-1.58)	0.8	0.54	(0.26-1.10)	0.091
	3 <sup>o</sup>	1.89	(1.67-2.14)	<0.001	0.59	(0.45-0.76)	<0.001	0.37	(0.13-1.11)	0.076
<b>Socio-economic status</b>	V low	1.15	(0.85-1.55)	0.4	0.94	(0.77-1.14)	0.5	1.01	(0.70-1.47)	0.9
	Low	1			1			1		
	Med	1.61	(1.31-1.97)	<0.001	0.86	(0.73-1.01)	0.074	0.74	(0.55-1.00)	0.046
	High	2.04	(1.81-2.31)	<0.001	0.89	(0.72-1.10)	0.3	0.44	(0.31-0.62)	<0.001
<b>Nutritional status (mid-upper arm circumference in cm)</b>	≤23.9	0.89	(0.63-1.25)	0.5	1.27	(1.23-1.32)	<0.001	1.71	(1.20-2.44)	0.003
	24-25.9	1			1			1		
	26-27.9	1.51	(1.10-2.08)	0.010	0.90	(0.81-1.01)	0.074	0.57	(0.47-0.68)	<0.001
	≥28	2.40	(1.73-3.34)	<0.001	0.73	(0.63-0.86)	<0.001	0.85	(0.49-1.48)	0.6
<b>HIV status</b>	No	1			1			1		
	Yes, no CTX	0.75	(0.59-0.95)	0.015	1.28	(0.95-1.72)	0.1	0.56	(0.40-0.79)	0.001
	Yes, on CTX	1.02	(0.91-1.15)	0.7	1.02	(0.65-1.61)	0.9	0.41	(0.11-1.45)	0.2
<b>Obst. Comp.</b>	No	1			1			1		
	Yes	0.78	(0.48-1.29)	0.3	2.31	(2.10-2.55)	<0.001	4.35	(3.81-4.96)	<0.001
<b>Multiple delivery</b>	No	1			1			1		
	Yes	0.09	(0.02-0.38)	<0.001	9.02	(6.59-12.34)	<0.001	22.8	(14.00-37.17)	<0.001

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

## exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§ Interaction tests for high temperature for high birthweight p=0.7, low birthweight p=0.8 and very low birthweight p<0.001

7b) multivariable analyses (N=4993)

		High birth weight (>3500g)			Low birth weight (1500 – 2499g)			Very low birth weight (<1500g)			
		mOR#	CI	p	mOR##	CI	p	mOR###	CI	p	
GBS negative <sup>§</sup>	Temperature	<36.5	0.98	(0.87-1.10)	0.7	0.86	(0.83-0.89)	<0.001	0.98	(0.48-2.04)	1.0
		36.5-37.5	1								
		>37.5	0.76	(0.24-2.44)	0.6	1.16	(0.69-1.95)	0.6	<0.1	(<0.1)	<0.001
GBS positive <sup>§</sup>	temperature	<36.5	0.83	(0.52-1.31)	0.4	1.15	(1.03-1.27)	0.009	0.16	(0.10-0.36)	<0.001
		36.5-37.5	0.96	(0.46-1.99)	0.9	0.97	(0.67-1.41)	0.9	0.84	(0.25-2.76)	0.8
		>37.5	0.89	(0.32-2.46)	0.8	0.93	(0.17-5.10)	0.9	>30	(>30)	<0.001
Age in quartiles	<21.5	0.82	(0.63-1.08)	<0.001	1.09	(0.92-1.29)	0.3	1.44	(0.99-2.10)	0.058	
	21.5-25.3	1.02	(0.92-1.13)	0.7	1.09	((0.84-1.42)	0.5	1.60	(1.42-1.80)	<0.001	
	25.4-29.9	1			1			1			
	≥30	0.99	(0.83-1.18)	0.9	1.26	(1.16-1.36)	<0.001	0.79	(0.50-1.24)	0.3	
Parity	0	0.63	(0.40-0.99)	0.048	1.59	(1.44-1.76)	<0.001	0.83	(0.75-0.91)	<0.001	
	1-4	1			1			1			
	≥5	1.10	(0.80-1.52)	0.5	1.02	(0.85-1.21)	0.9	1.09	(1.01-1.18)	0.027	
Sex	Female	1			1			1			
	Male	1.74	(1.31-2.31)	<0.001	0.88	(0.78-0.99)	0.031	1.04	(0.59-1.84))	0.9	
Education	None	0.90	(0.76-1.07)	0.2	0.99	(0.82-1.19)	0.9	0.81	(0.66-1.00)	0.048	
	1°	1			1			1			
	2°	1.46	(1.36-1.55)	<0.001	1.03	(0.53-2.00)	0.8	0.69	(0.25-1.93)	0.5	
	3°	1.82	(1.16-2.88)	0.010	0.64	(0.54-0.76)	<0.001	0.19	(0.04-0.95)	0.044	
Socio-economic status	V low	1.04	(0.71-1.52)	0.8	0.76	(0.63-0.93)	0.008	0.92	(0.61-1.38)	0.7	
	Low	1			1			1			
	Med	1.23	(1.14-1.33)	<0.001	0.86	(0.72-1.03)	0.1	1.11	(0.72-1.70)	0.6	
	High	1.48	(1.34-1.63)	<0.001	1.01	(0.82-1.23)	0.9	0.85	(0.49-1.46)	0.6	
Nutritional status (mid-upper arm circumference in cm)	≤23.9	0.94	(0.51-1.75)	0.9	1.25	(1.18-1.33)	<0.001	1.46	(0.80-2.66)	0.2	
	24-25.9	1			1			1			
	26-27.9	1.42	(1.00-2.77)	0.052	0.81	(0.74-0.89)	<0.001	0.37	(0.19-0.71)	0.003	
	≥28	2.00	(1.44-2.77)	<0.001	0.73	(0.66-0.81)	<0.001	0.85	(0.35-2.10)	0.7	
HIV status	No	1			1			1			
	Yes, no CTX	0.69	(0.59-0.95)	0.2	1.63	(0.93-2.87)	0.087	0.45	(0.23-0.87)	0.018	
	Yes, on CTX	0.89	(0.91-1.15)	<0.001	1.04	(0.49-2.18)	0.9	0.50	(0.09-2.94)	0.4	
Obst. Comp.	No	1			1			1			
	Yes	0.73	(0.44-1.22)	0.2	2.00	(1.43-2.79)	<0.001	3.31	(1.88-5.84)	<0.001	
Multiple delivery	No	1			1			1			
	Yes	0.06	(0.01-0.30)	<0.001	10.20	(8.41-12.38)	<0.001	15.44	(7.71-30.94)	<0.001	

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

###exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§Interaction tests for high temperature for high birthweight p=0.9, low birthweight p=0.6 and very low birthweight p<0.001

### 7c) Imputed multivariable analyses (N=7408)

		High birth weight (>3500g)			Low birth wt (1500 – 2499g)			Very low birth wt (<1500g)			
		mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	mOR <sup>##</sup>	CI	p	
<b>GBS negative<sup>§</sup></b>	<b>Temperature</b>	<36.5	1.00	(0.90-1.11)	1.0	0.93	(0.85-1.02)	0.09	0.85	(0.60-1.21)	0.4
		36.5-37.5	1								
		>37.5	0.79	(0.30-2.07)	0.6	1.09	(0.61-1.94)	0.4	0.43	(0.07-2.78)	0.5
<b>GBS positive<sup>§</sup></b>	<b>Temperature</b>	<36.5	0.92	(0.66-1.26)	0.6	1.15	(0.04-1.28)	0.006	0.25	(0.05-1.24)	0.089
		36.5-37.5	0.89	(0.48-1.67)	0.7	1.07	(0.77-1.49)	0.7	0.53	(0.26-1.10)	0.087
		>37.5	0.99	(0.25-3.83)	0.9	1.19	(0.30-4.63)	0.8	21.0	(5.51-79.9)	<0.001
<b>Age in quartiles</b>		<21.5	0.81	(0.61-1.08)	0.2	1.06	(0.88-1.29)	0.5	1.37	(0.91-2.06)	0.1
		21.5-25.3	1.02	(0.86-1.22)	0.8	1.04	(0.85-1.27)	0.7	1.32	(0.93-1.87)	0.1
		25.4-29.9	1			1			1		
		≥30	1.03	(0.88-1.20)	0.7	1.16	(1.03-1.30)	0.017	0.74	(0.49-1.12)	0.2
		0	0.70	(0.51-0.97)	0.033	1.58	(1.37-1.82)	<0.001	0.92	(0.77-1.10)	0.4
		1-4	1			1			1		
<b>Parity</b>		≥5	1.14	(0.88-1.48)	0.3	0.99	(0.88-1.11)	<0.001	1.02	(0.86-1.20)	0.9
		Female	1			1			1		
<b>Sex</b>		Male	1.70	(1.44-2.01)	<0.001	0.84	(0.74-0.94)	0.004	1.02	(0.62-1.68)	0.9
		None	0.95	(0.84-1.07)	0.4	0.97	(0.79-1.18)	0.7	0.65	(0.49-0.87)	0.004
<b>Education</b>		1o	1			1			1		
		2o	1.41	(1.27-1.57)	<0.001	1.06	(0.67-1.67)	0.8	0.68	(0.28-1.64)	0.4
		3o	1.50	(1.19-1.89)	0.001	0.62	(0.55-0.70)	<0.001	0.53	(0.17-1.63)	0.3
		V low	1.07	(0.77-1.49)	0.7	0.90	(0.80-1.01)	0.085	0.93	(0.61-1.41)	0.7
<b>Socio-economic status</b>		Low	1			1			1		
		Med	1.31	(1.17-1.47)	<0.001	0.90	(0.76-1.06)	0.2	0.79	(0.59-1.06)	0.7
		High	1.57	(1.47-1.68)	<0.001	1.00	(0.84-1.18)	1.0	0.57	(0.41-0.78)	<0.001
<b>Nutritional status (mid-upper arm circumference in cm)</b>		≤23.9	0.92	(0.63-1.25)	0.5	1.26	(1.18-1.36)	<0.001	1.78	(1.22-2.58)	0.003
		24-25.9	1			1			1		
		26-27.9	1.37	(1.00-1.89)	0.010	0.88	(0.78-1.00)	0.047	0.59	(0.43-0.83)	<0.001
		≥28	1.95	(1.50-2.53)	<0.001	0.72	(0.66-0.796)	<0.001	1.03	(0.48-2.18)	0.9
<b>HIV status</b>		No	1			1			1		
		Yes, no CTX	0.65	(0.43-0.99)	0.045	1.52	(1.04-2.23)	0.032	0.84	(0.37-1.89)	0.7
		Yes, on CTX	0.86	(0.76-0.99)	0.033	1.13	(0.63-2.02)	0.7	0.56	(0.12-2.70)	0.5
<b>Obst. Comp.</b>		No	1			1			1		
		Yes	0.74	(0.46-1.19)	0.2	2.04	(1.92-2.17)	<0.001	3.75	(3.08-4.57)	<0.001
<b>Multiple delivery</b>		No	1			1			1		
		Yes	0.08	(0.02-0.34)	0.001	9.29	(6.66-13.00)	<0.001	20.54	(11.96-35.27)	<0.001

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

##exponentiated coefficients from an -mlogit- model, these multinomial odds ratios are also referred to as relative risk ratios (but these are not risk ratios)

§Interaction tests for high temperature for high birthweight p=0.9, low birthweight p=0.9 and very low birthweight p<0.001

**Table S8: Association between maternal GBS colonisation and possible serious bacterial infection, in three sites in coastal Kenya.**

Variable	Category	Univariable analyses			Multivariable complete case (n=5062)			Multivariable imputed (n=7408)			
		OR	95%CI*	p**	OR	95%CI*	p**	OR	95%CI*	p**	
<b>GBS</b>	Neg	1									
	Pos	0.99	(0.81-1.23)	0.9							
<b>GBS negative</b> §	<b>PROM</b>	Neg	1		1			1		0.7	
		Pos	0.83	(0.32-2.15)	0.7	0.83	(0.74-0.93)	0.001	0.89	(0.53-1.51)	
<b>GBS positive</b> §	<b>PROM</b>	Neg	0.91	(0.83-1.00)	0.046	0.94	(0.57-1.54)	0.8	0.94	(0.82-1.10)	0.4
		Pos	2.30	(0.94-5.63)	0.067	3.10	(0.68-14.1)	0.143	2.20	(0.73-6.67)	0.163
<b>Age in quartiles</b>	<21.5	0.93	(0.56-1.55)		0.90	(0.64-1.22)		1.08	(0.83-1.41)		
	21.5-25.3	0.94	(0.72-1.21)		0.89	(0.72-1.12)		1.00	(0.86-1.17)		
	25.4-29.9	1			1			1			
	≥30	0.91	(0.71-1.17)	0.099	0.81	(0.77-0.95)	0.005	0.86	(0.77-0.98)	0.070	
	0	1.03	(0.64-1.66)		1.06	(0.64-1.71)		0.99	(0.67-1.48)		
<b>Parity</b>	1-4	1			1			1			
	≥5	0.99	(0.51-1.91)	0.9	1.11	(0.86-1.66)	<0.001	1.21	(0.89-1.63)	<0.001	
	Female	1			1			1			
<b>Sex</b>	Male	1.19	(1.14-1.25)	<0.001	1.24	(1.13-1.36)	<0.001	1.22	(1.17-1.26)	<0.001	
	None	0.65	(0.30-1.38)		0.79	(0.59-1.07)		0.73	(0.64-0.83)		
<b>Education</b>	1°	1.14	(0.91-1.44)		1			1			
	2°	1			0.83	(0.58-1.19)		0.96	(0.60-1.53)		
	3°	0.64	(0.25-1.65)	0.5	0.63	(0.29-1.38)	0.011	0.52	(0.23-1.18)	<0.001	
	Very low	1.34	(0.93-1.92)		1.43	(1.01-2.04)		1.29	(1.02-1.63)		
<b>Socio-economic status</b>	Low	1			1			1			
	Medium	1.37	(0.65-2.90)		1.58	(0.87-2.86)		1.34	(0.63-2.85)		
	High	2.18	(1.12-4.23)	0.005	2.11	(1.51-2.95)	0.045	2.22	(1.24-3.99)	<0.001	
	≤23.9	0.87	(0.73-1.02)		0.82	(0.51-1.31)		0.9	(0.71-1.12)		
<b>Nutritional status (mid-upper arm circumference in cm)</b>	24-25.9	1			1			1			
	26-27.9	1.18	(0.86-1.62)		1.13	(0.88-1.56)		1.13	(0.84-1.50)		
	≥28	1.37	(1.06-1.78)	0.008	1.24	(0.85-1.80)	<0.001	1.23	(1.02-1.49)	<0.001	
<b>HIV status</b>	No	1			1			1			
	Yes, no CTX	0.83	(0.39-1.78)		0.80	(0.51-1.25)		0.97	(0.56-1.64)		
	Yes, on CTX	1.69	(0.61-4.65)	<0.001	1.48	(0.55-4.03)	<0.001	1.59	(0.56-4.54)	0.069	
<b>Obstetric complication</b>	No	1			1			1			
	Yes	1.94	(1.42-2.66)	<0.001	1.41	(0.86-2.31)	0.017	1.64	(1.25-2.15)	<0.001	
<b>Multiple delivery</b>	No	1			1			1			
	Yes	3.02	(2.51-3.64)	<0.001	3.98	(3.04-5.21)	<0.001	2.86	(2.44-3.35)	<0.001	

\* odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\* p values from combined Wald test

§ Interaction test p=0.040 univariable, p=0.133 multivariable complete case, p=0.104 imputed

**Table S9: Association between maternal GBS colonisation and stillbirth in three sites in coastal Kenya.**

Variable	Category	Univariable analyses			Multivariable complete case analyses n=5191			Multivariable imputed analyses n=7833			
		OR	95%CI*	p**	95%CI*	p**	OR	95%CI*	p**		
<b>GBS</b>	Negative	1									
	Positive	0.85	(0.72-1.00)	0.050							
<b>GBS negative</b> §	<b>UTI</b>	Negative	1		1		1				
		Positive	0.91	(0.63-1.30)	0.6	0.93	(0.86-1.02)	0.092	0.83	(0.62-1.11)	0.2
<b>GBS positive</b> §	<b>UTI</b>	Negative	0.88	(0.79-0.99)	0.036	0.89	(0.61-1.29)	0.6	0.89	(0.72-1.11)	0.3
		Positive	1.33	(1.22-1.45)	<0.001	2.48	(2.34-2.63)	<0.001	1.27	(0.74-2.20)	0.4
<b>Age in quartiles</b>	<21.5	0.77	(0.40-1.50)		0.54	(0.20-1.44)		0.67	(0.37-1.21)		
	21.5-25.3	1.13	(0.97-1.31)		0.97	(0.78-1.20)		1.06	(0.92-1.23)		
	25.4-29.9	1			1			1			
	≥30	1.27	(1.08-1.48)	<0.001	1.28	(0.98-1.74)	<0.001	1.19	(0.85-1.66)	<0.001	
	0	1.13	(0.86-1.48)		1.74	(1.61-1.88)		1.33	(1.07-1.66)		
<b>Parity</b>	1-4	1			1			1			
	≥5	1.68	(0.98-2.89)	<0.001	1.15	(0.81-1.65)	<0.001	1.32	(0.92-1.89)	<0.001	
<b>Sex</b>	Female	1			1			1			
	Male	0.93	(0.89-0.97)	0.001	0.97	(0.82-1.13)	0.7	0.93	(0.89-0.98)	0.004	
<b>Education</b>	None	1.14	(0.74-1.76)		1.08	(0.69-1.69)		1.10	(0.89-1.39)		
	1o	1			1			1			
	2o	0.86	(0.82-0.91)		0.65	(0.54-0.77)		0.77	(0.65-0.93)		
	3o	0.66	(0.31-1.39)	0.5	0.77	(0.51-1.17)	0.4	0.64	(0.38-1.12)	<0.001	
<b>Socio-economic status</b>	Very low	1.27	(0.80-2.01)		1.16	(0.99-1.25)		1.03	(0.84-1.26)		
	Low	1			1			1			
	Medium	1.00	(0.63-1.60)		0.82	(0.51-1.33)		0.95	(0.63-1.44)		
	High	1.05	(0.60-1.81)	0.4	0.94	(0.57-1.62)	0.1	1.04	(0.68-1.60)	<0.001	
<b>Nutritional status (mid-upper arm circumference in cm)</b>	≤23.9	1.05	(0.94-1.65)		1.08	(0.74-1.57)		1.11	(0.88-1.39)		
	24-25.9	1			1			1			
	26-27.9	1.54	(1.27-1.87)		1.56	(1.15-2.13)		1.44	(1.16-1.80)		
	≥28	1.41	(1.12-1.77)	<0.001	1.24	(1.01-1.53)	<0.001	1.31	(1.06-1.60)	<0.001	
<b>HIV status</b>	No	1			1			1			
	Yes, no CTX	1.88	(1.42-2.50)		1.71	(1.30-2.23)		1.97	(1.31-3.00)		
	Yes, on CTX	1.12	(0.70-1.78)	<0.001	1.25	(0.58-2701)	<0.001	1.27	(0.73-2.13)	<0.001	
<b>Obstetric complication</b>	No	1			1			1			
	Yes	5.07	(2.64-9.71)	<0.001	3.87	(2.11-7.06)	<0.001	4.98	(2.50-9.91)	<0.001	
<b>Multiple delivery</b>	No	1			1			1			
	Yes	1.42	(1.23-1.64)	<0.001	1.22	(0.79-1.87)	0.4	0.94	(0.79-1.12)	0.5	

\*odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\*p values from combined Wald test

§Interaction tests: univariable p<0.001, complete case p<0.001, imputed p=0.104.

**Table S10: Associations between maternal GBS colonisation and perinatal mortality, in three sites in coastal Kenya.**

Variable	Category	Univariable analyses			Multivariable complete case (n=5668)			Multivariable imputed (n=7833)		
		Odds Ratio (OR)	95%CI*	p **	Odds Ratio (OR)	95%CI*	p **	Odds Ratio (OR)	95%CI*	p **
<b>GBS<sup>§</sup></b>	negative	1			1			1		
	positive	0.88	(0.71-1.10)	0.3	0.99	(0.59-1.67)	0.9	0.94	(0.71-1.26)	0.7
<b>Age in quartiles</b>	<21.5	0.81	(0.47-1.40)		0.66	(0.33-1.34)		0.75	(0.48-1.16)	
	21.5-25.3	1.05	(0.91-1.20)		0.95	(0.93-1.65)		1.02	(0.91-1.16)	
	25.4-29.9	1		<0.001	1		<0.001	1		0.002
	≥30	1.29	(1.15-1.43)		1.24	(0.93-1.65)		1.17	(0.94-1.46)	
<b>Parity</b>	0	1.05	(0.71-1.55)		1.50	(1.22-1.84)		1.19	(0.85-1.68)	
	1-4	1		<0.001	1		<0.001	1		<0.001
	≥5	1.66	(1.10-2.52)		1.29	(1.11-1.48)		1.31	(1.09-1.58)	
<b>Sex</b>	Female	1			1			1		
	Male	0.95	(0.89-1.02)	0.2	0.97	(0.92-1.03)	0.3	0.94	(0.97-1.02)	0.2
<b>Education</b>	None	1.09	(0.69-1.71)		1.04	(0.74-1.47)		1.02	(0.81-1.68)	
	1°	1		0.6	1		0.8	1		<0.001
	2°	0.86	(0.78-0.95)		0.71	(0.62-0.82)		0.81	(0.69-0.95)	
	3°	0.68	(0.33-1.39)		0.86	(0.54-1.37)		0.70	(0.43-1.17)	
<b>Socio-economic status</b>	Very low	1.29	(0.82-2.03)		1.14	(0.89-1.46)		1.12	(0.69-1.85)	
	Low	1		0.4	1		0.5	1.06		0.2
	Medium	0.99	(0.62-1.59)		0.90	(0.55-1.48)		1	(0.70-1.61)	
	High	0.97	(0.59-1.61)		0.93	(0.57-1.53)		1.02	(0.98-1.06)	
<b>Nutritional status (mid-upper arm circumference in cm)</b>	≤23.9	1.18	(1.06-1.31)		1.25	(0.85-1.85)		1.23	(1.03-1.45)	
	24-25.9	1		<0.001	1		<0.001	1		<0.001
	26-27.9	1.45	(1.28-1.65)		1.48	(1.09-2.07)		1.36	(1.18-1.59)	
	≥28	1.48	(1.20-1.83)		1.42	(1.05-1.52)		1.39	(1.13-1.73)	
<b>HIV status</b>	No	1			1			1		
	Yes, no CTX	1.45	(1.22-1.99)	<0.001	1.34	(1.03-1.74)	<0.001	1.60	(1.18-2.21)	<0.001
	Yes, on CTX	1.03	(1.09-1.32)		1.36	(1.30-1.42)		1.33	(1.07-1.65)	
<b>Obst. comp.</b>	No	1		<0.001	1		<0.001	1		<0.001
	Yes	4.31	(2.83-6.57)		3.28	(2.41-4.45)		4.17	(2.67-6.51)	
<b>Multiple delivery</b>	No	1			1			1		
	Yes	1.69	(1.45-1.97)	<0.001	1.52	(1.23-1.87)	<0.001	1.17	(1.08-1.27)	<0.001

\*odds ratios 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

\*\*p values from combined Wald test

#HIV positive and on co-trimoxazole prophylaxis

§Interaction tests were not significant for maternal UTI, PROM or maternal temperature (at p<0.1 in univariable analyses); in addition, for any of these risk factors in mothers who were GBS colonised OR=1.11 (0.52-2.34) p=0.8; interaction term p=0.4.

**Table S11: Serotypes of GBS colonising mothers at delivery across three study sites in coastal Kenya 2011-2013\***

Serotype of GBS isolates allocated by whole genome sequencing	Number of GBS isolates colonising mothers	(%)
Ia	194	(21.2)
Ib	114	(12.5)
II	80	(8.7)
III	350	(38.3)
IV	18	(2.0)
V	156	(17.0)
VI	0	(0.0)
VII	3	(0.3)
VIII	0	(0.0)
IX	0	(0.0)
Total	915	(100)



**Table S12: Clonal complexes and Sequence types of GBS colonising mothers at delivery across three study sites in coastal Kenya 2011-2013**

Clonal Complex	Sequence type (ST)*	GBS isolates colonising mothers N	%	GBS isolates colonising mothers N	(%)
1	1	77	8.4		
	2	6	0.7		
	3	2	0.2		
	167	1	0.1		
	196	16	1.7		
	138-1-2-1-1-2-2	9	1.0		
	1-61-2-1-1-2-2	1	0.1		
	138-1-2-1-1-76-2	2	0.2	114	(12.5)
10	10	86	9.4		
	12	2	0.2		
	8	57	6.2		
	4-1-4-1-3-3-65	1	0.1		
	9-1-4-1-3-3-66	1	0.1		
	9-1-4-1-3-3-70	1	0.1	148	(16.2)
17	17	183	20.0		
	484	67	7.3		
	109	1	0.1		
	291	2	0.2		
	2-1-1-82-1-1-1	1	0.1		
	2-1-1-2-78-1-1	2	0.2		
	139-1-1-2-1-1-1	6	0.7		
	2-1-1-83-1-1-1	2	0.2		
	2-1-57-2-1-1-67	1	0.1		
	144-1-57-2-1-1-1	1	0.1		
	2-1-57-2-1-75-1	1	0.1		
	2-1-1-2-82-1-1	1	0.1	268	(29.3)
19	182	66	7.2		
	19	28	3.1		
	327	28	3.1		
	1-1-4-2-20-3-68	2	0.2		
	328	9	1.0		
	28	39	4.3		
	143-1-4-2-20-3-2	1	0.1	173	(18.9)
23	23	191	20.9		
	5-4-6-1-79-1-3	2	0.2		
	144	1	0.1		
	223	2	0.2		
	498	4	0.4		
	24	7	0.8		
	55	1	0.1	208	(22.7)
Other	103	1	0.1		
	486	2	0.2		
	13-3-95-2-1-1-22	1	0.1	4	(0.4)
Total		915	100		

\* For STs newly identified in this study, ST numbers are pending and therefore individual allele numbers are shown (*adhP-pheS-atr-glnA-sdhA-glcK-tkf*); there were no ST types from clonal complex-26 or 67.

**Table S13: Exposures associated with maternal GBS colonisation with ST-17**

Variable		GBS <sup>c</sup>	GBS ST-17 <sup>c</sup>	Univariable complete case analysis (N=914)			Multivariable complete case analysis (N=728)			
		N not ST-17 (not missing)	N ST-17 (not missing)	(%)	Odds Ratio (OR)	95%CI <sup>a</sup>	p <sup>b</sup>	OR	95%CI <sup>a</sup>	p <sup>b</sup>
Site	Rural	37	9	28.3	0.90	(0.42-1.91)	0.3	1.20	(1.12-1.28)	<0.001
	Semi-rural	464	126	31.7	1			1		
	Urban	232	46	24.1	0.73	(0.50-1.01)		1.00	(0.97-1.04)	
Age in quartiles (years) <sup>e</sup>	<21.5	131	33	29.9	1.21	(0.98-1.50)	0.024	1.2	(0.93-1.56)	0.3
	21.5-25.3	174	42	27.8	1.16	(0.74-1.82)		1.01	(0.80-1.46)	
	25.4-29.9	173	36	26.8	1			1		
	≥30	147	34	28.2	1.11	(0.97-1.28)		0.94	(0.77-1.15)	
	0	291	64	27.6	0.84	(0.48-1.47)		0.75	(0.43-1.31)	
Parity	1 to 5	344	90	30.6	1		0.7	1		<0.001
	≥5	92	26	29.7	1.08	(0.90-1.30)		1.01	(0.74-1.37)	
	Ethnicity: Mijikenda <sup>c</sup>	No	286	55	23.2	1			1	
	Yes	438	124	32.6	1.47	(1.40-1.54)	<0.001	1.78	(1.35-2.36)	<0.001
Household SES (quartiles)	Very low	82	14	26.0	0.61	(0.48-0.80)	<0.001	0.64	(0.37-1.12)	0.003
	Low	225	62	33.1	1			1		
	Medium	168	56	30.8	1.21	(0.82-1.80)		1.42	(0.97-2.07)	
	High	258	49	25.4	0.69	(0.41-1.15)		1.02	(0.62-1.66)	
Mother looks after cattle	No	678	175	29.9	1		0.073	1		
	Yes	50	6	21.4	0.46	(0.20-1.07)		0.46	(0.20-1.07)	
Nutritional status (mid-upper arm circumference in cm <sup>d</sup> )	≤23.9	95	27	33.6	1.21	(0.572-5.6)	0.7	1.21	(0.572-5.6)	
	24-25.9	209	49	29.8	1			1		
	26-27.9	143	35	27.0	1.04	(0.60-1.81)		1.04	(0.60-1.81)	
	≥28	244	60	28.0	1.05	(0.60-1.85)		1.05	(0.60-1.85)	
HIV infection	No	688	171	29.2	1		<0.001	1		<0.001
	Yes, no CTX <sup>e</sup>	15	5	35.0	1.34	(0.83-2.17)		1.46	(1.11-1.92)	
	Yes, on CTX <sup>e</sup>	3	2	60.0	2.69	(0.22-33.2)		4.30	(0.59-31.3)	

<sup>a</sup> 95% confidence intervals based on robust standard errors to account for intracluster correlation within recruitment sites

<sup>b</sup> p values derived from the Wald test (imputations combined using Rubin's rules)

<sup>c</sup> Mijikenda are the indigenous coastal population

<sup>d</sup> non-linearity in continuous variables incorporated using natural cubic splines (Figure S2).

<sup>e</sup> CTX=co-trimoxazole prophylaxis

**Table S14: Characteristics of mothers and newborns included in the study of GBS transmission (surface colonisation) in Kilifi County Hospital (2012-13)**

Variable	Category	Total	Maternal GBS colonisation		Neonatal GBS colonisation	
		N	n	(%)	n	(%)
		<b>830</b>	<b>104</b>	<b>( 12.5)</b>	<b>44</b>	<b>5.3)</b>
Parity	1	301	47	(15.6)	20	(6.6)
	2-4	352	40	(11.4)	17	(4.8)
	≥5	170	17	(10.0)	7	(4.1)
	Missing	7	0	(0.0)	0	(0.0)
Sex of baby	Male	431	48	(11.1)	19	(4.4)
	Female	385	56	(14.5)	25	(6.5)
	Missing	14	0	(0.0)	0	(0.0)
Mode of delivery	Non-operative	662	80	(12.1)	36	(5.4)
	Operative	161	23	(14.3)	7	(4.3)
	Missing	7	1	(14.3)	1	(14.3)
Gestation (weeks)	<34	27	5	(18.5)	0	(0.0)
	<37	200	20	(10.0)	11	(5.5)
	37-42	505	64	(12.7)	24	(4.8)
	>42	84	14	(16.7)	8	(9.5)
	Missing	14	1	(7.1)	1	(7.1)
Weight	<1500	10	1	(10.0)	0	(0.0)
	<2500	121	14	(11.6)	11	(9.1)
	2500-3500	592	76	(12.8)	30	(5.1)
	>3500	94	12	(12.8)	3	(3.2)
	Missing	13	1	(7.7)	0	(0.0)
PROM >18h	No	715	89	(12.4)	37	(5.2)
	Yes	35	3	(8.6)	2	(5.7)
	Missing	80	12	(15.0)	5	(6.3)
Maternal fever (>38.0°C)	No	690	85	(12.3)	36	(5.2)
	Yes	5	2	(40.0)	1	(20.0)
	Missing	135	17	(12.6)	7	(5.2)
Maternal urinary tract infection	No	693	84	(12.1)	39	(5.6)
	Yes	25	6	(24.0)	1	(4.0)
	Missing	112	14	(12.5)	4	(3.6)

**Table S15: Characteristics of neonates admitted to Kilifi County Hospital with GBS disease (1998-2013)**

		<b>Cases N=82</b>	<b>(%)</b>	<b>Deaths N=23</b>	<b>CFR (%)</b>
<b>Age category</b>	<48h	25	(30)	14	(56)
	2-6 days	11	(13)	3	(27)
	7-28 days	43	(52)	5	(12)
	Missing	3	(4)	1	(33)
<b>Sex</b>	Male	52	(63)	15	(29)
	Female	27	(33)	6	(22)
	Missing	3	(4)	1	(33)
<b>HIV infection</b>	No	65	(79)	17	(26)
	Yes	6	(7)	2	(33)
	Missing	11	(13)	4	(36)
<b>Weight category</b>	<1500g	9	(11)	6	(67)
	1500-2499g	16	(20)	9	(56)
	2500-3499g	39	(48)	3	(8)
	≥3500g	12	(15)	1	(8)
	Missing	6	(7)	4	(67)
<b>Disease type</b>	Sepsis	58	(71)	21	(36)
	Meningitis	8	(10)	0	(0)
	Sepsis and meningitis	16	(20)	2	(13)

CFR=Case fatality Risk

**Table S16: Clonal complexes and ST types causing neonatal GBS disease (Kilifi County Hospital 1998-2013).**

GBS isolates causing neonatal disease in Kilifi County Hospital		Clinical syndrome					
Clonal Complex	Sequence Type (ST)*	Sepsis	Meningitis	Sepsis and meningitis	N	Total	(%)
1	2	1	0	0	1	2	(2.7)
	196	1	0	0	1		
10	10	2	0	0	2	5	(6.8)
	8	2	0	0	2		
	4-1-4-84-3-3-2	1	0	0	1		
17	147	1	0	0	1	51	(69.9)
	17	25	4	13	42		
	484	3	2	2	7		
	144-1-57-2-1-1-1	1	0	0	1		
19	182	2	1	0	3	4	(5.5)
	19	1	0	0	1		
23	23	10	0	0	10	11	(15.1)
	141-4-6-3-2-1-3	0	0	1	1		

\* For STs newly identified in this study, ST numbers are pending and therefore individual allele numbers are shown (*adhP-pheS-atr-glnA-sdhA-glck-tkl*)

**Table S17: *Streptococcus agalactiae* isolates used in analyses**

Please see separate file.

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