

Supplementary Information for:

Reduced antibacterial drug resistance and blaCTX-M β -lactamase gene carriage in cattle-associated Escherichia coli at low temperatures, at sites dominated by older animals and on pastureland: implications for surveillance

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Supplementary Tables

Table S1: All univariable analyses from the Calf dataset. All variables presented in the table were screened for association with *E. coli* carrying *bla*_{CTX-M} using univariable, multilevel logistic regression with each variable entered as a fixed effect and with random intercepts for each farm. Variables with associations where the adjusted $p < 0.25$ (after controlling for false discovery rate using the Benjamini-Hochberg procedure) were taken forward into the backwards stepwise model.

Variable	Odds ratio	Lower CI	Upper CI	p	Adjusted p	Description
s_temp	1.79	1.39	2.30	0.00	0.00	Average monthly temperature
s_cefq_dct_6m	4.22	1.80	9.90	0.00	0.01	Use of cefquinome dry cow therapy in the last six months
s_fram_dct_6m	2.95	1.45	5.98	0.00	0.03	Use of framycetin dry cow therapy in the last six months
f_trough_clean	0.43	0.24	0.77	0.00	0.04	Daily cleaning of water troughs in calf housing
f_nsaiddiarr	0.28	0.10	0.76	0.01	0.08	Routine use of anti-inflammatories in cases of calf diarrhoea
f_ceph_1	0.45	0.23	0.88	0.02	0.12	Total amount of first-generation cephalosporin use
f_poultry	2.64	1.05	6.63	0.04	0.19	Presence of poultry on the farm
f_rain	1.18	0.93	1.49	0.17	0.62	Average monthly rainfall
f_give_col	2.01	0.72	5.58	0.18	0.62	Administration of colostrum within six hours of life
f_pneum_vacc	0.51	0.20	1.29	0.15	0.62	Routine use of calf respiratory vaccination
f_calf_housing_type	0.52	0.16	1.67	0.27	0.76	Type of calf housing
f_anticocc	1.68	0.68	4.13	0.26	0.76	Routine use of anticoccidials
f_calving_group	1.85	0.41	8.40	0.43	0.80	Whether calves were born in a group pen
s_clox_dct_6m	0.62	0.22	1.76	0.37	0.80	Use of cloxacillin dry cow therapy in the last six months
f_scc	0.84	0.55	1.28	0.41	0.80	Average herd somatic cell count
f_geographical_area	1.66	0.49	5.61	0.42	0.80	Geographical location of the farm
f_heifers_waste	1.44	0.59	3.53	0.42	0.80	Whether waste milk has been fed to heifers
f_anything_waste	1.45	0.54	3.88	0.46	0.83	Whether waste milk was fed to any calves
f_pattern	1.50	0.44	5.09	0.52	0.86	Calving pattern
f_water	1.32	0.49	3.59	0.58	0.86	Source of drinking water
f_calf_housing_older	0.82	0.28	2.40	0.71	0.86	Whether calves have been kept near to older animals
s_ceph_dct_6m	1.18	0.48	2.95	0.72	0.86	Use of cephalonium dry cow therapy in the last six months
f_um_spray	0.72	0.22	2.36	0.59	0.86	Routine use of umbilical treatment
f_time_dam	0.86	0.45	1.62	0.63	0.86	Amount of time spent with dam
f_halocur	1.16	0.46	2.98	0.75	0.86	Routine use of treatment to prevent cryptosporidiosis
f_diarrvacc	0.79	0.30	2.06	0.63	0.86	Routine use of calf enteric disease vaccination
f_bought_pre	0.92	0.61	1.39	0.70	0.86	Number of cattle bought in the 12 months before the start of the project
f_herd_size	1.08	0.70	1.67	0.73	0.86	Number of milking cows on the farm

f_yield	1.08	0.69	1.69	0.72	0.86	Average herd yield
f_total_cattle	0.92	0.59	1.42	0.69	0.86	Total number of cattle on the farm
f_total_mg_pcu	1.04	0.70	1.54	0.84	0.90	Total antibiotic usage
f_wean	1.16	0.34	3.93	0.81	0.90	Age of weaning
f_equine	0.94	0.39	2.30	0.90	0.92	Presence of horses on the farm
f_ceph_3_4	1.02	0.64	1.64	0.93	0.93	Amount of third- and fourth-generation cephalosporins used

Table S2: All univariable analyses from the full dataset. All variables presented in the table were screened for association with *E. coli* carrying *bla*_{CTX-M} using univariable, multilevel logistic regression with each variable entered as a fixed effect and with random intercepts for each farm. Variables with associations where the adjusted $p < 0.25$ (after controlling for false discovery rate using the Benjamini-Hochberg procedure) were taken forwards into the backwards stepwise model.

Variable	Odds ratio	Lower CI	Upper CI	p	Adjusted p	Description
preweaned_heifer	5.85	4.33	7.89	0.00	0.00	Sample collected from a pre-weaned heifer
s_temp	1.52	1.32	1.76	0.00	0.00	Average monthly temperature
weaned_heifer	0.48	0.33	0.68	0.00	0.00	Sample collected from a weaned heifer
s_housed_outdoor	0.30	0.17	0.54	0.00	0.00	Sample collected from pastureland
f_foragetype_3	3.11	1.51	6.43	0.00	0.03	Maize silage used on farm
footpath	0.37	0.20	0.70	0.00	0.03	Sample collected from a public footpath
adult	0.62	0.46	0.84	0.00	0.03	Sample collected from a milking cow
dry	0.40	0.20	0.81	0.01	0.12	Sample collected from a dry cow
f_othergraze	0.47	0.25	0.86	0.02	0.15	Use of grazing land away from the farm
f_salmvacc	0.15	0.03	0.83	0.03	0.24	Routine vaccination against Salmonella
f_trough_clean	0.67	0.43	1.04	0.07	0.52	Daily cleaning of water troughs in calf housing
f_cefq_dct	1.90	0.90	4.01	0.09	0.59	Use of cefquinome dry cow therapy
f_acf	1.71	0.90	3.21	0.10	0.59	Use of automatic cluster flushing
f_scc	0.75	0.53	1.06	0.10	0.59	Average herd somatic cell count
f_total_mg_pcu	1.23	0.94	1.60	0.13	0.62	Total antibiotic usage
f_manure_7	0.14	0.01	1.67	0.12	0.62	Use of composter for muck management
f_manure_1	1.61	0.84	3.07	0.15	0.62	Use of slurry lagoon
f_hunt	0.61	0.32	1.17	0.14	0.62	Whether the hunt crosses the farm
f_um_spray	0.54	0.23	1.25	0.15	0.62	Routine use of umbilical treatment
f_anticocc	1.60	0.84	3.05	0.15	0.62	Routine use of anticoccidials
f_lungvacc	0.63	0.31	1.25	0.18	0.64	Routine vaccination against lungworm
f_bvdvacc	1.59	0.79	3.19	0.19	0.64	Routine vaccination against bovine viral diarrhoea
f_give_col	1.58	0.79	3.16	0.19	0.64	Administration of colostrum within six hours of life
f_time_dam	0.74	0.47	1.16	0.19	0.64	Time calf spends with the dam
f_poultry	1.56	0.82	2.97	0.18	0.64	Presence of poultry on the farm
f_manure_3	0.66	0.32	1.37	0.27	0.73	Use of a metal slurry store
f_bedmilk_6	3.39	0.46	25.07	0.23	0.73	Use of green bedding for milking cows
f_rat	1.47	0.75	2.89	0.27	0.73	Perceived level of rat infestation on the farm
f_cleancluster	1.27	0.82	1.98	0.28	0.73	How often the milking cluster was cleaned
f_timesfirstmast	1.18	0.87	1.61	0.28	0.73	How often clinical mastitis cases were treated with intramammary tubes
f_leptovacc	1.50	0.71	3.16	0.29	0.73	Routine use of leptospirosis vaccination

f_nsaiddiarr	0.64	0.30	1.36	0.24	0.73	Routine use of anti-inflammatories in the case of calf diarrhoea
f_anything_waste	1.49	0.74	2.98	0.26	0.73	Whether waste milk was fed to any calves
f_halocur	1.42	0.73	2.77	0.31	0.75	Routine use of treatment to prevent cryptosporidiosis
f_water	1.39	0.69	2.81	0.36	0.84	Source of drinking water
f_bedmilk_2	1.36	0.69	2.65	0.37	0.85	Use of straw as milking cow bedding
f_manure_8	1.47	0.56	3.85	0.43	0.88	Use of separator for muck management
f_manure_2	1.36	0.58	3.19	0.47	0.88	Use of a weeping wall for slurry management
f_bedmilk_3	0.78	0.41	1.50	0.46	0.88	Use of sawdust as milking cow bedding
f_starling	0.77	0.39	1.52	0.46	0.88	Perceived amount of starling infestation
f_abcalve	1.42	0.62	3.23	0.40	0.88	Routine use of antibiotics following a difficult calving
f_organic	0.58	0.14	2.48	0.47	0.88	Whether the farm is certified organic
f_clostrvacc	1.34	0.60	2.99	0.48	0.88	Routine use of clostridial vaccine
s_rain	0.95	0.83	1.09	0.48	0.88	Average monthly rainfall
f_manure_4	0.81	0.43	1.54	0.52	0.89	Use of a concrete slurry store
f_foragetype_5	1.21	0.59	2.45	0.61	0.89	Feeding of hay
f_foragetype_2	0.77	0.29	2.06	0.61	0.89	Feeding of big bale grass silage
f_aiexternal	1.21	0.64	2.30	0.55	0.89	Artificial insemination performed by external company
f_pheasant	0.80	0.33	1.91	0.61	0.89	Perceived amount of pheasants on farmland
f_deer	1.26	0.59	2.69	0.55	0.89	Perceived amount of deer on farmland
f_shows	1.47	0.46	4.72	0.52	0.89	Whether cattle go to shows
f_nsaidmast	1.09	0.81	1.47	0.58	0.89	Routine use of anti-inflammatories in cases of mastitis
f_calf_housing_older	0.81	0.37	1.78	0.60	0.89	Whether calves have been kept near to older animals
f_herd_size	1.10	0.80	1.51	0.56	0.89	Number of milking cows on the farm
f_heifers_waste	1.20	0.62	2.35	0.59	0.89	Whether waste milk has been fed to heifers
f_machinery	0.86	0.45	1.63	0.64	0.90	Whether machinery was shared with other farms
f_muckspreader	0.86	0.45	1.66	0.66	0.90	Use of a contract muck spreader
f_calving_group	1.30	0.44	3.82	0.64	0.90	Whether calves were born in a group pen
f_diarrvacc	0.85	0.43	1.69	0.65	0.90	Routine use of calf enteric disease vaccination
s_calving_now	1.15	0.60	2.22	0.67	0.90	Whether cows were calving during the month in which the sample was taken
f_ceph_1	0.97	0.72	1.32	0.85	0.93	Total amount of first-generation cephalosporin use
f_ceph_3_4	0.95	0.70	1.29	0.75	0.93	Amount of third- and fourth- generation cephalosporins used
f_clox_dct	0.92	0.42	2.02	0.83	0.93	Use of cloxacillin dry cow therapy
f_foragetype_4	1.12	0.59	2.13	0.73	0.93	Feeding of whole crop silage
f_bedmilk_4	0.66	0.06	7.33	0.74	0.93	Use of paper waste for milking cow bedding
f_shoot	1.09	0.57	2.06	0.80	0.93	Whether the shoot crosses the farm
f_badger	1.10	0.40	3.01	0.86	0.93	Perceived badger population on the farm
f_premises	0.94	0.49	1.81	0.86	0.93	Number of farm premises

f_drytrough	0.95	0.60	1.50	0.84	0.93	How often the dry cow water trough was cleaned out
f_treatfoot	1.07	0.57	2.01	0.84	0.93	Use of a footbath for lameness outbreaks
f_daystreatmast	1.04	0.76	1.43	0.81	0.93	Number of days cases of mastitis were treated with antibiotics
f_hectares	1.03	0.75	1.42	0.84	0.93	Size of farm in hectares
f_wean	0.88	0.33	2.31	0.79	0.93	Age of weaning
f_equine	0.94	0.49	1.79	0.85	0.93	Presence of horses on the farm
f_manure_6	0.97	0.51	1.84	0.93	0.96	Use of muck heap on concrete
f_feedlorry	0.97	0.49	1.91	0.92	0.96	Whether feed lorries crossed any cattle yards when delivering
f_lime	1.03	0.53	1.99	0.93	0.96	Use of lime in milking cow housing
f_pneum_vacc	0.97	0.49	1.92	0.93	0.96	Routine use of calf respiratory vaccination
f_total_cattle	0.98	0.71	1.36	0.92	0.96	Total number of cattle on the farm
f_foragetype_1	1.04	0.25	4.26	0.96	0.97	Feeding of clamp grass silage
f_bedmilk_1	0.99	0.49	2.00	0.99	0.99	Use of sand in milking cow bedding

Table S3: Results of the Bayesian analysis, odds ratios with 95% credible intervals associated with the presence of *E. coli* carrying *bla*_{CTX-M}. The type of prior (diffuse/regularized) is also shown. Variables in *italics* were regularized and are ordered according to the average (for factor variables with more than two levels) magnitude of their effect.

Variable	Odds ratio	Lower CI	Upper CI	Description
total_mg_pcu	1.16	0.78	1.69	Total antibiotic usage
ceph_1	1.01	0.69	1.45	Total amount of first-generation cephalosporin use
ceph_3_4	0.96	0.65	1.45	Amount of third- and fourth- generation cephalosporins used
<i>dry1</i>	0.96	0.63	1.17	Sample collected from the dry cow environment
<i>f_abcalve1</i>	1.02	0.74	1.59	Routine use of antibiotics following a difficult calving
<i>f_acf1</i>	1.09	0.85	2.13	Use of automatic cluster flushing
<i>f_aiexternal1</i>	1.07	0.87	1.85	Artificial insemination performed by external company
<i>f_anticocc1</i>	1.04	0.81	1.61	Routine use of anticoccidials
<i>f_anything_waste1</i>	1.03	0.81	1.59	Whether waste milk was fed to any calves
<i>f_badger2</i>	1.01	0.74	1.51	Perceived badger population on the farm
<i>f_bedmilk_1yes</i>	0.99	0.67	1.37	Use of sand in milking cow bedding
<i>f_bedmilk_2yes</i>	1.03	0.79	1.54	Use of straw as milking cow bedding
<i>f_bedmilk_3yes</i>	0.98	0.67	1.24	Use of sawdust as milking cow bedding
<i>f_bedmilk_4yes</i>	1.00	0.60	1.60	Use of paper waste for milking cow bedding
<i>f_bedmilk_6yes</i>	1.02	0.68	1.83	Use of green bedding for milking cows
<i>f_bought_pre</i>	0.96	0.69	1.12	Number of cattle bought in the 12 months before the start of the project
<i>f_bvdvaccY</i>	1.07	0.84	1.93	Routine vaccination against bovine viral diarrhoea
<i>f_calf_housing_older1</i>	0.98	0.67	1.30	Whether calves have been kept near to older animals
<i>f_calf_housing_type3</i>	1.01	0.76	1.40	Type of calf housing
<i>f_calveclean.L</i>	1.00	0.76	1.31	How often the calving pens are cleaned out
<i>f_calving_group1</i>	1.02	0.74	1.63	Whether calves were born in a group pen
<i>f_cefq_dct1</i>	1.04	0.80	1.66	Use of cefquinome dry cow therapy
<i>f_ceph_dct1</i>	0.84	0.31	1.15	Use of cephalonium dry cow therapy
<i>f_cleancluster.L</i>	1.03	0.85	1.42	How often the milking cluster was cleaned
<i>f_clostvaccY</i>	1.01	0.73	1.48	Routine use of clostridial vaccine
<i>f_clox_dct1</i>	1.03	0.77	1.63	Use of cloxacillin dry cow therapy
<i>f_daystreatmast</i>	1.00	0.82	1.24	Number of days cases of mastitis were treated with antibiotics
<i>f_deer2</i>	1.01	0.74	1.38	Perceived amount of deer on farmland
<i>f_diarrvaccY</i>	0.97	0.68	1.22	Routine use of calf enteric disease vaccination
<i>f_drytrough.L</i>	0.98	0.70	1.20	How often the dry cow water trough was cleaned out
<i>f_equine1</i>	0.97	0.67	1.24	Presence of horses on the farm
<i>f_feedlorry1</i>	0.97	0.66	1.26	Whether feed lorries crossed any cattle yards when delivering
<i>f_firstmastitisCobactan</i>	1.02	0.67	1.71	First line mastitis treatment
<i>f_firstmastitisMastiplanLC</i>	0.92	0.29	1.34	

<i>f_firstmastitisOrbeninLA</i>	0.93	0.33	1.41	
<i>f_firstmastitistdDmultinject</i>	1.01	0.76	1.40	
<i>f_firstmastitisUbrolexin</i>	1.07	0.80	2.33	
<i>f_firstmastitisUbroYellow</i>	0.98	0.66	1.27	
<i>f_foragetype_1yes</i>	0.98	0.63	1.38	Feeding of clamp grass silage
<i>f_foragetype_2yes</i>	0.95	0.51	1.24	Feeding of big bale grass silage
<i>f_foragetype_3yes</i>	1.32	0.87	4.36	Maize silage used on farm
<i>f_foragetype_4yes</i>	1.02	0.81	1.46	Feeding of whole crop silage
<i>f_foragetype_5yes</i>	1.02	0.79	1.56	Feeding of hay
<i>f_foragetype_6yes</i>	1.18	0.81	4.84	Feeding of straw
<i>f_foragetype_7yes</i>	0.98	0.69	1.29	Feeding of haylage
<i>f_fox2</i>	1.00	0.75	1.33	Perceived amount of foxes on farmland
<i>f_fram_dct1</i>	1.56	0.93	5.06	Use of framycetin dry cow therapy
<i>f_geographical_area2</i>	0.99	0.70	1.34	Farm is in geographical area 2
<i>f_geographical_area3</i>	1.15	0.87	2.75	Farm is in geographical area 3
<i>f_give_col1</i>	1.03	0.78	1.57	Administration of colostrum within six hours of life
<i>f_halocur1</i>	1.01	0.79	1.41	Routine use of treatment to prevent cryptosporidiosis
<i>f_hectares</i>	1.01	0.85	1.26	Size of farm in hectares
<i>f_heifers_waste1</i>	1.09	0.85	2.15	Whether waste milk has been fed to heifers
<i>f_herd_size</i>	1.01	0.83	1.26	Number of milking cows on the farm
<i>f_hostfarmwalk1</i>	0.97	0.62	1.23	Whether a farm walk has taken place on the farm in the last two years
<i>f_hunt2</i>	0.95	0.57	1.18	Whether the hunt crosses the farm
<i>f_ibrvaccY</i>	1.02	0.78	1.54	Routine use of infectious bovine rhinotracheitis vaccination
<i>f_injectmast</i>	1.03	0.86	1.40	Whether mastitis cases are routinely injected with antibiotic
<i>f_leptovaccY</i>	1.00	0.74	1.34	Routine use of leptospirosis vaccination
<i>f_lime1</i>	0.97	0.65	1.26	Use of lime in milking cow housing
<i>f_lungvaccY</i>	0.94	0.53	1.19	Routine vaccination against lungworm
<i>f_machinery1</i>	0.96	0.61	1.22	Whether machinery was shared with other farms
<i>f_manure_1yes</i>	1.08	0.85	1.99	Use of slurry lagoon
<i>f_manure_2yes</i>	1.03	0.80	1.65	Use of a weeping wall for slurry management
<i>f_manure_3yes</i>	0.97	0.65	1.25	Use of a metal slurry store
<i>f_manure_4yes</i>	0.98	0.69	1.26	Use of a concrete slurry store
<i>f_manure_5yes</i>	0.97	0.61	1.23	Muck heap in field used
<i>f_manure_6yes</i>	0.99	0.71	1.28	Use of muck heap on concrete
<i>f_manure_7yes</i>	0.92	0.32	1.35	Use of composter for muck management
<i>f_manure_8yes</i>	1.03	0.74	1.67	Use of separator for muck management
<i>f_market1</i>	1.01	0.76	1.44	Whether cattle are taken to market regularly
<i>f_milkgraze1</i>	1.02	0.76	1.58	Whether milking cows graze
<i>f_muckspreader3</i>	1.04	0.72	2.02	Use of a contract muck spreader
<i>f_nsaidcalve1</i>	0.98	0.69	1.26	Routine use of anti-inflammatories at calving
<i>f_nsaiddiarr1</i>	0.97	0.62	1.30	Routine use of anti-inflammatories in cases of calf diarrhoea
<i>f_nsaidmast</i>	0.99	0.80	1.18	Routine use of anti-inflammatories in cases of mastitis
<i>f_organic1</i>	1.01	0.68	1.62	Whether the farm is certified organic
<i>f_othergrazeY</i>	0.91	0.44	1.16	Use of grazing land away from the farm
<i>f_outsource1</i>	0.86	0.26	1.23	Whether heifer calves are reared by a different enterprise

<i>f_pattern2</i>	1.12	0.84	2.66	Calving pattern
<i>f_pheasant2</i>	0.99	0.69	1.38	Perceived amount of pheasants on farmland
<i>f_pigeon2</i>	0.96	0.59	1.20	Perceived level of pigeon infestation
<i>f_pneum_vacc1</i>	1.00	0.73	1.37	Routine use of calf respiratory vaccination
<i>f_poultry1</i>	1.03	0.82	1.55	Presence of poultry on the farm
<i>f_predip1</i>	1.05	0.84	1.66	Whether pre-dip is used when milking
<i>f_premises2</i>	1.01	0.74	1.45	Number of farm premises
<i>f_rat2</i>	1.02	0.79	1.43	Perceived level of rat infestation on the farm
<i>f_rook2</i>	0.94	0.52	1.20	Perceived level of rook infestation on farm
<i>f_salmvaccY</i>	0.85	0.20	1.23	Routine vaccination against <i>Salmonella</i>
<i>f_scc</i>	0.96	0.71	1.14	Average herd somatic cell count
<i>f_shoot2</i>	0.99	0.70	1.29	Whether the shoot crosses the farm
<i>f_shows1</i>	1.14	0.82	3.75	Whether cattle from the farm are taken to shows
<i>f_starling2</i>	0.98	0.69	1.26	Perceived amount of starling infestation
<i>f_time_dam.L</i>	0.99	0.76	1.25	Time calf spends with dam
<i>f_timesfirstmast</i>	1.02	0.88	1.28	How often clinical mastitis cases were treated with intramammary tubes
<i>f_total_cattle</i>	0.99	0.78	1.20	Total number of cattle on the farm
<i>f_treatfoot1</i>	0.99	0.72	1.31	Use of a footbath for lameness outbreaks
<i>f_trough_clean.L</i>	0.88	0.47	1.10	Daily cleaning of water troughs in calf housing
<i>f_um_spray1</i>	0.98	0.64	1.33	Routine use of umbilical treatment
<i>f_water1</i>	1.07	0.84	2.07	Source of drinking water
<i>f_wean2</i>	0.95	0.51	1.25	Age of weaning
<i>f_wean3</i>	1.12	0.86	2.48	
<i>f_whichclinrespMacrolide</i>	0.99	0.69	1.30	Most commonly used antibiotic to treat calf pneumonia
<i>f_whichclinrespOtherDdontknow</i>	0.92	0.32	1.47	
<i>f_whichclinrespPenicillimoxycillin</i>	0.93	0.31	1.39	
<i>f_whichclinrespTetracycline</i>	1.00	0.71	1.40	
<i>f_yield</i>	1.02	0.85	1.32	Average herd yield
<i>footpath1</i>	0.90	0.41	1.16	Sample collected from a public footpath
<i>preweaned_heifer1</i>	5.58	3.86	8.49	Sample collected from the environment of a pre-weaned heifer
<i>s_calving_now1</i>	1.00	0.74	1.32	Whether cows were calving during the month in which the sample was taken
<i>s_housed_outdooroutdoor</i>	0.50	0.22	1.02	Sample collected from pastureland
<i>s_rain</i>	1.19	0.99	1.47	Average monthly rainfall
<i>s_temp</i>	1.71	1.42	2.05	Average monthly temperature
<i>weaned_heifer1</i>	0.99	0.78	1.24	Sample collected from the environment of a weaned heifer
<i>adult1</i>	1.06	0.90	1.54	Sample collected from the milking cow environment

Table S4: Full details from Bayesian logistic regression models for non-cephalosporin resistance with odds ratios, 95% credible intervals and effective sample sizes. Tables are ordered by magnitude of effect size of the variables. A prefix 'main_' indicates variables tested as the main variables with diffuse priors. A prefix 'reg_' indicated regularised variables where a horseshoe prior was applied.

Amoxicillin

Variable	Odds ratio	Lower CI	Upper CI	Description	Effective sample size
reg_s_housed_outdooroutdoor	0.27	0.2	0.37	Sample collected from pasture	16776
reg_preweaned_heifer1	1.99	1.29	2.98	Sample collected from the environment of a pre-weaned heifer	14162
main_s_temp	1.91	1.57	2.35	Average monthly temperature	14045
main_total_mg_pcu	1.61	0.91	2.86	Total antibiotic usage	11829
main_pen	0.71	0.31	1.67	Total usage of penicillin	11046
main_co_amox	1.24	0.82	1.92	Total usage of amoxicillin-clavulanic acid	12507
reg_f_shows1	1.17	0.92	3.31	Whether animals are taken to shows	5518
reg_f_firstmastitistdDmultiject	1.17	0.95	2.22	First line choice of mastitis treatment is streptomycin/neomycin/novobiocin/penicillin	4957
main_strep	0.88	0.7	1.11	Total streptomycin usage	12932
reg_f_lungvaccY	0.89	0.54	1.06	Routine use of lungworm vaccination	8244
reg_f_foragetype_2yes	0.9	0.43	1.08	Feeding of big bale grass silage	8200
main_ceph_1	0.91	0.63	1.31	Total usage of first-generation cephalosporins	13338
main_fq	1.1	0.85	1.43	Total fluoroquinolone usage	12700
main_amox	1.08	0.78	1.47	Total amoxicillin usage	12016
reg_f_manure_4yes	0.93	0.61	1.06	Use of a concrete slurry store	10621
main_tet	1.07	0.82	1.41	Total tetracycline usage	13366
reg_f_acf1	0.93	0.61	1.07	Use of automatic cluster flushing	10392
reg_f_calf_housing_type3	0.94	0.61	1.07	Type of calf housing	10640
reg_weaned_heifer1	0.94	0.68	1.06	Sample collected from the environment of a weaned heifer	14146
reg_weaned_heifer0	1.06	0.94	1.46	Sample collected from the environment of a weaned heifer	14252
reg_f_poultry1	1.06	0.94	1.59	Presence of poultry on the farm	10856
reg_f_foragetype_3yes	1.06	0.93	1.64	Maize silage used on farm	11536
main_cefalexin	0.95	0.68	1.32	Total cefalexin usage	12769
reg_f_firstmastitisOrbeninLA	1.05	0.86	2.19	First line choice of mastitis treatment is cloxacillin	12774
reg_f_lime1	1.05	0.93	1.53	Use of lime in milking cow housing	12295
reg_f_bedmilk_1yes	0.95	0.66	1.08	Use of sand in milking cow bedding	11987
reg_f_firstmastitisUbrolexin	0.96	0.58	1.11	First line choice of mastitis treatment is cefalexin/kanamycin	13189
reg_f_manure_1yes	1.05	0.93	1.51	Use of slurry lagoon	10583
reg_f_clostvaccY	0.96	0.64	1.1	Routine use of clostridial vaccination	13062
reg_f_salmvaccY	0.96	0.58	1.13	Routine use of <i>Salmonella</i> vaccination	11197
reg_f_predip1	1.04	0.93	1.44	Whether pre-dip is used when milking	11247
reg_f_fox2	0.96	0.71	1.08	Perceived fox population on farm	13343
reg_f_equine1	1.04	0.92	1.42	Presence of horses on the farm	14623
reg_f_badger2	1.04	0.9	1.55	Perceived badger population on the farm	12196
reg_f_deer2	0.97	0.68	1.09	Perceived amount of deer on farmland	11514
reg_s_calving_now1	1.03	0.93	1.38	Sample collected during the calving season	13902
reg_f_manure_9yes	1.03	0.87	1.68	Use of other manure management	12921
reg_f_cleancluster.L	0.97	0.76	1.07	How often the milking cluster was cleaned	13794
reg_f_foragetype_8yes	0.97	0.6	1.16	Feeding of other forage	14145
reg_f_nsaidmast	0.97	0.8	1.05	Routine use of anti-inflammatories in cases of mastitis	12903

reg_f_shoot2	0.97	0.71	1.08	Whether the shoot crosses the farm	10858
reg_f_firstmastitisMastiplanLC	0.97	0.61	1.17	First line choice of mastitis treatment is cefapirin	15368
reg_f_pattern2	1.03	0.91	1.43	Calving pattern	13418
reg_f_whichclinrespPenicillimoxycillin	0.97	0.62	1.17	First line choice of pneumonia treatment is amoxicillin	14627
reg_f_machinery1	0.97	0.74	1.08	Whether machinery was shared with other farms	13809
reg_f_anything_waste1	1.03	0.92	1.35	Whether waste milk was fed to any calves	14253
reg_f_diarrvaccY	0.97	0.74	1.09	Routine use of calf enteric disease vaccination	13367
reg_f_percentdryoff	1.03	0.95	1.22	Proportion of cows dried off with antibiotic tubes	13079
reg_f_bedmilk_6yes	1.03	0.86	1.54	Use of green bedding for milking cows	13859
reg_f_manure_3yes	1.03	0.91	1.38	Use of a metal slurry store	13836
reg_f_othergrazeY	0.97	0.75	1.08	Use of grazing land away from the farm	13721
reg_f_rook2	1.03	0.91	1.34	Perceived rook population on farm	13452
reg_f_feedlorry1	1.03	0.92	1.32	Whether feed lorries crossed any cattle yards when delivering	14284
reg_f_geographical_area2	1.02	0.92	1.32	Geographical area 2	13961
reg_f_um_spray1	1.02	0.9	1.37	Routine use of umbilical treatment at birth	13855
reg_f_organic1	0.98	0.71	1.13	Whether the farm is organic	13493
reg_f_manure_6yes	1.02	0.92	1.29	Use of muck heap on concrete	15221
reg_f_daystreatmast	1.02	0.94	1.21	Number of days mastitis is treated for	15025
reg_adult1	1.02	0.92	1.25	Sample collected from the milking cow environment	15001
reg_f_hostfarmwalk1	1.02	0.91	1.29	Whether a farm walk has taken place on the farm in the last two years	14356
reg_f_bedmilk_2yes	1.02	0.91	1.27	Use of straw as milking cow bedding	14695
reg_f_trough_clean.L	1.02	0.93	1.22	Daily cleaning of water troughs in calf housing	13884
reg_f_timesfirstmast	0.98	0.85	1.06	How often clinical mastitis cases were treated with intramammary tubes	14080
reg_f_hectares	0.98	0.85	1.06	Size of farm in hectares	13599
reg_f_foragetype_4yes	1.02	0.92	1.25	Feeding of whole crop silage	14484
reg_f_time_dam.L	1.02	0.92	1.24	Time calf spends with dam	13291
reg_f_abcalve1	1.02	0.89	1.31	Routine use of antibiotics following a difficult calving	13603
reg_f_manure_7yes	1.02	0.86	1.37	Use of composter for muck management	15307
reg_f_whichclinrespOtherDdontknow	1.02	0.84	1.42	First line choice of pneumonia treatment is unknown	15451
reg_s_rain	1.02	0.96	1.12	Average monthly rainfall	15328
reg_f_yield	1.02	0.93	1.18	305-day milk yield	14634
reg_f_foragetype_1yes	1.02	0.87	1.33	Feeding of clamp grass silage	15498
reg_f_outsource1	1.01	0.88	1.3	Whether heifer calves are reared by a different enterprise	15180
reg_f_firstmastitisCobactan	0.99	0.73	1.19	First line choice of mastitis treatment is cefquinome	14799
reg_f_aiexternal1	1.01	0.91	1.24	Artificial insemination performed by external company	14228
reg_f_wean2	0.99	0.79	1.13	Age of weaning	14301
reg_f_hunt2	0.99	0.81	1.1	Whether the hunt crosses the farm	14843
reg_f_bedmilk_8yes	0.99	0.72	1.21	Unknown milking cow bedding type	14857
reg_f_halocur1	1.01	0.9	1.23	Routine use of treatment to prevent cryptosporidiosis	15015
reg_f_muckspreader3	0.99	0.75	1.19	Use of a contract muck spreader	15745
reg_f_bedmilk_4yes	1.01	0.84	1.35	Use of paper waste for milking cow bedding	14530
reg_f_calf_housing_older1	0.99	0.8	1.12	Whether calves have been kept near to older animals	15647
reg_f_foragetype_7yes	0.99	0.81	1.12	Feeding of haylage	14456
reg_f_calf_housing_type2	1.01	0.9	1.21	Type of calf housing	15435
reg_f_injectmast	0.99	0.85	1.09	Whether mastitis cases are routinely injected with antibiotic	15577
reg_f_nsaiddiarr1	0.99	0.82	1.12	Routine use of anti-inflammatories in cases of calf diarrhoea	14910
reg_f_calving_group1	1.01	0.87	1.25	Whether calves were born in a group pen	14965
reg_f_ibrvaccY	0.99	0.82	1.11	Routine use of IBR vaccination	15763
reg_dry1	0.99	0.83	1.11	Sample collected from the dry cow environment	15410
reg_f_bought_pre	1.01	0.93	1.14	Number of cattle bought in the 12 months before the start of the project	14805
reg_f_foragetype_6yes	1.01	0.87	1.26	Feeding of straw	15578

reg_f_drytrough.L	0.99	0.86	1.09	How often the dry cow water trough was cleaned out	14593
reg_f_pneum_vacc1	1.01	0.89	1.21	Routine use of calf respiratory vaccination	15422
reg_f_premises2	0.99	0.84	1.12	Number of farm premises	15055
reg_f_market1	0.99	0.83	1.13	Whether animals are taken to market	14304
reg_f_geographical_area3	1.01	0.88	1.19	Geographical area 3	15533
reg_f_bdvaccY	1.01	0.89	1.19	Routine use of bovine viral diarrhoeavaccination	14765
reg_f_pheasant2	1.01	0.87	1.22	Perceived pheasant population on farm	16033
reg_f_fram_dct1	0.99	0.84	1.13	Use of framycetin dry cow therapy	15346
reg_f_firstmastitisUbroYellow	0.99	0.82	1.14	First line choice of mastitis treatment is streptomycin/framycetin	15943
reg_f_rat2	1.01	0.89	1.19	Perceived rat population on farm	15668
reg_f_wean3	0.99	0.85	1.12	Age of weaning	16139
reg_footpath1	1.01	0.89	1.19	Sample collected from a public footpath	14807
reg_f_herd_size	1.01	0.92	1.13	Total milking cattle on farm	15719
reg_f_manure_8yes	1.01	0.86	1.23	Use of separator for muck management	15645
reg_f_heifers_waste1	1.01	0.88	1.19	Whether waste milk has been fed to heifers	16652
reg_f_anticocc1	0.99	0.84	1.13	Routine use of anticoccidials	14850
reg_f_manure_2yes	0.99	0.82	1.16	Use of a weeping wall for slurry management	15670
reg_f_calveclean.L	0.99	0.86	1.12	How often the calving pens are cleaned out	15365
reg_f_pigeon2	1	0.89	1.16	Perceived pigeon population on farm	16287
reg_f_total_cattle	1	0.91	1.13	Total number of cattle on farm	15650
reg_f_give_col1	1	0.87	1.19	Administration of colostrum within six hours of life	16275
reg_f_starling2	1	0.85	1.14	Perceived amount of starling infestation	15575
reg_f_whichclinrespTetracycline	1	0.84	1.15	First line choice of pneumonia treatment is tetracycline	15426
reg_f_clox_dct1	1	0.84	1.15	Use of cloxacillin dry cow therapy	14993
reg_f_leptovaccY	1	0.85	1.16	Routine use of leptospirosis vaccination	15273
reg_f_milkgraze1	1	0.84	1.17	Whether milking cows graze	15249
reg_f_manure_5yes	1	0.85	1.16	Muck heap in field used	16334
reg_f_water1	1	0.87	1.17	Water supply to the farm	16330
reg_f_ceph_dct1	1	0.87	1.18	Use of cephalonium dry cow therapy	15314
reg_f_nsaiddcalve1	1	0.87	1.14	Routine use of anti-inflammatories at calving	15448
reg_f_whichclinrespMacrolide	1	0.86	1.14	First line choice of pneumonia treatment is Macrolide	15614
reg_f_cefq_dct1	1	0.84	1.17	Use of cefquinome dry cow therapy	15436
reg_f_bedmilk_3yes	1	0.86	1.14	Use of sawdust as milking cow bedding	14504
reg_f_muckspreader1	1	0.86	1.15	Use of a contract muck spreader	15654
reg_f_treatfoot1	1	0.87	1.14	Use of a footbath for lameness outbreaks	15255
reg_f_foragetype_5yes	1	0.86	1.15	Feeding of hay	15969
reg_f_scc	1	0.91	1.09	Somatic cell count	15473

Ciprofloxacin

Variable	Odds ratio	Lower CI	Upper CI	Description	Effective sample size
reg_preweaned_heifer1	4.13	2.79	6.46	Sample collected from the environment of a pre-weaned heifer	15693
main_s_temp	2.14	1.63	2.87	Average monthly temperature	12028
reg_f_calf_housing_type3	0.69	0.25	1.07	Type of calf housing	4232
main_fq	1.43	1	2.06	Total fluoroquinolone usage	10768
reg_f_firstmastitisUbroYellow	0.73	0.23	1.09	First line choice of mastitis treatment is streptomycin/framycetin	7563
reg_weaned_heifer1	0.75	0.36	1.11	Sample collected from the environment of a weaned heifer	6799
reg_weaned_heifer0	1.32	0.89	2.73	Sample collected from the environment of a weaned heifer	6662
reg_f_manure_5yes	0.78	0.34	1.07	Muck heap in field used	5482
reg_f_nsaiddiarr1	0.83	0.33	1.1	Routine use of anti-inflammatories in cases of calf diarrhoea	6236
reg_f_foragetype_8yes	1.19	0.82	7.3	Feeding of other forage	7416
reg_f_starling2	1.17	0.92	2.45	Perceived amount of starling infestation	6626
reg_f_um_spray1	1.17	0.88	3.45	Routine use of umbilical treatment at birth	6640

reg_f_badger2	0.86	0.33	1.14	Perceived badger population on the farm	6769
reg_f_equine1	1.15	0.92	2.26	Presence of horses on the farm	7623
main_novobiocin	1.15	0.82	1.61	Total usage of novobiocin	12967
reg_s_rain	1.14	0.99	1.4	Average monthly rainfall	11234
reg_f_foragetype_6yes	0.89	0.37	1.15	Feeding of straw	8766
reg_f_calf_housing_older1	0.91	0.47	1.12	Whether calves have been kept near to older animals	10059
main_total_mg_pcu	1.1	0.81	1.51	Total antibiotic usage	10506
reg_f_lime1	0.92	0.48	1.14	Use of lime in milking cow housing	8800
reg_f_geographical_area2	0.92	0.51	1.12	Geographical area 2	10736
reg_f_shows1	0.92	0.39	1.19	Whether animals are taken to shows	9575
reg_f_pneum_vacc1	1.08	0.9	1.91	Routine use of calf respiratory vaccination	10497
reg_f_nsaidcalve1	0.93	0.55	1.11	Routine use of anti-inflammatories at calving	11633
reg_f_daystreatmast	0.94	0.67	1.08	Number of days mastitis is treated for	7167
main_ceph_3_4	1.07	0.79	1.44	Total usage of third- and fourth-generation cephalosporins	13594
reg_f_timesfirstmast	1.07	0.94	1.42	How often clinical mastitis cases were treated with intramammary tubes	11138
reg_f_organic1	1.07	0.82	2.29	Whether the farm is organic	12424
reg_f_shoot2	1.06	0.88	1.78	Whether the shoot crosses the farm	9954
reg_f_poultry1	0.94	0.58	1.13	Presence of poultry on the farm	10396
reg_f_bedmilk_6yes	1.06	0.79	2.28	Use of green bedding for milking cows	12193
reg_f_geographical_area3	1.06	0.88	1.69	Geographical area 3	11375
reg_f_deer2	1.06	0.87	1.69	Perceived amount of deer on farmland	12957
reg_f_fox2	1.05	0.86	1.76	Perceived fox population on farm	7675
reg_f_foragetype_3yes	0.95	0.58	1.15	Maize silage used on farm	10977
reg_f_whichclinrespOtherDdontknow	0.95	0.46	1.37	First line choice of pneumonia treatment is unknown	13574
reg_f_manure_7yes	1.05	0.81	1.93	Use of composter for muck management	13782
reg_f_foragetype_4yes	1.05	0.88	1.55	Feeding of whole crop silage	13965
reg_f_manure_9yes	0.96	0.49	1.28	Use of other manure management	13485
reg_f_foragetype_7yes	1.04	0.85	1.66	Feeding of haylage	11290
reg_f_bedmilk_2yes	0.96	0.62	1.16	Use of straw as milking cow bedding	13291
reg_f_bedmilk_4yes	1.04	0.78	1.96	Use of paper waste for milking cow bedding	13598
reg_f_calf_housing_type2	1.04	0.84	1.63	Type of calf housing	12407
reg_f_bedmilk_3yes	0.96	0.65	1.16	Use of sawdust as milking cow bedding	13805
reg_f_clox_dct1	1.04	0.86	1.55	Use of cloxacillin dry cow therapy	14131
reg_f_market1	0.96	0.66	1.15	Whether animals are taken to market	12646
reg_f_hectares	0.96	0.75	1.08	Size of farm in hectares	13697
reg_f_wean2	1.04	0.83	1.61	Age of weaning	14120
reg_adult1	1.04	0.86	1.48	Sample collected from the milking cow environment	13968
reg_f_machinery1	1.04	0.87	1.48	Whether machinery was shared with other farms	14737
reg_f_manure_6yes	0.97	0.66	1.17	Use of muck heap on concrete	10417
reg_f_nsaidmast	0.97	0.77	1.1	Routine use of anti-inflammatories in cases of mastitis	14039
reg_f_time_dam.L	1.03	0.89	1.4	Time calf spends with dam	13189
reg_f_whichclinrespTetracycline	1.03	0.84	1.5	First line choice of pneumonia treatment is tetracycline	14007
reg_f_predip1	1.03	0.85	1.48	Whether pre-dip is used when milking	14150
reg_f_anything_waste1	1.03	0.85	1.47	Whether waste milk was fed to any calves	13999
reg_f_rat2	1.03	0.86	1.45	Perceived rat population on farm	12527
reg_f_drytrough.L	1.03	0.88	1.35	How often the dry cow water trough was cleaned out	13553
reg_f_othergrazeY	1.03	0.85	1.45	Use of grazing land away from the farm	14048
reg_f_firstmastitistdDmultiject	1.03	0.84	1.49	First line choice of mastitis treatment is streptomycin/neomycin/novobiocin/penicillin	13907
reg_f_salmvaccY	0.97	0.6	1.31	Routine use of <i>Salmonella</i> vaccination	14613
reg_s_housed_outdooroutdoor	0.97	0.74	1.14	Sample collected from pasture	15477
reg_f_bedmilk_1yes	1.03	0.84	1.47	Use of sand in milking cow bedding	14998
reg_f_firstmastitisOrbeninLA	0.98	0.57	1.38	First line choice of mastitis treatment is cloxacillin	14319
reg_f_whichclinrespMacrolide	1.02	0.85	1.42	First line choice of pneumonia treatment is macrolide	14843
reg_f_foragetype_1yes	1.02	0.77	1.6	Feeding of clamp grass silage	14457

reg_f_bought_pre	0.98	0.79	1.11	Number of cattle bought in the 12 months before the start of the project	14481
reg_f_yield	1.02	0.9	1.27	305-day milk yield	13160
reg_f_muckspreader1	0.98	0.72	1.18	Use of a contract muck spreader	14627
reg_f_calveclean.L	1.02	0.86	1.35	How often the calving pens are cleaned out	14038
reg_f_halocur1	0.98	0.72	1.18	Routine use of treatment to prevent cryptosporidiosis	15356
reg_f_wean3	1.02	0.83	1.42	Age of weaning	13750
reg_f_manure_8yes	0.98	0.66	1.26	Use of separator for muck management	15110
reg_f_manure_2yes	0.98	0.68	1.23	Use of a weeping wall for slurry management	13636
reg_f_cleancluster.L	0.98	0.77	1.14	How often the milking cluster was cleaned	15715
reg_f_firstmastitisCobactan	1.02	0.75	1.61	First line choice of mastitis treatment is cefquinome	14490
reg_f_firstmastitisUbrolexin	0.98	0.66	1.27	First line choice of mastitis treatment is cefalexin/kanamycin	15576
reg_f_injectmast	0.98	0.79	1.13	Whether mastitis cases are routinely injected with antibiotic	14950
reg_f_premises2	0.98	0.72	1.19	Number of farm premises	13996
reg_f_manure_1yes	1.02	0.84	1.38	Use of slurry lagoon	15333
reg_s_calving_now1	1.02	0.85	1.36	Sample collected during the calving season	15832
reg_f_scc	0.98	0.79	1.12	Somatic cell count	13187
reg_f_manure_3yes	0.98	0.71	1.21	Use of a metal slurry store	14400
reg_f_hunt2	0.98	0.71	1.21	Whether the hunt crosses the farm	15981
reg_f_rook2	1.02	0.82	1.41	Perceived rook population on farm	15432
reg_f_percentdryoff	0.98	0.82	1.11	Proportion of cows dried off with antibiotic tubes	13978
reg_footpath1	1.02	0.85	1.32	Sample collected from a public footpath	15593
reg_f_hostfarmwalk1	1.02	0.83	1.36	Whether a farm walk has taken place on the farm in the last two years	15339
reg_f_clostvaccY	0.98	0.71	1.23	Routine use of clostridial vaccination	15736
reg_f_manure_4yes	0.98	0.76	1.18	Use of a concrete slurry store	15247
reg_f_heifers_waste1	1.02	0.82	1.37	Whether waste milk has been fed to heifers	15220
reg_f_foragetype_2yes	1.01	0.8	1.41	Feeding of big bale grass silage	15358
reg_f_treatfoot1	0.99	0.76	1.21	Use of a footbath for lameness outbreaks	15499
reg_f_pheasant2	0.99	0.73	1.25	Perceived pheasant population on farm	15243
reg_f_lungvaccY	1.01	0.83	1.32	Routine use of lungworm vaccination	15349
reg_f_feedlorry1	0.99	0.76	1.22	Whether feed lorries crossed any cattle yards when delivering	15026
reg_f_leptovaccY	1.01	0.81	1.36	Routine use of leptospirosis vaccination	14451
reg_f_calving_group1	0.99	0.7	1.29	Whether calves were born in a group pen	15731
reg_f_bedmilk_8yes	1.01	0.69	1.58	Unknown milking cow bedding type	16431
reg_f_outsource1	0.99	0.72	1.28	Whether heifer calves are reared by a different enterprise	16010
reg_f_total_cattle	0.99	0.82	1.16	Total number of cattle on farm	14539
reg_f_abcalve1	1.01	0.78	1.37	Routine use of antibiotics following a difficult calving	14795
reg_f_diarrvaccY	0.99	0.77	1.21	Routine use of calf enteric disease vaccination	16283
reg_f_anticocc1	0.99	0.75	1.23	Routine use of anticoccidials	14699
reg_f_ceph_dct1	1.01	0.81	1.33	Use of cephalonium dry cow therapy	14106
reg_f_give_col1	0.99	0.76	1.24	Administration of colostrum within six hours of life	15443
reg_f_pigeon2	1.01	0.82	1.28	Perceived pigeon population on farm	15848
reg_f_trough_clean.L	1.01	0.85	1.25	Daily cleaning of water troughs in calf housing	14505
reg_f_herd_size	1.01	0.86	1.22	Total milking cattle on farm	15973
reg_dry1	0.99	0.77	1.24	Sample collected from the dry cow environment	16680
reg_f_acf1	1.01	0.81	1.31	Use of automatic cluster flushing	16258
reg_f_cefq_dct1	0.99	0.75	1.26	Use of cefquinome dry cow therapy	15543
reg_f_pattern2	1.01	0.8	1.32	Calving pattern	16463
reg_f_milkgraze1	1.01	0.77	1.38	Whether milking cows graze	15393
reg_f_whichclinrespPenicillimoxycillin	0.99	0.64	1.45	First line choice of pneumonia treatment is amoxicillin	16502
reg_f_firstmastitisMastiplanLC	0.99	0.64	1.45	First line choice of mastitis treatment is cefapirin	16583
reg_f_bvdvaccY	1.01	0.81	1.29	Routine use of BVD vaccination	15891
reg_f_water1	1	0.81	1.28	Water supply to the farm	16726
reg_f_ibrvaccY	1	0.79	1.22	Routine use of IBR vaccination	16969
reg_f_foragetype_5yes	1	0.79	1.32	Feeding of hay	16330

reg_f_muckspreader3	1	0.65	1.49	Use of a contract muck spreader	15633
reg_f_aiexternal1	1	0.79	1.23	Artificial insemination performed by external company	15194
reg_f_fram_dct1	1	0.79	1.27	Use of framycetin dry cow therapy	16268

Streptomycin

Variable	Odds ratio	Lower CI	Upper CI	Description	Effective sample size
reg_preweaned_heifer1	1.95	1.46	2.51	Sample collected from the environment of a pre-weaned heifer	15464
reg_footpath1	0.57	0.33	1.01	Sample collected from a public footpath	8540
main_s_temp	1.53	1.32	1.77	Average monthly temperature	13407
reg_s_housed_outdooroutdoor	0.75	0.44	1.03	Sample collected from pasture	8326
reg_s_calving_now1	1.27	0.98	2	Sample collected during the calving season	8738
reg_dry1	1.16	0.97	1.79	Sample collected from the dry cow environment	12817
reg_f_foragetype_3yes	1.14	0.95	2.08	Maize silage used on farm	5522
reg_f_pneum_vacc1	1.14	0.95	1.92	Routine use of calf respiratory vaccination	6699
main_total_mg_pcu	1.13	0.86	1.49	Total antibiotic usage	12578
reg_f_abcalve1	0.89	0.48	1.07	Routine use of antibiotics following a difficult calving	10026
main_cefalexin	0.9	0.75	1.09	Total cefalexin usage	12778
reg_f_wean2	0.9	0.52	1.06	Age of weaning	10638
reg_f_firstmastitisUbrolexin	0.91	0.44	1.09	First line choice of mastitis treatment is cefalexin/kanamycin	10314
main_tet	1.09	0.89	1.34	Total tetracycline usage	12151
reg_f_cleancluster.L	0.92	0.69	1.04	How often the milking cluster was cleaned	11173
reg_f_foragetype_5yes	1.08	0.94	1.65	Feeding of hay	11173
reg_f_bedmilk_4yes	1.07	0.89	2.5	Use of paper waste for milking cow bedding	9850
reg_f_pheasant2	1.06	0.93	1.69	Perceived pheasant population on farm	10567
reg_f_shows1	1.06	0.91	1.79	Whether animals are taken to shows	12426
reg_f_halocur1	0.95	0.66	1.07	Routine use of treatment to prevent cryptosporidiosis	10267
reg_f_nsaidmast	0.95	0.77	1.04	Routine use of anti-inflammatories in cases of mastitis	12851
reg_adult1	0.95	0.73	1.04	Sample collected from the milking cow environment	13692
reg_f_whichclinrespPenicillimoxycillin	0.95	0.47	1.16	First line choice of pneumonia treatment is amoxicillin	12856
reg_f_firstmastitisMastiplanLC	0.95	0.48	1.15	First line choice of mastitis treatment is cefapirin	12121
reg_f_organic1	0.96	0.59	1.13	Whether the farm is organic	11453
reg_f_firstmastitistDmultiject	1.04	0.93	1.44	First line choice of mastitis treatment is streptomycin/neomycin/novobiocin/penicillin	12760
reg_f_ceph_dct1	1.04	0.93	1.41	Use of cephalonium dry cow therapy	13189
reg_f_manure_3yes	1.04	0.92	1.44	Use of a metal slurry store	10961
reg_f_milkgraze1	1.04	0.91	1.5	Whether milking cows graze	10565
reg_f_foragetype_2yes	0.96	0.67	1.1	Feeding of big bale grass silage	12546
reg_f_total_cattle	1.04	0.96	1.26	Total number of cattle on farm	12890
reg_f_foragetype_8yes	0.97	0.6	1.16	Feeding of other forage	13344
reg_f_geographical_area2	0.97	0.74	1.08	Geographical area 2	13343
reg_f_whichclinrespTetracycline	0.97	0.72	1.08	First line choice of pneumonia treatment is tetracycline	13601
main_amox	1.03	0.84	1.28	Total amoxicillin usage	12754
reg_f_cefq_dct1	0.97	0.72	1.09	Use of cefquinome dry cow therapy	13947
reg_f_bvdvaccY	1.03	0.93	1.35	Routine use of BVD vaccination	12468
reg_f_time_dam.L	1.03	0.93	1.34	Time calf spends with dam	8561
reg_f_leptovaccY	1.03	0.92	1.38	Routine use of leptospirosis vaccination	11081
reg_f_heifers_waste1	1.03	0.92	1.36	Whether waste milk has been fed to heifers	10976
reg_f_rook2	1.03	0.92	1.32	Perceived rook population on farm	14780
reg_f_muckspreader3	0.97	0.65	1.16	Use of a contract muck spreader	14810
reg_f_foragetype_6yes	1.03	0.89	1.43	Feeding of straw	13953
reg_f_acf1	0.98	0.76	1.1	Use of automatic cluster flushing	14077
reg_f_calf_housing_type2	0.98	0.79	1.08	Type of calf housing	14890
reg_f_aiexternal1	1.02	0.93	1.28	Artificial insemination performed by external company	14294

reg_f_fram_dct1	0.98	0.76	1.09	Use of framycetin dry cow therapy	12804
reg_f_calveclean.L	1.02	0.93	1.27	How often the calving pens are cleaned out	14198
reg_f_othergrazeY	0.98	0.78	1.09	Use of grazing land away from the farm	14255
reg_f_herd_size	1.02	0.94	1.2	Total milking cattle on farm	15398
reg_f_foragetype_1yes	1.02	0.88	1.37	Feeding of clamp grass silage	14665
reg_f_scc	0.98	0.85	1.05	Somatic cell count	15049
reg_f_clostvaccY	1.02	0.9	1.27	Routine use of clostridial vaccination	14789
reg_f_trough_clean.L	1.02	0.93	1.2	Daily cleaning of water troughs in calf housing	14231
reg_f_starling2	1.02	0.91	1.24	Perceived amount of starling infestation	14589
reg_f_equine1	0.98	0.81	1.1	Presence of horses on the farm	13757
reg_f_whichclinrespMacrolide	0.98	0.82	1.09	First line choice of pneumonia treatment is macrolide	14467
reg_f_calving_group1	1.02	0.89	1.29	Whether calves were born in a group pen	14737
reg_f_foragetype_4yes	0.99	0.83	1.09	Feeding of whole crop silage	14526
reg_f_daystreatmast	1.01	0.94	1.15	Number of days mastitis is treated for	14779
reg_f_machinery1	1.01	0.91	1.22	Whether machinery was shared with other farms	15002
reg_f_percentdryoff	1.01	0.95	1.14	Proportion of cows dried off with antibiotic tubes	15287
reg_f_manure_1yes	0.99	0.82	1.1	Use of slurry lagoon	12786
reg_f_feedlorry1	0.99	0.82	1.1	Whether feed lorries crossed any cattle yards when delivering	15377
reg_f_manure_6yes	1.01	0.9	1.22	Use of muck heap on concrete	13867
reg_f_bedmilk_8yes	0.99	0.74	1.21	Unknown milking cow bedding type	14951
reg_f_pigeon2	1.01	0.91	1.19	Perceived pigeon population on farm	15008
reg_f_manure_4yes	1.01	0.91	1.19	Use of a concrete slurry store	15383
reg_f_deer2	1.01	0.9	1.22	Perceived amount of deer on farmland	15014
main_strep	1.01	0.84	1.22	Total streptomycin usage	12830
reg_f_predip1	1.01	0.92	1.19	Whether pre-dip is used when milking	15077
reg_f_pattern2	0.99	0.81	1.12	Calving pattern	13256
reg_f_geographical_area3	1.01	0.9	1.21	Geographical area 3	14418
reg_f_um_spray1	1.01	0.88	1.23	Routine use of umbilical treatment at birth	15700
reg_f_salmvaccY	1.01	0.85	1.31	Routine use of Salmonella vaccination	14891
reg_f_bedmilk_1yes	0.99	0.83	1.11	Use of sand in milking cow bedding	14669
reg_f_lungvaccY	1.01	0.9	1.19	Routine use of lungworm vaccination	14451
reg_weaned_heifer1	1.01	0.9	1.18	Sample collected from the environment of a weaned heifer	14119
reg_weaned_heifer0	0.99	0.85	1.1	Sample collected from the environment of a weaned heifer	14629
reg_f_yield	1.01	0.93	1.14	305-day milk yield	14481
reg_f_premises2	0.99	0.84	1.11	Number of farm premises	14509
reg_f_badger2	0.99	0.81	1.14	Perceived badger population on the farm	14838
reg_f_anticocc1	1.01	0.89	1.2	Routine use of anticoccidials	15149
reg_f_bought_pre	1.01	0.93	1.13	Number of cattle bought in the 12 months before the start of the project	16151
reg_s_rain	1.01	0.97	1.08	Average monthly rainfall	15991
reg_f_ibrvaccY	1.01	0.9	1.19	Routine use of IBR vaccination	15637
reg_f_firstmastitisCobactan	0.99	0.78	1.19	First line choice of mastitis treatment is cefquinome	14987
reg_f_nsaidcalve1	1.01	0.9	1.18	Routine use of anti-inflammatories at calving	14262
reg_f_rat2	1.01	0.9	1.18	Perceived rat population on farm	14971
reg_f_diarrvaccY	1.01	0.9	1.18	Routine use of calf enteric disease vaccination	15340
reg_f_nsaiddiarr1	1.01	0.89	1.19	Routine use of anti-inflammatories in cases of calf diarrhoea	15850
reg_f_manure_2yes	1.01	0.88	1.21	Use of a weeping wall for slurry management	14431
reg_f_drytrough.L	0.99	0.87	1.09	How often the dry cow water trough was cleaned out	14578
reg_f_injectmast	0.99	0.87	1.09	Whether mastitis cases are routinely injected with antibiotic	14922
reg_f_wean3	0.99	0.85	1.12	Age of weaning	15060
reg_f_give_col1	1.01	0.89	1.18	Administration of colostrum within six hours of life	14275
reg_f_shoot2	1.01	0.88	1.19	Whether the shoot crosses the farm	14900
reg_f_bedmilk_2yes	1.01	0.89	1.18	Use of straw as milking cow bedding	15338
reg_f_treatfoot1	1.01	0.9	1.17	Use of a footbath for lameness outbreaks	14794
reg_f_manure_8yes	1.01	0.86	1.23	Use of separator for muck management	16202

reg_f_whichclinrespOtherDdontknow	0.99	0.77	1.22	First line choice of pneumonia treatment is unknown	16004
reg_f_manure_9yes	1.01	0.84	1.26	Use of other manure management	15507
reg_f_firstmastitisOrbeninLA	1.01	0.81	1.3	First line choice of mastitis treatment is cloxacillin	15499
reg_f_muckspreader1	1.01	0.89	1.17	Use of a contract muck spreader	15809
reg_f_foragetype_7yes	1.01	0.88	1.18	Feeding of haylage	15916
reg_f_poultry1	1.01	0.89	1.18	Presence of poultry on the farm	13463
main_fq	1	0.81	1.24	Total fluoroquinolone usage	12370
reg_f_hectares	1	0.93	1.1	Size of farm in hectares	15000
reg_f_anything_waste1	1	0.86	1.13	Whether waste milk was fed to any calves	16071
reg_f_manure_7yes	1	0.83	1.25	Use of composter for muck management	15095
reg_f_bedmilk_3yes	1	0.87	1.12	Use of sawdust as milking cow bedding	15988
reg_f_timesfirstmast	1	0.91	1.08	How often clinical mastitis cases were treated with intramammary tubes	15557
reg_f_manure_5yes	1	0.86	1.13	Muck heap in field used	16106
reg_f_outsource1	1	0.83	1.17	Whether heifer calves are reared by a different enterprise	15346
reg_f_hunt2	1	0.89	1.15	Whether the hunt crosses the farm	15077
reg_f_calf_housing_type3	1	0.86	1.13	Type of calf housing	16222
reg_f_hostfarmwalk1	1	0.88	1.17	Whether a farm walk has taken place on the farm in the last two years	15878
reg_f_water1	1	0.85	1.14	Water supply to the farm	15786
reg_f_clox_dct1	1	0.86	1.15	Use of cloxacillin dry cow therapy	14865
reg_f_lime1	1	0.88	1.15	Use of lime in milking cow housing	15821
reg_f_firstmastitisUbroYellow	1	0.87	1.17	First line choice of mastitis treatment is streptomycin/framycetin	14361
reg_f_fox2	1	0.87	1.14	Perceived fox population on farm	15965
reg_f_calf_housing_older1	1	0.87	1.16	Whether calves have been kept near to older animals	14803
reg_f_market1	1	0.87	1.15	Whether animals are taken to market	16430
reg_f_bedmilk_6yes	1	0.8	1.26	Use of green bedding for milking cows	15380

Tetracycline

Variable	Odds ratio	Lower CI	Upper CI	Description	Effective sample size
reg_s_housed_outdooroutdoor	0.24	0.15	0.35	Sample collected from pasture	14783
reg_preweaned_heifer1	3.39	2	5.82	Sample collected from the environment of a pre-weaned heifer	16320
reg_f_foragetype_3yes	2.15	0.98	4.53	Maize silage used on farm	5799
reg_s_calving_now1	2.02	1.1	3.29	Sample collected during the calving season	11454
main_s_temp	1.98	1.55	2.55	Average monthly temperature	11857
reg_f_foragetype_2yes	0.67	0.22	1.09	Feeding of big bale grass silage	7025
main_total_mg_pcu	1.47	1.01	2.13	Total antibiotic usage	10534
reg_f_calf_housing_older1	0.74	0.38	1.06	Whether calves have been kept near to older animals	9125
reg_dry1	0.74	0.42	1.05	Sample collected from the dry cow environment	12095
main_strep	0.76	0.6	0.97	Total streptomycin usage	10355
reg_s_rain	1.26	1.08	1.47	Average monthly rainfall	15742
reg_weaned_heifer1	1.26	0.87	2.27	Sample collected from the environment of a weaned heifer	9246
reg_weaned_heifer0	0.8	0.44	1.15	Sample collected from the environment of a weaned heifer	9151
main_amox	0.83	0.6	1.15	Total amoxicillin usage	10154
reg_f_calf_housing_type3	0.84	0.43	1.1	Type of calf housing	10060
reg_f_manure_7yes	1.18	0.83	3.86	Use of composter for muck management	10262
reg_f_lime1	1.18	0.92	2.14	Use of lime in milking cow housing	9542
reg_f_yield	1.17	0.96	1.76	305-day milk yield	6215
reg_footpath1	1.15	0.91	2.02	Sample collected from a public footpath	13684
reg_f_geographical_area2	1.14	0.91	2.05	Geographical area 2	10536
reg_f_calf_housing_type2	1.13	0.9	1.93	Type of calf housing	10850
reg_f_clostvaccY	1.12	0.88	2.05	Routine use of clostridial vaccination	12058
reg_f_firstmastitistdDmultiject	1.11	0.89	1.86	First line choice of mastitis treatment is streptomycin/neomycin/novobiocin/penicillin	11310
reg_f_shows1	1.1	0.84	2.21	Whether animals are taken to shows	12045

reg_f_bedmilk_8yes	0.91	0.33	1.29	Unknown milking cow bedding type	12577
reg_f_equine1	1.1	0.9	1.74	Presence of horses on the farm	11693
reg_f_firstmastitisUbrolexin	0.92	0.45	1.19	First line choice of mastitis treatment is cefalexin/kanamycin	11084
reg_f_bedmilk_2yes	1.09	0.89	1.82	Use of straw as milking cow bedding	12136
reg_f_foragetype_7yes	0.92	0.55	1.14	Feeding of haylage	13396
reg_f_salmvaccY	1.08	0.78	2.46	Routine use of <i>Salmonella</i> vaccination	11949
reg_f_manure_4yes	0.92	0.62	1.12	Use of a concrete slurry store	12254
reg_f_whichclinrespPenicillimoxycillin	0.92	0.35	1.31	First line choice of pneumonia treatment is amoxicillin	13006
reg_f_firstmastitisMastiplanLC	0.92	0.37	1.34	First line choice of mastitis treatment is cefapirin	11972
reg_f_treatfoot1	1.07	0.88	1.65	Use of a footbath for lameness outbreaks	12678
reg_f_percentdryoff	1.07	0.95	1.34	Proportion of cows dried off with antibiotic tubes	13056
reg_f_ceph_dct1	0.93	0.61	1.13	Use of cephalonium dry cow therapy	11352
reg_f_foragetype_5yes	1.07	0.88	1.66	Feeding of hay	13979
reg_f_water1	1.07	0.87	1.67	Water supply to the farm	12733
reg_f_hunt2	1.07	0.88	1.61	Whether the hunt crosses the farm	13310
reg_f_cefq_dct1	1.06	0.85	1.72	Use of cefquinome dry cow therapy	13318
reg_f_hectares	1.06	0.94	1.33	Size of farm in hectares	12996
reg_f_firstmastitisCobactan	0.94	0.47	1.3	First line choice of mastitis treatment is cefquinome	14092
reg_f_give_col1	1.06	0.86	1.62	Administration of colostrum within six hours of life	13436
reg_f_foragetype_8yes	0.95	0.47	1.33	Feeding of other forage	14021
reg_f_pattern2	0.95	0.59	1.19	Calving pattern	13079
reg_f_wean3	0.95	0.66	1.15	Age of weaning	13309
reg_f_bought_pre	0.95	0.76	1.09	Number of cattle bought in the 12 months before the start of the project	13511
reg_f_machinery1	1.05	0.86	1.51	Whether machinery was shared with other farms	13494
reg_f_anything_waste1	0.95	0.66	1.16	Whether waste milk was fed to any calves	13856
reg_f_injectmast	1.05	0.9	1.38	Whether mastitis cases are routinely injected with antibiotic	13948
reg_f_foragetype_4yes	1.05	0.87	1.45	Feeding of whole crop silage	14290
main_cefalexin	1.05	0.75	1.46	Total cefalexin usage	9197
reg_f_poultry1	1.05	0.86	1.51	Presence of poultry on the farm	13159
reg_f_muckspreader3	0.96	0.5	1.39	Use of a contract muck spreader	14964
reg_f_cleancluster.L	0.96	0.74	1.12	How often the milking cluster was cleaned	14549
reg_f_ibrvaccY	1.04	0.85	1.49	Routine use of IBR vaccination	13355
reg_f_time_dam.L	1.04	0.84	1.46	Time calf spends with dam	11342
reg_f_anticocc1	1.04	0.84	1.51	Routine use of anticoccidials	14568
reg_f_predip1	1.04	0.86	1.42	Whether pre-dip is used when milking	14122
reg_f_shoot2	0.96	0.69	1.17	Whether the shoot crosses the farm	14314
reg_f_firstmastitisUbroYellow	1.04	0.84	1.51	First line choice of mastitis treatment is streptomycin/framycetin	15162
reg_f_muckspreader1	1.04	0.84	1.49	Use of a contract muck spreader	14473
reg_f_manure_9yes	1.04	0.74	1.8	Use of other manure management	14351
reg_f_pneum_vacc1	1.04	0.85	1.45	Routine use of calf respiratory vaccination	14655
reg_f_badger2	1.04	0.8	1.59	Perceived badger population on the farm	13939
reg_f_manure_8yes	1.03	0.79	1.61	Use of separator for muck management	14545
reg_f_rook2	1.03	0.85	1.44	Perceived rook population on farm	15600
reg_f_whichclinrespTetracycline	1.03	0.83	1.49	First line choice of pneumonia treatment is tetracycline	14297
reg_f_nsaidcalve1	0.97	0.71	1.16	Routine use of anti-inflammatories at calving	14669
reg_f_manure_5yes	0.97	0.69	1.19	Muck heap in field used	15226
reg_f_hostfarmwalk1	1.03	0.84	1.44	Whether a farm walk has taken place on the farm in the last two years	14724
reg_f_firstmastitisOrbeninLA	0.97	0.52	1.44	First line choice of mastitis treatment is cloxacillin	16658
reg_f_wean2	0.97	0.65	1.24	Age of weaning	12976
reg_f_market1	1.03	0.84	1.43	Whether animals are taken to market	14828
reg_f_calveclean.L	1.03	0.86	1.36	How often the calving pens are cleaned out	14240
reg_f_manure_6yes	1.03	0.85	1.43	Use of muck heap on concrete	12981
reg_f_abcalve1	1.03	0.8	1.54	Routine use of antibiotics following a difficult calving	15179

reg_f_total_cattle	1.03	0.88	1.29	Total number of cattle on farm	15234
reg_f_bedmilk_1yes	0.97	0.69	1.22	Use of sand in milking cow bedding	14603
reg_f_feedlorry1	0.97	0.71	1.19	Whether feed lorries crossed any cattle yards when delivering	14536
reg_f_herd_size	1.03	0.88	1.3	Total milking cattle on farm	15734
reg_f_leptovaccY	0.97	0.7	1.22	Routine use of leptospirosis vaccination	14241
reg_f_whichclinrespOtherDdontknow	1.03	0.71	1.81	First line choice of pneumonia treatment is unknown	15240
reg_f_bedmilk_6yes	0.97	0.58	1.39	Use of green bedding for milking cows	14250
reg_f_pigeon2	0.98	0.74	1.17	Perceived pigeon population on farm	15773
reg_f_calving_group1	1.02	0.78	1.52	Whether calves were born in a group pen	14519
reg_f_manure_2yes	0.98	0.69	1.25	Use of a weeping wall for slurry management	15317
reg_f_organic1	0.98	0.61	1.38	Whether the farm is organic	14649
reg_f_um_spray1	0.98	0.69	1.26	Routine use of umbilical treatment at birth	14147
reg_f_fox2	0.98	0.74	1.21	Perceived fox population on farm	15565
reg_f_clox_dct1	0.98	0.71	1.23	Use of cloxacillin dry cow therapy	14750
reg_f_othergrazeY	0.98	0.73	1.21	Use of grazing land away from the farm	14461
reg_f_whichclinrespMacrolide	1.02	0.83	1.34	First line choice of pneumonia treatment is Macrolide	15840
reg_f_fram_dct1	1.02	0.81	1.39	Use of framycetin dry cow therapy	13613
reg_f_timesfirstmast	1.02	0.89	1.23	How often clinical mastitis cases were treated with intramammary tubes	12810
reg_f_scc	0.98	0.84	1.11	Somatic cell count	15570
reg_f_trough_clean.L	1.02	0.86	1.25	Daily cleaning of water troughs in calf housing	14955
reg_f_deer2	1.02	0.81	1.37	Perceived amount of deer on farmland	15528
reg_f_nsaiddiarr1	1.01	0.82	1.34	Routine use of anti-inflammatories in cases of calf diarrhoea	15523
reg_f_acf1	0.99	0.76	1.22	Use of automatic cluster flushing	16112
reg_f_heifers_waste1	0.99	0.73	1.25	Whether waste milk has been fed to heifers	14992
reg_f_manure_3yes	0.99	0.74	1.24	Use of a metal slurry store	15682
reg_f_daystreatmast	1.01	0.87	1.21	Number of days mastitis is treated for	16019
reg_f_rat2	1.01	0.82	1.3	Perceived rat population on farm	15792
reg_f_nsaidmast	1.01	0.88	1.2	Routine use of anti-inflammatories in cases of mastitis	15387
reg_f_halocur1	0.99	0.77	1.24	Routine use of treatment to prevent cryptosporidiosis	15260
reg_f_manure_1yes	1.01	0.81	1.33	Use of slurry lagoon	14497
reg_f_pheasant2	0.99	0.72	1.29	Perceived pheasant population on farm	14788
reg_adult1	1.01	0.79	1.31	Sample collected from the milking cow environment	14004
reg_f_drytrough.L	1.01	0.85	1.22	How often the dry cow water trough was cleaned out	16126
reg_f_bvdvaccY	1.01	0.79	1.33	Routine use of BVD vaccination	13955
reg_f_lungvaccY	0.99	0.77	1.24	Routine use of lungworm vaccination	15196
reg_f_foragetype_1yes	1.01	0.72	1.44	Feeding of clamp grass silage	15213
reg_f_diarrvaccY	1.01	0.8	1.28	Routine use of calf enteric disease vaccination	15370
reg_f_geographical_area3	1	0.76	1.3	Geographical area 3	14587
reg_f_premises2	1	0.79	1.29	Number of farm premises	15374
reg_f_starling2	1	0.79	1.29	Perceived amount of starling infestation	15983
main_fq	1	0.67	1.42	Total fluoroquinolone usage	7315
reg_f_milkgraze1	1	0.75	1.37	Whether milking cows graze	15098
main_tet	1	0.74	1.33	Total tetracycline usage	12200
reg_f_bedmilk_4yes	1	0.66	1.56	Use of paper waste for milking cow bedding	15625
reg_f_foragetype_6yes	1	0.7	1.46	Feeding of straw	15070
reg_f_aiexternal1	1	0.79	1.28	Artificial insemination performed by external company	13663
reg_f_bedmilk_3yes	1	0.78	1.27	Use of sawdust as milking cow bedding	15820
reg_f_outsource1	1	0.72	1.4	Whether heifer calves are reared by a different enterprise	15969

Table S5: Variables identified as associated with resistance for each multilevel, multivariable Bayesian logistic regression model and the effect on their coefficients when the model was re-run with sceptical priors.

Amoxicillin

Variable	Odds ratio	Lower CI	Upper CI	Odds ratio using sceptical priors	Lower CI using sceptical priors	Upper CI using sceptical priors	Description
reg_s_housed_outdooroutdoor	0.27	0.2	0.37	0.28	0.2	0.38	Sample collected from pasture
reg_preweaned_heifer1	1.99	1.29	2.98	1.99	1.29	2.95	Sample collected from the environment of a pre-weaned heifer
main_s_temp	1.91	1.57	2.35	1.9	1.56	2.34	Average monthly temperature

Ciprofloxacin

Variable	Odds ratio	Lower CI	Upper CI	Odds ratio using sceptical priors	Lower CI using sceptical priors	Upper CI using sceptical priors	Description
reg_preweaned_heifer1	4.13	2.79	6.46	4.12	2.79	6.41	Sample collected from the environment of a pre-weaned heifer
main_s_temp	2.14	1.63	2.87	2.12	1.61	2.82	Average monthly temperature

Streptomycin

Variable	Odds ratio	Lower CI	Upper CI	Odds ratio using sceptical priors	Lower CI using sceptical priors	Upper CI using sceptical priors	Description
reg_preweaned_heifer1	1.95	1.46	2.51	1.95	1.46	2.51	Sample collected from the environment of a pre-weaned heifer
main_s_temp	1.53	1.32	1.77	1.52	1.32	1.77	Average monthly temperature

Tetracycline

Variable	Odds ratio	Lower CI	Upper CI	Odds ratio using sceptical priors	Lower CI using sceptical priors	Upper CI using sceptical priors	Description
main_total_mg_pcu	1.47	1.01	2.13	1.46	1	2.11	Total antibiotic usage
main_strep	0.76	0.6	0.97	0.76	0.6	0.97	Total streptomycin usage
reg_s_rain	1.26	1.08	1.47	1.26	1.08	1.46	Average monthly rainfall
reg_s_housed_outdooroutdoor	0.24	0.15	0.35	0.24	0.15	0.35	Sample collected from pasture
reg_s_calving_now1	2.02	1.1	3.29	2.02	1.1	3.29	Sample collected during the calving season
reg_preweaned_heifer1	3.39	2	5.82	3.41	2.01	5.8	Sample collected from the environment of a pre-weaned heifer
main_s_temp	1.98	1.55	2.55	1.97	1.55	2.52	Average monthly temperature

Table S6: Questions asked in questionnaires 1-4.

	Data Type	Response Options (If Relevant)
Questionnaire 1		
How many hectares of land on the holding? Converted from acres by 0.4xacre where needed	numerical	
How many hectares on the holding are grazed? Converted from acres by 0.4xacre where needed	numerical	
Are sheep in contact with the cattle?	categorical	N: no Y: yes
Number of goats on the farm	numerical	
Are goats in contact with the cattle?	categorical	N: no Y: yes
Number of pigs on the farm	numerical	
Are the pigs in contact with the cattle?	categorical	N: no Y: yes
Number of poultry on the farm	numerical	
Is the poultry in contact with the cattle?	categorical	N: no Y: yes
Number of equines on the farm	numerical	
Are there horses or donkeys in contact with the cattle?	categorical	N: no Y: yes
Number of dogs on the farm	numerical	
Are the dogs in contact with the dairy cattle?	categorical	N: no Y: yes
Number of cats on the farm	numerical	
Are the cats in contact with the dairy cattle?	categorical	N: no Y: yes
Number of other species on the farm	numerical	
Are these other species in contact with the cattle?	categorical	N: no Y: yes
What other species of animal, comments about animals on farm	text	
How many cattle are currently on the farm?	numerical	
How many of these cattle are in the dairy herd?	numerical	
How many cows are currently in milk?	numerical	
How many dairy calves are currently under 8 weeks old?	numerical	
How many calves are currently 8-12 weeks old?	numerical	
How many dairy heifers are currently aged 12-24 months?	numerical	

How many heifers are currently over 24 months but not calved?	numerical	
Beef calves on farm	numerical	
Bulls on farm	numerical	
How many dairy calves under 8 weeks old brought in from elsewhere in the last year?	numerical	
Source of dairy calves under 8 weeks,	categorical	1: private market 2: another holding 3: other site own herd 4: other
How many dairy calves 8wk-12months brought in from elsewhere in the last year?	numerical	
Source of dairy calves 8 wks -12 months,	categorical	1: private market 2: another holding 3: other site own herd 4: other
How many heifers brought in from elsewhere in the last year?	numerical	
Source of heifers,	categorical	1: private market 2: another holding 3: other site own herd 4: other
How many older heifers >24 months brought in from elsewhere in the last year?	numerical	
Source of heifers	categorical	1: private market 2: another holding 3: other site own herd 4: other
How many dairy cows brought in from elsewhere in the last year?	numerical	
Source of dairy cows	categorical	1: private market 2: another holding 3: other site own herd 4: other
How many bulls brought in from elsewhere in the last year?	numerical	
Source of bulls	categorical	1: private market 2: another holding 3: other site own herd 4: other
Average age at first calving, in months	numerical	
Dry cow period length in days	numerical	
Do you use AI?	categorical	N: no Y: yes
Do you use natural service?	categorical	N: no Y: yes
Average number of serves per conception	numerical	
How frequently do you have routine fertility visit?	categorical	1: every week 2: every fortnight 3: every three weeks 4: monthly 5: as necessary 6: n/a
Total annual milk sales in million litres	numerical	
Average milk price over last 12 months, to nearest pence	numerical	
305 day milk yield 12 month rolling average per cow	numerical	
Somatic cell count 12 month rolling average per ml	numerical	

Average Bactoscan	numerical	
Average no of days in milk, 12 month rolling average per cow	numerical	
Number of milkings per day	numerical	
Which milking system do you use?	numerical	1: herringbone 2: abreast 3: rotary 4: side-opening 5: robot
Which company do you milk record with? Name or none	text	
Percentage of cows in which antibiotic dry-cow tubes were used at dry-off in last year	numerical	
Percentage of cows in which systemic antibiotics were used at dry-off in last year	numerical	
Clinical mastitis cases per 100 cows/year	numerical	
Percentage of clinical mastitis that occurs in first 30 days of lactation	numerical	
How is the milking routine adapted when high SCC cows are present?	text	
Routinely vaccinate against Bovine Viral Diarrhoea?	categorical	N: no Y: yes
Routinely test for Bovine Viral Diarrhoea?	categorical	N: no Y: yes
Herd status for BVD 0 - negative, 1 positive, 2 unknown	categorical	0: negative 1: positive 2: unknown
Accredited as free from BVD?	categorical	N: no Y: yes
Routinely vaccinate against Infectious Bovine Rhinotracheitis?	categorical	N: no Y: yes
Routinely test for IBR?	categorical	N: no Y: yes
Herd status for IBR	categorical	0: negative 1: positive 2: unknown
Accredited as free from IBR?	categorical	N: no Y: yes
Routinely vaccinate against Leptospirosis?	categorical	N: no Y: yes
Routinely test for Leptospirosis?	categorical	N: no Y: yes
Herd status for Leptospirosis?	categorical	0: negative 1: positive 2: unknown
Accredited as free from Leptospirosis?	categorical	N: no Y: yes
Routinely vaccinate against Johnes?	categorical	N: no Y: yes
Routinely test for Johnes?	categorical	N: no Y: yes
Herd status for Johnes?	categorical	0: negative 1: positive 2: unknown
Routinely vaccinate against Salmonella?	categorical	N: no Y: yes

Routinely vaccinate against Lungworm/given Huskvac?	categorical	N: no Y: yes
Routinely vaccinate against calf respiratory disease? Vaccine name or 'none'	text	
Routinely vaccinate against clostridial disease (Blackleg/7 in 1)	categorical	N: no Y: yes
Routinely vaccinate against pasteurilla/mannheimia	categorical	N: no Y: yes
Routinely vaccinate against diarrhoea , eg Rotavec corona	categorical	N: no Y: yes
Routinely vaccinate against ringworm	categorical	N: no Y: yes
comments on vaccination	text	
cull rate excluding TB percentage	numerical	
Cull rate due to TB percentage	numerical	
Death rate percentage	numerical	
Average life span if given in years	numerical	
Average life span if given in lactations	numerical	
Is this an organic farm?	categorical	N: no Y: yes
Questionnaire 2		
Main breed of cattle on farm	categorical	Holstein, Friesian, Guernsey, Jersey, Crossbreed
Date questionnaire completed	date	
Do you currently use selective dry cow therapy?	categorical	0: no 1: yes
When did you introduce selective dry cow therapy?	date	
What is your SCC threshold for antibiotic treatment?	ordinal	1: up to 50 thousand 2: 51-100 thousand 3: 101-150 thousand 4: 151-200 thousand 5: 201-250 thousand 6: 251-300 thousand 7: 301-350 thousand 8: 351-400 thousand.
When did you introduce this SCC threshold?	date	
What was your previous SCC threshold for antibiotic treatment?	ordinal	1: up to 50 thousand 2: 51-100 thousand 3: 101-150 thousand 4: 151-200 thousand 5: 201-250 thousand 6: 251-300 thousand 7: 301-350 thousand 8: 351-400 thousand 9: There wasn't one
What clinical history of mastitis would trigger receiving antibiotics?	categorical	1: Mastitis this lactation 2: Had a case of mastitis within the last three months 3: Had a case of mastitis within the last six months 4: Has had repeat mastitis 5: Other.
Do you currently use teat sealant?	categorical	0: no 1: yes
When did you start using teat sealant?	date	

Do you currently use StartVac to vaccinate against mastitis?	categorical	0: no 1: yes
When did you start using Startvac	date	
Do you currently use Imrestor to protect against mastitis?	categorical	0: no 1: yes
When did you start using Imrestor?	date	
Which antibiotic tube do you currently use as your first choice for drying off?	categorical	Bovaclox DC, Bovaclox DC, Xtra Cefimam DC, Cefshot DC, Cephaguard DC, Cepravin DC, Kepravine DC, Kloxerate Gold DC, Multishield DC, Noraclox DC, Noraclox DC, Xtra Orbenin Dry Cow, Orbenin Extra, Sheptaclox DC, Ubro Red Dry Cow, Ubrostar Dry Cow, Other
Have you changed your first choice of tube for drying off in the last few years?	categorical	0: no 1: yes
Approximately when did you change?	date	
What was your previous first choice for drying off?	categorical	Bovaclox DC, Bovaclox DC, Xtra Cefimam DC, Cefshot DC, Cephaguard DC, Cepravin DC, Kepravine DC, Kloxerate Gold DC, Multishield DC, Noraclox DC, Noraclox DC, Xtra Orbenin Dry Cow, Orbenin Extra, Sheptaclox DC, Ubro Red Dry Cow, Ubrostar Dry Cow, Other
First line dry cow tube used on the mothers of the calves in our cohort	categorical	Bovaclox DC, Bovaclox DC, Xtra Cefimam DC, Cefshot DC, Cephaguard DC, Cepravin DC, Kepravine DC, Kloxerate Gold DC, Multishield DC, Noraclox DC, Noraclox DC, Xtra Orbenin Dry Cow, Orbenin Extra, Sheptaclox DC, Ubro Red Dry Cow, Ubrostar Dry Cow, Other
Which antibiotic tube do you currently use as your second choice for drying off?	categorical	Bovaclox DC, Bovaclox DC, Xtra Cefimam DC, Cefshot DC, Cephaguard DC, Cepravin DC, Kepravine DC, Kloxerate Gold DC, Multishield DC, Noraclox DC, Noraclox DC, Xtra Orbenin Dry Cow, Orbenin Extra, Sheptaclox DC, Ubro Red Dry Cow, Ubrostar Dry Cow, Other
Have you changed your second choice of tube for drying off in the last few years?	categorical	0: no 1: yes
Approximately when did you change?	date	
What was your previous second choice for drying off?	categorical	Bovaclox DC, Bovaclox DC, Xtra Cefimam DC, Cefshot DC, Cephaguard DC, Cepravin DC, Kepravine DC, Kloxerate Gold DC, Multishield DC, Noraclox DC, Noraclox DC, Xtra Orbenin Dry Cow, Orbenin Extra, Sheptaclox DC, Ubro Red Dry Cow, Ubrostar Dry Cow, Other
What is your first line choice of antibiotic tube for clinical mastitis	categorical	Caremast Vet, Ceffect LC, Cefimam LC, Cefquinor LC, Clavamox LC, Cobactan MC, Combiclav Lactating Cow, Duofast, Lactaclox, Lactatrim MC, Lincocin Forte, Mastiplan LC, Multiject IMM, Noroclav Lactating Cow, Orbenin LA, Orbolan Lactating, Pathocef, Pathozone, Pirsue, Procopen Injector, Synulox Lactating Cow, Tetra-Delta, Ubro Yellow, Ubrolexin, Other
Have you changed your first line choice of tube for clinical mastitis in the last few years?	categorical	0: yes 1: no
Approximately when did you change?	date	

What was your previous first line choice for clinical mastitis	categorical	Caremast Vet, Ceffect LC, Cefimam LC, Cefquinor LC, Clavamox LC, Cobactan MC, Combiclav Lactating Cow, Duofast, Lactaclox, Lactatrim MC, Lincocin Forte, Mastiplan LC, Multiject IMM, Noroclav Lactating Cow, Orbenin LA, Orbolan Lactating, Pathocef, Pathozone, Pirsue, Procaben Injector, Synulox Lactating Cow, Tetra-Delta, Ubro Yellow, Ubrolexin, Other
What is your second line choice of antibiotic tube for clinical mastitis?	categorical	Caremast Vet, Ceffect LC, Cefimam LC, Cefquinor LC, Clavamox LC, Cobactan MC, Combiclav Lactating Cow, Duofast, Lactaclox, Lactatrim MC, Lincocin Forte, Mastiplan LC, Multiject IMM, Noroclav Lactating Cow, Orbenin LA, Orbolan Lactating, Pathocef, Pathozone, Pirsue, Procaben Injector, Synulox Lactating Cow, Tetra-Delta, Ubro Yellow, Ubrolexin, Other
Have you changed your second line choice of tube for clinical mastitis in the last few years?	categorical	0: yes 1: no
Approximately when did you change?	date	
What was your previous second line choice for clinical mastitis	categorical	Caremast Vet, Ceffect LC, Cefimam LC, Cefquinor LC, Clavamox LC, Cobactan MC, Combiclav Lactating Cow, Duofast, Lactaclox, Lactatrim MC, Lincocin Forte, Mastiplan LC, Multiject IMM, Noroclav Lactating Cow, Orbenin LA, Orbolan Lactating, Pathocef, Pathozone, Pirsue, Procaben Injector, Synulox Lactating Cow, Tetra-Delta, Ubro Yellow, Ubrolexin, Other
How many days do you routinely treat clinical mastitis cases for with your first line tube?	numerical	
How many times a day do you tube clinical cases of mastitis with your first line tube?	numerical	
What percentage of clinical mastitis cases are given injectable antibiotics?	numerical	
What percentage of cases receive non steroidal anti inflammatories?	numerical	
Have you made any other changes to prevention or management of mastitis in the last few years?	categorical	0: no 1: yes
What are these changes?	text	
Which vaccines do you routinely use to prevent against calf respiratory disease?	categorical	None, Bovilis Bovipast RSP Bovilis IBR Marker Inactiv Bovilis IBR Marker Live Rispoval IBR Marker inactiv Rispoval IBR Marker Live Rispoval 3 Rispoval 4 Rispoval Pastuerella Rispoval RS Rispoval RS + PI3 Bovilis BVD Other (freetext)
Did you start vaccinating routinely in the last few years?	categorical	0: no 1: yes
Do you give antibiotics to all calves to prevent respiratory disease (blanket therapy)?	categorical	0: no 1: yes
Which antibiotic do you mainly use for preventative blanket thereapy?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other

Do you use metaphylaxis if there's an outbreak of respiratory disease?	categorical	0: no 1: yes
Which antibiotic do you mainly use for metaphylaxis?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Do you usually treat clinical cases with an antibiotic?	categorical	0: no 1: yes
What are the criteria for treating a clinical case of respiratory disease?	categorical	1: Heavy breathing 2: Fever/pyrexia 3: Nasal discharge 4: Number of cases
Which antibiotic do you mainly use to treat clinical cases?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Do you routinely use non-steroidal anti-inflammatories in calf pneumonia cases?	categorical	0: no 1: yes
Do you routinely use steroids in calf pneumonia cases?	categorical	0: no 1: yes
Have you made any changes around prevention of calf pneumonia in the last few years?	categorical	1: I started using blanket therapy 2: I changed the antibiotic used for blanket therapy 3: I stopped using blanket therapy 4: I started using metaphylaxis 5: I changed the antibiotic used in metaphylaxis 6: I stopped using metaphylaxis 7: I changed the criteria for treatment of clinical cases 8: I changed the antibiotic used for clinical cases 9: I started using NSAIDs or steroids 10: I stopped using NSAIDs or steroids 11: No change 12: Other change
Approximately when did you change?	date	
Briefly describe the changes in prevention of calf pneumonia	text	
Categorising the changes they've made to pneumonia management- see coding column	categorical	0: none 1: Housing 2: Vaccinating 3: Colostrum 4: Treatments
Do you routinely use Rotavac corona to vaccinate against enteric disease?	categorical	0: no 1: yes
Did you start routinely vaccinating against calf diarrhoea in the last year?	categorical	0: no 1: yes
Approximately when did you start?	date	
Do you routinely give preventive anticoccidial treatments?	categorical	0: no 1: yes
Do you routinely use Halocur as a cryptosporidium preventative?	categorical	0: no 1: yes
Do you currently routinely add antibiotics in milk or feed for calves?	categorical	0: no 1: yes

Do you routinely use oral antibiotics as prevention against calf diarrhoea?	categorical	0: no 1: yes
Have you made any changes in prevention of calf diarrhoea in the last few years?	categorical	1: I started using anticoccidials routinely 2: I stopped using anticoccidials routinely 3: I started using Halocur 4: I stopped using Halocur 5: I started adding antibiotic to milk/feed 6: I stopped adding antibiotic to milk/feed 7: I changed the antibiotic added to milk/feed 8: I started giving oral antibiotic 9: I stopped using oral antibiotic 10: I changed oral antibiotic 11: No change 12: Other change
Give brief details of the change	text	
Do you routinely use oral antibiotics (including boluses) to treat clinical cases of calf diarrhoea?	categorical	0: no 1: yes
Which oral antibiotics do you mostly use for clinical cases?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Do you routinely use injectable antibiotics to treat clinical cases?	categorical	0: no 1: yes
Which injectable antibiotic do you mostly use for clinical cases?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Do you routinely use electrolytes to treat clinical cases of calf diarrhoea?	categorical	0: no 1: yes
Do you routinely use intravenous fluids to treat clinical cases of calf diarrhoea?	categorical	0: no 1: yes
Do you routinely use non steroidal anti inflammatories to treat clinical cases of calf diarrhoea?	categorical	0: no 1: yes
Have you made any changes around treatment of calf diarrhoea in the last few years?	categorical	1: I started using oral antibiotics/boluses 2: I stopped using oral antibiotis 3: I changed the oral antibiot 4: I started using injectable antibiotic 5: I stopped using injectable antibiotics 6: I changed the injectable antibiotic that I use 7: Other change 8: No changes
Briefly describe these changes	text	
Do you routinely use a footbath for lameness prevention?	categorical	0: no 1: yes
Which product do you most frequently use in the footbath for preventative treatment?	categorical	1: Formalin 2: Copper Sulphate 3: Zinc Sulphate 4: Tylan 5: Lincospectin 6: Lincocin 7: Other 8: macrolide
Name of routine footbath product	text	

Do you frequently use any other product do you routinely use in the footbath for preventative treatment?	categorical	1: Formalin 2: Copper Sulphate 3: Zinc Sulphate 4: Tylan 5: Lincospectin 6: Lincocin 7: Other 8: macrolide
Name of second footbath product	text	
How frequently do you footbath for prevention of lameness?	categorical	1: Daily 2: every other day 3: every few days 4: weekly 5: less than weekly.
Do you use a footbath to treat an outbreak of lameness?	categorical	0: no 1: yes
What product do you most frequently used in the footbath for treatment?	categorical	1: Formalin 2: Copper Sulphate 3: Zinc Sulphate 4: Tylan 5: Lincospectin 6: Lincocin 7: Other 8: macrolide
How do you usually treat individual cows with infectious lameness (foul, digital dermatitis)	categorical	1: topical antibiotic 2: injectable antibiotic 3: other
Name of other footbath product for lameness	text	
Which topical antibiotic do you mostly use for infectious lameness?	categorical	Alamycin, Animedazon CT,C Cyclo, Engemycin, Oxycare Taf, Terramycin, Other
Name of topical antibiotic for lameness	text	
Which injectable antibiotic do you mostly used for clinical lameness	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Have you made, any changes to your lameness prevention or treatment routines with the intention of reducing antibiotic use?	categorical	0: no 1: yes
Briefly describe the changes to your lameness protocols	text	
Do you routinely use antibiotics following a difficult calving?	categorical	0: no 1: yes
Which antibiotic do you routinely use post-calving?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Do you routinely give non steroidal anti inflammatories for a difficult calving?	categorical	0: no 1: yes
How do you routinely treat cases of Retained Foetal Membrane (without illness)?	categorical	1: Injectable antibiotics 2: intra-uterine antibiotics 3: intra-uterine non-antibiotic 4: non-steroidal anti-inflammatory 5: oral fluids 6: no treatment 7: other
Which other treatment for retained foetal membrane?	text	

Which antibiotic do you mostly use for retained foetal membrane?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Name of antibiotic for retained foetal membrane?	text	
How do you routinely treat cases of metritis?	categorical	1: Injectable antibiotics 2: intra-uterine antibiotics 3: intra-uterine non-antibiotic 4: non-steroidal anti-inflammatory 5: oral fluids 6: no treatment 7: other
Which antibiotic do you mostly use for metritis?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Name of antibiotic for metritis?	text	
How do you routinely treat cases of endometritis?	categorical	1: Injectable antibiotics 2: intra-uterine antibiotics 3: intra-uterine non-antibiotic 4: non-steroidal anti-inflammatory 5: oral fluids 6: no treatment 7: other
What other treatment for endometritis?	text	
Which antibiotic do you mostly use for endometritis?	categorical	1st gen Ceph, 3rd gen Ceph, 4th gen Ceph, Aminoglycoside, Amphenicol, Fluoroquinolone, Macrolide, Penicillin/Pen-Strep/Amox-Clav, Sulfonamide/Suf-Trim, Tetracycline, Lincomycin, Other
Have you made any changes to your post-calving procedures with a view to reducing antibiotic use?	categorical	0: no 1: yes
Briefly describe these changes	text	
Categorising the changes they've made to post calving management- see coding column	categorical	0: none 1: Nutrition 2: Abs 3: Hygiene 4: Monitoring 5: Pain relief
Other comments noted by researcher	text	
Questionnaire 3		
Which housing types do you use for the milking herd?	categorical	1:cubicle shed 2: loose housing 3: kennels 4:other
Which housing types do you use for youngstock ?	categorical	1:cubicle shed 2: loose housing 3: kennels 4:other
Which housing types do you use for dry cows?	categorical	1:cubicle shed 2: loose housing 3: kennels 4:other
If other types of housing are used, please give details	text	
Are close-up cows housed separately to other dry cows?	ordinal	1:yes always 2: yes in summer 3: yes sometimes 4:No not at all
Where are calves usually born?	categorical	1:In group pen 2: In individual pen 3: Outdoors 4:Other
If other, please give details	text	
Is the area where calves are usually born...	categorical	1:Also used for sick cows 2: Also used for lame cows 3: Also used for Johne's positive cows 4:Only used for close-up or calving cows 5: Also used for any other cows

If 'any other cows', please give details	text	
What flooring types are in the main calving areas?	categorical	1:concrete 2: rubber mats 3: dirt 4:pasture 5: other
When are these calving areas cleaned?	ordinal	1:After each calving 2: After every few calvings 3: Daily 4:Weekly 5: Monthly 6: Other
Are calving pens,	categorical	1:Temporary sectioned off areas of the dry cow pen 2: Separate pen adjoining the dry cow pen 3: Separate pen not adjoining the dry cow pen 4:Other
Is your hospital area	categorical	1:Individual animal pens 2: Shared with other hospitalised cows 3: Shared with dry cows 4:Shared with youngstock 5: Shared with calving cows 6: other
If other, please give details	text	
What housing types have calves been kept in since the start of the study?	categorical	1:Individual animals in a shed also used for older animals 2: Individual animals in a shed not used for older animals 3: Individual calf hutches with external pen 4:Individual calf hutches without external pen 5: Group pens in a shed also used for older animals 6: Group pens in a shed not used for older animals 7: Group calf hutches without external pen 8: Group calf hutches with external pen
Where are youngstock housed?	categorical	1:Same unit and airspace as milking herd 2: Same unit as milking herd but different airspace 3: Same unit but different building to dairy herd 4:Different unit to dairy herd
How is manure removed from cubicle sheds?	categorical	1>manual/tractor scrape 2: automatic scraper 3: alley flush 4:slats 5: other
What bedding types have you mostly use for milking cows since the start of the study?	categorical	1:Sand 2: Straw 3: Sawdust 4:Paper waste 5: Wood waste 6: Green bedding (RMS) 7: Seperated digestate from AD plant 8: Other
What bedding types have you mostly use for pre weaned calves since the start of the study?	categorical	1:Sand 2: Straw 3: Sawdust 4:Paper waste 5: Wood waste 6: Green bedding (RMS) 7: Seperated digestate from AD plant 8: Other
What bedding types have you mostly use for youngstock since the start of the study?	categorical	1:Sand 2: Straw 3: Sawdust 4:Paper waste 5: Wood waste 6: Green bedding (RMS) 7: Seperated digestate from AD plant 8: Other
What bedding types have you mostly use for dry cows since the start of the study?	categorical	1:Sand 2: Straw 3: Sawdust 4:Paper waste 5: Wood waste 6: Green bedding (RMS) 7: Seperated digestate from AD plant 8: Other
Do you use lime in housing areas?	ordinal	1:yes routinely 2: yes sometimes 3: no never 4:Don't know
What is your premilking routine?	categorical	1:Dry wipe 2: Wipe with wet cloth 3: Wipe with medicated cloth 4:Robots- udder cleaned with brush 5: none 6: other 7: Robots-other
When are fresh cloths used?	ordinal	1:between each teat 2: between each animal 3: between parlour sides 4:for each milking session 5: daily 6: other 7: N/A- cloths not used
Do you pre-dip?	categorical	1:yes routinely 2: yes sometimes 3: no never 4:No robots used
Do you post-dip?	categorical	1:yes frequently 2: yes sometimes 3: no never
Are gloves worn?	categorical	1:yes routinely 2: yes sometimes 3: no never 4:N/A- robots
Do you have automatic cluster flushing?	categorical	1:yes 2: no

How often is the milking cluster cleaned?	categorical	1:Between each animal 2: Between groups 3: For each milking session 4:After high risk animals 5: Daily 6: other
How often do you use disinfectant to wash down the milking parlour/ robot area?	ordinal	1:Daily 2: Weekly 3: Monthly 4:Yearly 5: As needed 6: Other
Is your farm organic?	categorical	1:yes 2: no 3: no transitioning
disinfect Pens, sheds and other housing	text	
Calving and hospital areas	text	
disinfect Milking parlour and equipment	text	
Boot baths for staff and visitors	text	
Calf milk feed equipment	text	
Food and water troughs	text	
Pre-dip and post-dip disinfectants	text	
How do you dilute your disinfectants/antiseptics?	categorical	1:Measure out accurately 2: Measure out by eye 3: Use approximate measures 4:However it comes
What forages do you feed animals on farm?	categorical	1:Clamp grass silage 2: Big bale grass silage 3: Maize silage 4:Wholecrop silage 5: Hay 6: Straw 7: Haylage 8: Other
Have you bought in any of these forages in the last 2 years?	categorical	1:Clamp grass silage 2: Big bale grass silage 3: Maize silage 4:Wholecrop silage 5: Hay 6: Straw 7: Haylage 8: Other9: haven't bought any in
Where have you bought non-forage feeds from?	categorical	1:Feed mill 2: Another farm 3: Food waste processor 4:Other
Do your milking cows graze?	categorical	1:yes - all 2: yes - some 3: no
Do your dry cows graze?	categorical	1:yes - all 2: yes - some 3: no
Do your dairy youngstock graze?	categorical	1:yes - all 2: yes - some 3: no
Which sources of drinking water supply are used?	categorical	1:mains 2: private source - treated 3: private source - untreated 4:other
Which sources of drinking water are available on pasture?	categorical	1:water course 2: pond 3: trough - mains 4:trough- private source 5: other
If other, please describe sources	text	
How often are water troughs cleaned for the milking cows?	ordinal	1:daily 2: every few days 3: weekly 4:monthly 5: as needed
How often are water troughs cleaned for the dry cows?	ordinal	1:daily 2: every few days 3: weekly 4:monthly 5: as needed
How often are water troughs cleaned for the youngstock?	ordinal	1:daily 2: every few days 3: weekly 4:monthly 5: as needed
How often are water troughs cleaned for the pre weaned calves?	ordinal	1:daily 2: every few days 3: weekly 4:monthly 5: as needed

How long do calves usually stay with their dams?	ordinal	1: taken immediately 2: <1 hour 3: 1-4 hours 4: >4 hours 5: >12 hours 6: >24 hours
Do you dip or spray the umbilicus?	ordinal	1: yes frequently 2: yes sometimes 3: no never
If so, what with?	categorical	1: Blue spray 2: Iodine 3: Chlorhexidine 4: Other
If other, please give details	text	
Do calves suckle after birth?	ordinal	1: yes frequently 2: yes sometimes 3: no never
Is colostrum given within the first six hours by a member of staff?	ordinal	1: Always 2: Often 3: Usually 4: Sometimes 5: Occasionally 6: No the calves suckle
How much colostrum do they get in the first six hours?	ordinal	1: <1L 2: 1-2L 3: 2-3L 4: 3-4L 5: >4L
How is it given?	categorical	1: Stomach tube 2: Bottle 3: Bucket 4: Other
Which types of colostrum do you routinely use?	categorical	1: Dam- fresh 2: Dam- pasteurised 3: Other cow- fresh 4: Other cow- frozen 5: Other cow- pasteurised 6: Pooled 7: Locatim 8: Powder
How do you store colostrum?	categorical	1: Buckets (room temperature) 2: Fridge 3: Freezer 4: I don't store it 5: Other
Which types of milk do you routinely use for replacement heifer calves?	categorical	1: whole milk 2: pasteurised whole milk 3: milk replacer 4: other
In the last year or so, have dairy calves been fed waste milk from cows treated with antibacterials at dry off?	ordinal	1: yes routinely 2: yes sometimes 3: no never 4: Don't know
In the last year or so have beef calves been fed waste milk from cows treated with antibacterials at dry off?	ordinal	1: yes routinely 2: yes sometimes 3: no never 4: Don't know
In the last year or so have dairy calves been fed waste milk from cows treated with antibacterials during lactation?	ordinal	1: yes routinely 2: yes sometimes 3: no never 4: Don't know
In the last year or so have beef calves been fed waste milk from cows treated with antibacterials during lactation?	ordinal	1: yes routinely 2: yes sometimes 3: no never 4: Don't know
Have you changed your practices around feeding of waste milk in the last 12-24 months?	categorical	1: yes 2: no 3: Don't know
If yes, what has changed?	text	
How are calves fed?	categorical	1: Individual buckets- with teat 2: Individual buckets- without teat 3: Shared buckets 4: Milk bars 5: Machine
How often are calves fed?	ordinal	1: Daily 2: Twice a day 3: Three times a day 4: Four times a day 5: On demand 6: Other
How much milk are calves given per feed in the first few weeks of life?	ordinal	1: <1L 2: 1-2L 3: 2-3L 4: 3-4L 5: >4L 6: Ad lib
	text	

What sources of water are used to make up calf milk replacer?	categorical	1:Mains 2: Private-untreated 3: Private- treated 4:Other 5: Not applicable- I only use whole milk
What temperature do you normally feed calf milk at?	categorical	1:Ambient 2: 40 degrees 3: Other
How do you achieve this temperature?	categorical	1:Use whole milk straight from the cow 2: Milk replacer- made with water from a boiler heated to a constant temperature 3: Milk replacer- made with water from a hot tap mixed with a cold tap as necessary 4:Milk replacer- made with water from a boiler heated to above the desired temperature and cold water added 5: Other
At what age are calves usually weaned?	categorical	1:<6 weeks 2: 6-8 weeks 3: 8-10 weeks 4:>10 weeks 5: Depends on weight 6: Depends on amount of creep feed they're eating 7: Other
At what age are calves usually given access to water?	ordinal	1:1-3 weeks 2: 4-8 weeks 3: More than 8 weeks
At what age are calves usually given access to creep feed?	ordinal	1:1-3 weeks 2: 4-8 weeks 3: More than 8 weeks
How is calf milk feeding equipment routinely cleaned?	categorical	1:rinsed with cold water 2: rinsed with hot water 3: high pressure water 4:washed/scrubbed with cleaning product/disinfected 5: other
How often are teats cleaned with disinfectant?	ordinal	1:Between each calf 2: After each feed 3: Every day 4:Every few days 5: As needed 6: Never7: not applicable, teats not used
How often are buckets cleaned with disinfectant?	ordinal	1:Between each calf 2: After each feed 3: Every day 4:Every few days 5: As needed 6: Never7: not applicable
How do you dispose of waste milk?	categorical	1:Slurry pit 2: Drain 3: Incinerate 4:Fed to calves 5: Fed to other animals on the farm 6: Other
If other, please give details	text	
What kind of manure management facilities are used on farm?	categorical	1:Lagoon 2: Weeping wall 3: Metal slurry tank 4:Concrete slurry store 5: Muck heap in field 6: Muck heap on concrete 7: Composting 8: Separator 9: Other
Has muck from a different farm been brought onto your farm in the last two years?	categorical	1:yes 2: no 3: Don't know
Which of the following have been spread or stored on your farm in the last two years?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste
Which of the following have been brought in from another farm in the last two years?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste
Do you spread any of the following on ground that beef animals graze?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste
Do you spread any of the following on ground that dairy youngstock graze?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste
Do you spread any of the following on ground that milking or dry cows graze?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste

Do you spread any of the following on ground that is used for forage?	categorical	1:Cattle slurry 2: Cattle FYM 3: Pig slurry 4:Pig FYM 5: Poultry manure 6: AD plant digestate 7: Human sewage sludge 8: Dirty water 9: Food waste
Are calves/heifers outsourced at any point?	categorical	1:yes 2: no 3: other
If yes, where do they go?	categorical	1:A single rearing facility no contact with other cattle 2: Multiple rearing facilities no contact with other cattle 3: Sent to a single rearing facility with contact with other cattle 4:Multiple rearing facilities contact with other cattle 5: Other
If other, or mixing with other cattle, give details	text	
When do they leave the farm?	ordinal	1:under 4 weeks of age 2: 4-8 weeks old 3: 8-12 weeks old 4:3-6 months 5: 6-12 month 6: 12 months - serving 7: After serving
When do they return to the farm?	ordinal	1:under 4 weeks of age 2: 4-8 weeks old 3: 8-12 weeks old 4:3-6 months 5: 6-12 month 6: 13 months - serving 7: After serving 8: After PD 9: Pre calving 10: Post calving
On average how many miles are they transported to the other site?	text	
How many premises does your farm occupy, excluding grazing?	ordinal	1:one 2: two 3: three 4:four 5: five
What quarantining procedure do you have in place for incoming stock?	categorical	1:complete isolation for 6 weeks 2: complete isolation for less than 6 weeks 3: no shared airspace for 6 weeks 4:no shared airspace for less than 6 weeks 5: Wormed on arrival 6: Given AM on arrival 7: none8: other
Do you take your cattle to shows?	ordinal	1:yes frequently 2: yes sometimes 3: no never
Do you sell stock at market?	ordinal	1:yes frequently 2: yes sometimes 3: no never
Are cattle transport vehicles shared with other farms?	ordinal	1:yes frequently 2: yes sometimes 3: no never
How often are cattle transport vehicles washed?	ordinal	1:After every use 2: Every 2-3 uses 3: As needed 4:Weekly 5: Several times a year 6: Less often 7: don't know8: not applicable
When did you last host a farm walk?	ordinal	1:In the last six months 2: In the last year 3: In the last few years 4:never
When did you last go to another farm on a farm walk?	ordinal	1:In the last six months 2: In the last year 3: In the last few years 4:never
Do you ever have non-professional visitors - e.g. schoolchildren, work experience, casual visitors	ordinal	1:yes frequently 2: yes sometimes 3: no never
Give details of other visitors	text	
Are all visitors required to wear protective clothing?	ordinal	1:yes frequently 2: yes sometimes 3: no never
Do feed lorries have to go through the yard when delivering?	categorical	1:yes 2: no 3: other
Do you use have a contract muck spreader?	categorical	1:yes 2: no 3: other
If yes, who is your contract muck spreader?	text	
Do you use an external company for AI?	categorical	1:yes 2: no

If yes, which company?	text	
Do you use an external foot trimmer?	text	
If yes, who?	text	
Do you share machinery with other farms?	categorical	1:yes 2: no 3: other
Give details of shared machinery and who shared with	text	
Are you part of a silage making syndicate?	categorical	1:yes 2: no 3: other
If yes, give details	text	
Do you use contractors for silage making?	categorical	1:yes 2: no 3: other
If yes, give details	text	
Do you regularly see the following or signs of the following on your farm, Starlings	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Deer	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Badger	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Rooks	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Pigeons and doves	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Foxes	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Gull	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Pheasant	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Do you regularly see the following or signs of the following on your farm, Rats	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Does the hunt cross your land?	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Questionnaire 4		
Does the shoot cross your land?	ordinal	1: Frequently 2: Sometimes 3: Occasionally 4:Rarely 5: never
Farm ref	text	Unique farm code - XXX
Date	date	

Do any of the people who work on your farm live or work on any other farms?	categorical	1: yes 2: no
Details of above	text	
Do any of the people who live on your farm live or work on any other farms?	categorical	1: yes 2: no
Details of above	text	
Staff turnover – how many new staff have started in the last 18 months?	numerical	
How many have left?	numerical	
Details of above	text	
Total cattle currently on site	numerical	
Total dairy herd	numerical	
Preweaned dairy calves (still on milk)	numerical	
Weaned dairy calves (up to 12m)	numerical	
Dairy heifers 12-24 months	numerical	
Dairy heifers over 24 months, not yet calved	numerical	
Bull calves	numerical	
Older beef cattle	numerical	
Bulls	numerical	
Comments on above	text	
How many sheep have been kept on your farm in the last 18 months?	numerical	
How many new sheep have been bought in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on sheep	text	
How many goats have been kept on your farm in the last 18 months?	numerical	
How many goats have arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on goats	text	

How many pigs have been kept on your farm in the last 18 months?	numerical	
How many pigs have arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on pigs	text	
How many poultry have been kept on your farm in the last 18 months?	numerical	
How many poultry have arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on poultry	text	
How many horses/donkeys have been kept on your farm in the last 18 months?	numerical	
How many equines have arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on horses/donkeys	text	
How many dogs have been kept on your farm in the last 18 months?	numerical	
How many dogs arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on dogs	text	
How many cats have been kept on your farm in the last 18 months?	numerical	
How many cats arrived in that time?		
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on cats	text	
Any other species kept on farm in the last 18 months?	text	text
How many of them?	numerical	

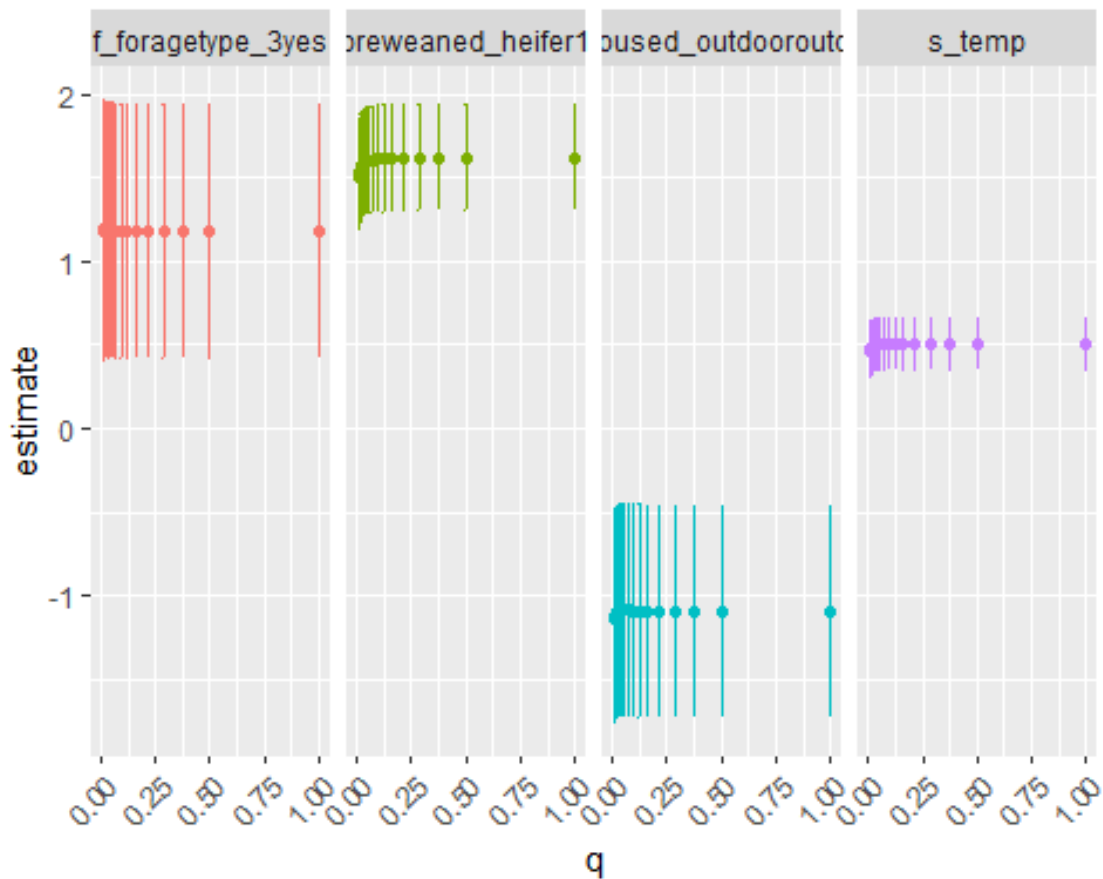
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on other species	text	
Any other species kept on farm in the last 18 months?	text	text
How many of them?	numerical	
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on other species	text	
Any other species kept on farm in the last 18 months?	text	text
How many of them?	numerical	
When did they arrive?	date	
Where did they come from?	categorical	1: market 2: another holding 3: own holding 4: other
Comments on other species	text	
Preweaned dairy calves (still on milk)	numerical	
Source of preweaned	categorical	1: private market 2: another holding 3: own herd 4: other
Dairy heifers (weaned to 12m)	numerical	
Source of weaned-12m heifers	categorical	1: private market 2: another holding 3: own herd 4: other
Dairy heifers 12-24 months	numerical	
Source of 12-24 month heifers	categorical	1: private market 2: another holding 3: own herd 4: other
Dairy heifers over 24 months, not yet calved	numerical	
Source of over 24 month heifers	categorical	1: private market 2: another holding 3: own herd 4: other
Dairy cows	numerical	
Source of dairy cows	categorical	1: private market 2: another holding 3: own herd 4: other
Bull calves	numerical	
Source of bull calves	categorical	1: private market 2: another holding 3: own herd 4: other
Older beef cattle	numerical	
Source of older beef cattle	categorical	1: private market 2: another holding 3: own herd 4: other
Bulls	numerical	
Source of bulls	categorical	1: private market 2: another holding 3: own herd 4: other
Any comments about cattle bought in?	text	

What is your calving pattern?	categorical	1: tight block 2: loose block 3: most of the year with a few months off 4: all year spread evenly 5: all year but concentrated at certain times 6: other.
During which months did cows calve last year?	text	
Average age at first calving	numerical	
Did the heifers in this study have AI?	categorical	1: yes 2: no
Did the heifers in this study have natural service?	categorical	1: yes 2: no
Average number of serves/conception	numerical	
Total annual milk sales	numerical	
Milk price average over 12 months	numerical	
305 day milk yield (12 month rolling average)	numerical	
Annual yield		
Somatic cell count (12 month rolling average)	numerical	
Bactoscan (12 month rolling average)	numerical	
Number of milkings per day	categorical	1: one 2: two 3: three
Milking system used (e.g. herringbone, abreast, rotary, robot)	categorical	1: herringbone 2: abreast 3: rotary 4: side-opening 5: robot
Percentage of cows in which antibiotic dry-cow tubes were used at dry-off in the last year	numerical	
Percentage of cows in which systemic antibiotics were used at dry-off in the last year?	numerical	
Cull rate excluding TB	numerical	
Cull rate due to TB	numerical	
No of cow deaths on farm in the last 12 months		
Any significant events?	freetext	

Supplementary Figures

Figure S1: Effect of minimum *bla*_{CTX-M} *E. coli* prevalence (q) on the output of the risk factor model using the total dataset. Variable codes are: “preweaned_heifer”, sample collected from a pre-weaned heifer (Calf sample); “s_temp”, average monthly temperature; “weaned_heifer”, sample collected from a weaned heifer (Heifer sample); “s_housed_outdoor”, sample collected from pastureland; “f_foragetype_3”, maize silage used on farm.

A: The effect on the model estimates for different values of q .



B: Effect on the predictive accuracy of the model with different values of q , measured as the area under the Receiver Operating Characteristic Curve.

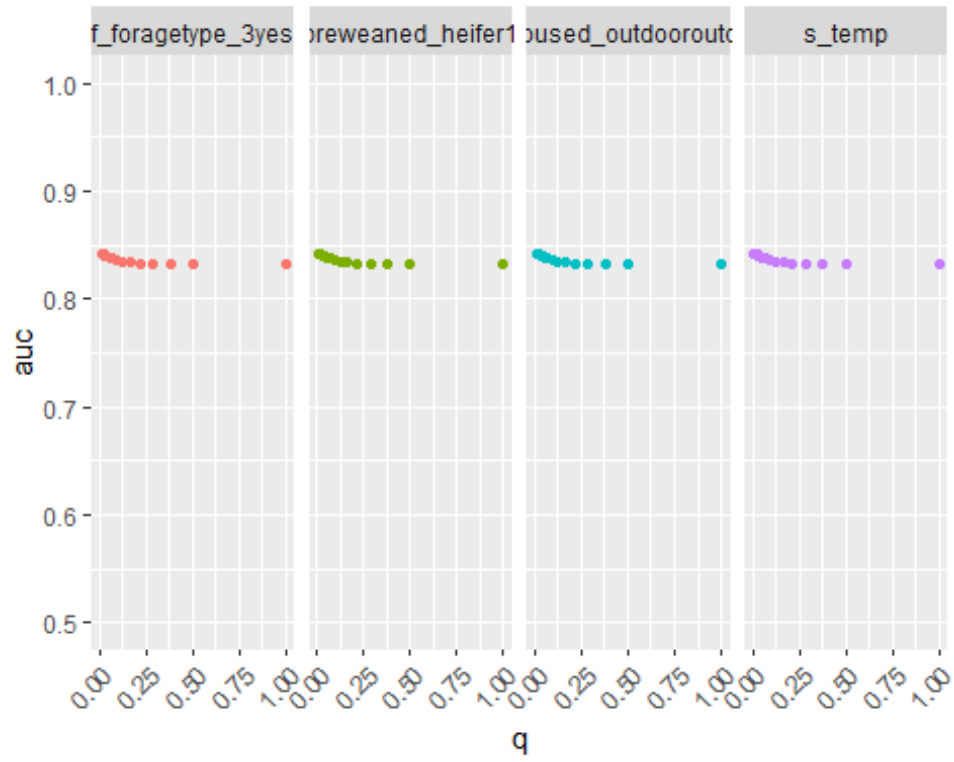


Figure S2: Flow diagram to demonstrate the various stages used to arrive at the final dataset used in analyses for CTX-M carriage.

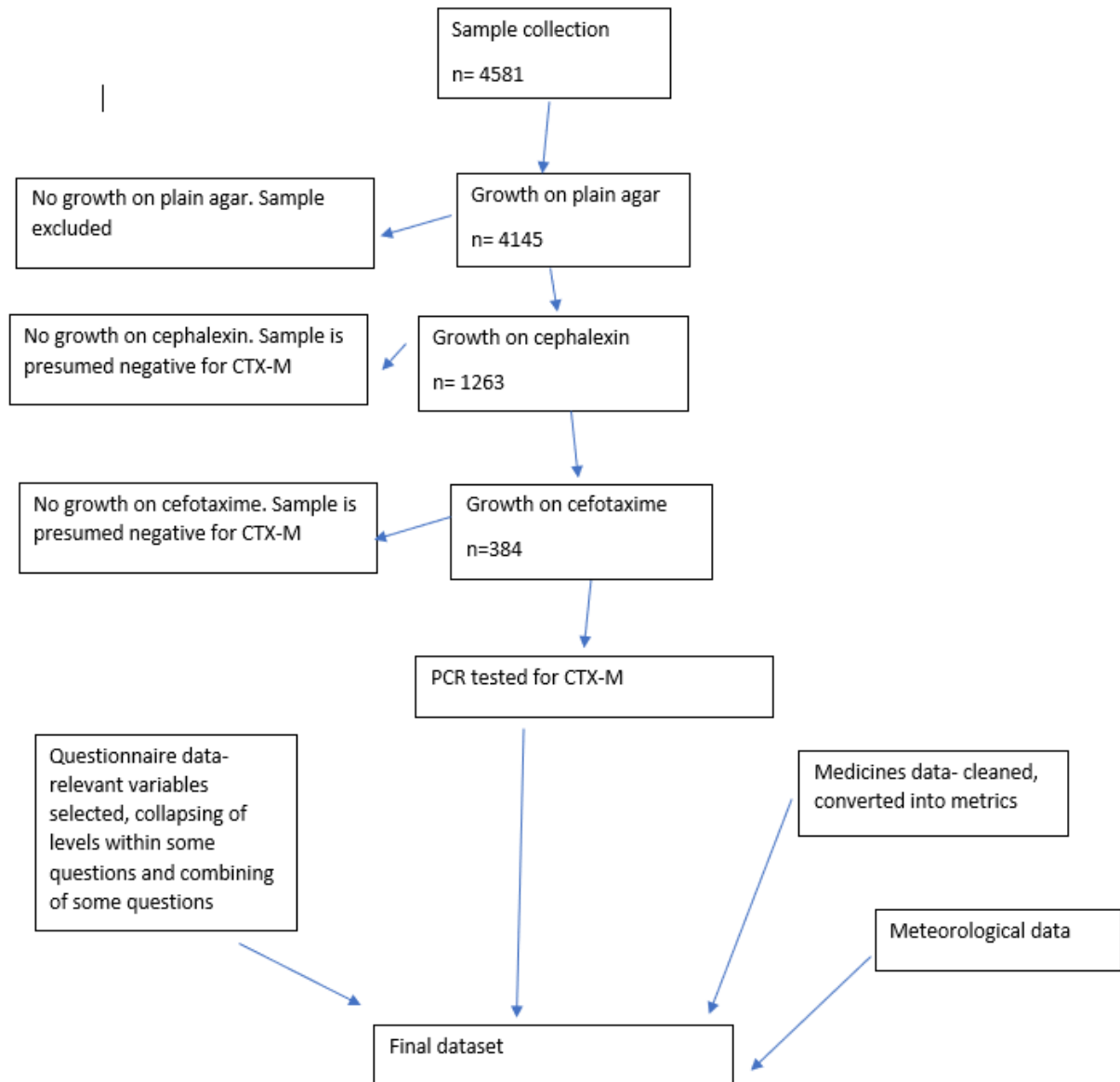


Figure S3: Model checking outputs for all models.

Calf CTX-M

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula:
## ctx_m ~ s_temp + f_trough_clean + s_cefq_dct_6m + s_fram_dct_6m +
## (1 | farm)
## Data: df_with_na
##
##      AIC      BIC  logLik deviance df.resid
##  484.2    511.0  -236.1   472.2     627
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.6504 -0.4324 -0.2660 -0.1882  4.7361
##
## Random effects:
## Groups Name          Variance Std.Dev.
## farm   (Intercept)  0.1752   0.4185
## Number of obs: 633, groups: farm, 51
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -2.2792    0.2142 -10.639 < 2e-16 ***
## s_temp          0.4436    0.1305   3.400 0.000673 ***
## f_trough_clean.L -0.7308    0.2039  -3.585 0.000338 ***
## s_cefq_dct_6m1  1.3697    0.3157   4.339 1.43e-05 ***
## s_fram_dct_6m1  0.5931    0.2974   1.994 0.046146 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) s_temp f_t_.L s_c__61
## s_temp      -0.076
## f_trgh_cl.L  0.019  0.065
## s_cfq_dc_61 -0.470 -0.103 -0.173
## s_frm_dc_61 -0.431 -0.307 -0.011  0.081
```

Main CTX-M

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula:
## ctx_m ~ s_temp + s_housed_outdoor + f_foragetype_3
## + preweaned_heifer +
## (1 | farm)
## Data: df
##
##      AIC      BIC  logLik deviance df.resid
## 1495.2    1533.2  -741.6   1483.2     4139
##
```

```

## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0491 -0.2323 -0.1547 -0.1017 11.4370
##
## Random effects:
##   Groups Name          Variance Std.Dev.
##   farm   (Intercept) 0.7928   0.8904
## Number of obs: 4145, groups: farm, 53
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    -4.58459    0.35626  -12.869 < 2e-16 ***
## s_temp          0.51227    0.07978   6.421 1.35e-10 ***
## s_housed_outdoor -1.09774    0.31778  -3.454 0.000552 ***
## f_foragetype_3yes  1.17822    0.37909   3.108 0.001883 **
## preweaned_heifer1  1.62387    0.15979  10.163 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) s_temp s_hsd_ f_fr_3
## s_temp        -0.087
## s_hsd_tdrtd  -0.081 -0.149
## f_frgtyp_3y  -0.858  0.009  0.006
## prewnd_hfr1  -0.218  0.020  0.191  0.028

```

Amox

```

## Family: bernoulli
## Links: mu = identity
## Formula: amoxR ~ (sens + spec - 1)/(1 + exp(-eta)) + (1 - spec)
##          eta ~ main + reg + rand
##          main ~ total_mg_pcu + tet + fq + amox + cefalexin + strep +
##          ceph_1 + co_amox + pen + me(s_temp, 0.61)
##          rand ~ 0 + (1 | farm)
##          reg ~ 0 + weaned_heifer + adult + dry + footpath
+ f_anything_waste + f_heifers_waste + f_whichclinresp + f_firstmastitis +
  f_poultry + f_equine + f_total_cattle + f_yield + f_herd_size + f_bought_
pre + f_scc + f_pneum_vacc + f_diarrvacc + f_anticocc + f_halocur + f_nsai
ddiarr + f_trough_clean + f_time_dam + f_um_spray + f_give_col + f_wean +
f_geographical_area + f_pattern + s_rain + f_percentdryoff + f_calving_gro
up + f_calf_housing_type + f_calf_housing_older + f_hectares + f_othergraz
e + f_bvdvacc + f_ibrvacc + f_leptovacc + f_salmvacc + f_lungvacc + f_clos
tvacc + f_organic + f_daystreatmast + f_timesfirstmast + f_injectmast + f_
nsaidmast + f_treatfoot + f_abcalve + f_nsaidcalve + f_calveclean + f_milk
graze + f_lime + f_predip + f_acf + f_cleancluster + f_drytrough + f_premi
ses + f_shows + f_market + f_hostfarmwalk + f_starling + f_deer + f_badger
+ f_rook + f_pigeon + f_fox + f_pheasant + f_rat + f_shoot + f_hunt + f_o
utsource + f_feedlorry + f_muckspreader + f_aiexternal + f_machinery +
f_bedmilk_1 + f_bedmilk_2 + f_bedmilk_3 + f_bedmilk_4 + f_bedmilk_6 +
f_bedmilk_8 + f_foragetype_1 + f_foragetype_2 + f_foragetype_3 +
f_foragetype_4 + f_foragetype_5 + f_foragetype_6 + f_foragetype_7 +
f_foragetype_8 + f_manure_1 + f_manure_2 + f_manure_3 + f_manure_4 +
f_manure_5 + f_manure_6 + f_manure_7 + f_manure_8 + f_manure_9
+ s_housed_outdoor + f_cefq_dct + f_ceph_dct + f_fram_dct + f_clox_dct + s

```

```

_calving_now + f_water + preweaned_heifer
## Data: df (Number of observations: 4145)
## Samples: 4 chains, each with iter = 10000; warmup = 1000; thin = 2;
## total post-warmup samples = 18000
##
## Group-Level Effects:
## ~farm (Number of levels: 53)
## Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS
## sd(rand_Intercept) 0.37 0.15 0.05 0.64 1.00 4046
## Tail_ESS
## sd(rand_Intercept) 5375
##
## Population-Level Effects:
## Estimate Est.Error l-95% CI
## main_Intercept 1.52 0.49 0.51
## main_total_mg_pcu 0.48 0.29 -0.09
## main_tet 0.07 0.14 -0.19
## main_fq 0.09 0.13 -0.17
## main_amox 0.07 0.16 -0.24
## main_cefalexin -0.05 0.17 -0.39
## main_strep -0.13 0.12 -0.36
## main_ceph_1 -0.09 0.19 -0.46
## main_co_amox 0.22 0.22 -0.20
## main_pen -0.34 0.43 -1.17
## reg_weaned_heifer0 0.06 0.12 -0.06
## reg_weaned_heifer1 -0.06 0.12 -0.39
## reg_adult1 0.02 0.07 -0.09
## reg_dry1 -0.01 0.07 -0.19
## reg_footpath1 0.01 0.07 -0.12
## reg_f_anything_waste1 0.03 0.09 -0.08
## reg_f_heifers_waste1 0.01 0.07 -0.12
## reg_f_whichclinrespMacrolide -0.00 0.07 -0.15
## reg_f_whichclinrespOtherDdontknow 0.02 0.14 -0.17
## reg_f_whichclinrespPenicillimoxycillin -0.03 0.17 -0.49
## reg_f_whichclinrespTetracycline -0.00 0.07 -0.17
## reg_f_firstmastitisCobactan -0.01 0.14 -0.32
## reg_f_firstmastitisMastiplanLC -0.03 0.18 -0.49
## reg_f_firstmastitisOrbeninLA 0.05 0.27 -0.15
## reg_f_firstmastitistdDmultiject 0.16 0.24 -0.05
## reg_f_firstmastitisUbroYellow -0.01 0.08 -0.19
## reg_f_firstmastitisUbrolexin -0.05 0.15 -0.54
## reg_f_poultry1 0.06 0.13 -0.06
## reg_f_equine1 0.04 0.10 -0.08
## reg_f_total_cattle 0.00 0.05 -0.09
## reg_f_yield 0.02 0.05 -0.07
## reg_f_herd_size 0.01 0.05 -0.09
## reg_f_bought_pre 0.01 0.05 -0.08
## reg_f_scc -0.00 0.04 -0.09
## reg_f_pneum_vacc1 0.01 0.07 -0.12
## reg_f_diarrvaccY -0.03 0.09 -0.31
## reg_f_anticocc1 -0.01 0.07 -0.17
## reg_f_halocur1 0.01 0.07 -0.11
## reg_f_nsaiddiarr1 -0.01 0.07 -0.20
## reg_f_trough_clean.L 0.02 0.06 -0.07

```

## reg_f_time_dam.L	0.02	0.07	-0.08
## reg_f_um_spray1	0.02	0.10	-0.11
## reg_f_give_col1	0.00	0.07	-0.14
## reg_f_wean2	-0.01	0.08	-0.24
## reg_f_wean3	-0.01	0.07	-0.16
## reg_f_geographical_area2	0.02	0.09	-0.08
## reg_f_geographical_area3	0.01	0.07	-0.12
## reg_f_pattern2	0.03	0.11	-0.10
## reg_s_rain	0.02	0.04	-0.04
## reg_f_percentdryoff	0.03	0.06	-0.05
## reg_f_calving_group1	0.01	0.08	-0.13
## reg_f_calf_housing_type2	0.01	0.07	-0.10
## reg_f_calf_housing_type3	-0.07	0.14	-0.50
## reg_f_calf_housing_older1	-0.01	0.08	-0.22
## reg_f_hectares	-0.02	0.05	-0.16
## reg_f_othergrazeY	-0.03	0.09	-0.28
## reg_f_bvdvaccY	0.01	0.07	-0.12
## reg_f_ibrvaccY	-0.01	0.07	-0.20
## reg_f_leptovaccY	-0.00	0.07	-0.17
## reg_f_salmvaccY	-0.04	0.17	-0.54
## reg_f_lungvaccY	-0.11	0.19	-0.62
## reg_f_clostvaccY	-0.04	0.13	-0.45
## reg_f_organic1	-0.02	0.12	-0.34
## reg_f_daystreatmast	0.02	0.06	-0.06
## reg_f_timesfirstmast	-0.02	0.05	-0.16
## reg_f_injectmast	-0.01	0.06	-0.16
## reg_f_nsaidmast	-0.03	0.07	-0.22
## reg_f_treatfoot1	-0.00	0.06	-0.14
## reg_f_abcalve1	0.02	0.09	-0.11
## reg_f_nsaidcalve1	-0.00	0.06	-0.14
## reg_f_calveclean.L	-0.01	0.06	-0.15
## reg_f_milkgraze1	-0.00	0.08	-0.18
## reg_f_lime1	0.05	0.12	-0.07
## reg_f_predip1	0.04	0.11	-0.07
## reg_f_acf1	-0.07	0.14	-0.50
## reg_f_cleancluster.L	-0.03	0.08	-0.27
## reg_f_drytrough.L	-0.01	0.06	-0.15
## reg_f_premises2	-0.01	0.07	-0.17
## reg_f_shows1	0.16	0.33	-0.08
## reg_f_market1	-0.01	0.07	-0.18
## reg_f_hostfarmwalk1	0.02	0.08	-0.10
## reg_f_starling2	-0.00	0.07	-0.16
## reg_f_deer2	-0.04	0.11	-0.38
## reg_f_badger2	0.04	0.13	-0.10
## reg_f_rook2	0.03	0.09	-0.09
## reg_f_pigeon2	0.00	0.06	-0.12
## reg_f_fox2	-0.04	0.10	-0.34
## reg_f_pheasant2	0.01	0.08	-0.14
## reg_f_rat2	0.01	0.07	-0.12
## reg_f_shoot2	-0.03	0.10	-0.34
## reg_f_hunt2	-0.01	0.07	-0.21
## reg_f_outsource1	0.01	0.10	-0.13
## reg_f_feedlorry1	0.02	0.08	-0.08
## reg_f_muckspreader1	-0.00	0.07	-0.15

## reg_f_muckspreader3	-0.01	0.13	-0.29	
## reg_f_aiexternal1	0.01	0.07	-0.10	
## reg_f_machinery1	-0.03	0.09	-0.30	
## reg_f_bedmilk_1yes	-0.05	0.12	-0.42	
## reg_f_bedmilk_2yes	0.02	0.08	-0.10	
## reg_f_bedmilk_3yes	-0.00	0.06	-0.15	
## reg_f_bedmilk_4yes	0.01	0.13	-0.18	
## reg_f_bedmilk_6yes	0.03	0.16	-0.16	
## reg_f_bedmilk_8yes	-0.01	0.16	-0.32	
## reg_f_foragetype_1yes	0.01	0.11	-0.14	
## reg_f_foragetype_2yes	-0.10	0.23	-0.84	
## reg_f_foragetype_3yes	0.06	0.14	-0.08	
## reg_f_foragetype_4yes	0.02	0.07	-0.09	
## reg_f_foragetype_5yes	-0.00	0.07	-0.16	
## reg_f_foragetype_6yes	0.01	0.09	-0.14	
## reg_f_foragetype_7yes	-0.01	0.08	-0.21	
## reg_f_foragetype_8yes	-0.03	0.17	-0.51	
## reg_f_manure_1yes	0.04	0.12	-0.07	
## reg_f_manure_2yes	-0.01	0.08	-0.19	
## reg_f_manure_3yes	0.03	0.10	-0.09	
## reg_f_manure_4yes	-0.07	0.14	-0.49	
## reg_f_manure_5yes	-0.00	0.07	-0.16	
## reg_f_manure_6yes	0.02	0.08	-0.08	
## reg_f_manure_7yes	0.02	0.12	-0.15	
## reg_f_manure_8yes	0.01	0.09	-0.15	
## reg_f_manure_9yes	0.03	0.16	-0.14	
## reg_s_housed_outdooroutdoor	-1.29	0.16	-1.61	
## reg_f_cefq_dct1	-0.00	0.08	-0.17	
## reg_f_ceph_dct1	0.00	0.07	-0.14	
## reg_f_fram_dct1	-0.01	0.07	-0.18	
## reg_f_clox_dct1	-0.00	0.07	-0.17	
## reg_s_calving_now1	0.03	0.09	-0.07	
## reg_f_water1	0.00	0.07	-0.14	
## reg_preweaned_heifer1	0.69	0.21	0.25	
## main_mes_temp0.61	0.65	0.10	0.45	
##	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
## main_Intercept	2.50	1.00	10713	13015
## main_total_mg_pcu	1.05	1.00	11833	14336
## main_tet	0.34	1.00	13464	15883
## main_fq	0.36	1.00	12740	16011
## main_amox	0.39	1.00	12053	15621
## main_cefalexin	0.28	1.00	12817	15945
## main_strep	0.10	1.00	12954	15149
## main_ceph_1	0.27	1.00	13369	15169
## main_co_amox	0.65	1.00	12572	14891
## main_pen	0.51	1.00	11102	13559
## reg_weaned_heifer0	0.38	1.00	14120	16139
## reg_weaned_heifer1	0.06	1.00	13989	16572
## reg_adult1	0.22	1.00	14598	15753
## reg_dry1	0.11	1.00	14843	16522
## reg_footpath1	0.17	1.00	14691	15162
## reg_f_anything_waste1	0.30	1.00	14436	14703
## reg_f_heifers_waste1	0.17	1.00	15682	16744
## reg_f_whichclinrespMacrolide	0.14	1.00	15373	15173

## reg_f_whichclinrespOtherDdontknow	0.35	1.00	14910	15191
## reg_f_whichclinrespPenicillimoxycillin	0.16	1.00	14773	14935
## reg_f_whichclinrespTetracycline	0.14	1.00	14969	15595
## reg_f_firstmastitisCobactan	0.17	1.00	14264	14918
## reg_f_firstmastitisMastiplanLC	0.16	1.00	14521	15427
## reg_f_firstmastitisOrbeninLA	0.78	1.00	14811	12465
## reg_f_firstmastitistdDmultiject	0.80	1.00	6189	8388
## reg_f_firstmastitisUbroYellow	0.14	1.00	15770	16200
## reg_f_firstmastitisUbrolexin	0.11	1.00	14020	14522
## reg_f_poultry1	0.47	1.00	12773	12284
## reg_f_equine1	0.35	1.00	14817	15750
## reg_f_total_cattle	0.12	1.00	15727	15971
## reg_f_yield	0.17	1.00	14982	15817
## reg_f_herd_size	0.12	1.00	15992	14986
## reg_f_bought_pre	0.13	1.00	14649	15882
## reg_f_scc	0.09	1.00	15206	16283
## reg_f_pneum_vacc1	0.19	1.00	15471	16243
## reg_f_diarrvaccY	0.08	1.00	14037	15070
## reg_f_anticocc1	0.13	1.00	14409	14245
## reg_f_halocur1	0.21	1.00	15380	14935
## reg_f_nsaiddiarr1	0.11	1.00	14571	15146
## reg_f_trough_clean.L	0.20	1.00	13457	15701
## reg_f_time_dam.L	0.21	1.00	14027	14568
## reg_f_um_spray1	0.31	1.00	14509	14783
## reg_f_give_col1	0.17	1.00	15692	15296
## reg_f_wean2	0.12	1.00	15104	14909
## reg_f_wean3	0.12	1.00	15995	16195
## reg_f_geographical_area2	0.28	1.00	14125	15558
## reg_f_geographical_area3	0.18	1.00	15162	15191
## reg_f_pattern2	0.36	1.00	13522	14774
## reg_s_rain	0.11	1.00	14801	16761
## reg_f_percentdryoff	0.20	1.00	13560	15612
## reg_f_calving_group1	0.22	1.00	14011	15321
## reg_f_calf_housing_type2	0.19	1.00	15102	15967
## reg_f_calf_housing_type3	0.07	1.00	11543	14538
## reg_f_calf_housing_older1	0.12	1.00	15289	15516
## reg_f_hectares	0.06	1.00	13610	15717
## reg_f_othergrazeY	0.08	1.00	13977	15367
## reg_f_bvdvaccY	0.17	1.00	14994	15404
## reg_f_ibrvaccY	0.11	1.00	15562	15558
## reg_f_leptovaccY	0.14	1.00	14712	16163
## reg_f_salmvaccY	0.13	1.00	12983	12830
## reg_f_lungvaccY	0.05	1.00	8645	14041
## reg_f_clostvaccY	0.09	1.00	14007	14881
## reg_f_organic1	0.12	1.00	14029	14411
## reg_f_daystreatmast	0.19	1.00	14568	16152
## reg_f_timesfirstmast	0.06	1.00	14065	15660
## reg_f_injectmast	0.08	1.00	15302	15963
## reg_f_nsaidmast	0.05	1.00	13148	15620
## reg_f_treatfoot1	0.13	1.00	15373	14548
## reg_f_abcalve1	0.27	1.00	14530	13892
## reg_f_nsaidcalve1	0.13	1.00	14675	15802
## reg_f_calveclean.L	0.11	1.00	14118	15841
## reg_f_milkgraze1	0.16	1.00	14951	15053

## reg_f_lime1	0.42	1.00	13090	14427
## reg_f_predip1	0.37	1.00	11861	13403
## reg_f_acf1	0.07	1.00	11402	13584
## reg_f_cleancluster.L	0.07	1.00	14170	14824
## reg_f_drytrough.L	0.09	1.00	14005	16142
## reg_f_premises2	0.11	1.00	15021	15678
## reg_f_shows1	1.20	1.00	7296	8773
## reg_f_market1	0.13	1.00	14978	14763
## reg_f_hostfarmwalk1	0.25	1.00	14077	15375
## reg_f_starling2	0.13	1.00	15270	15658
## reg_f_deer2	0.09	1.00	13071	12734
## reg_f_badger2	0.44	1.00	13048	12992
## reg_f_rook2	0.30	1.00	14037	14353
## reg_f_pigeon2	0.15	1.00	15779	16784
## reg_f_fox2	0.08	1.00	14110	14442
## reg_f_pheasant2	0.20	1.00	15081	15592
## reg_f_rat2	0.18	1.00	15070	14560
## reg_f_shoot2	0.08	1.00	12748	12430
## reg_f_hunt2	0.10	1.00	15381	14947
## reg_f_outsource1	0.26	1.00	14601	15497
## reg_f_feedlorry1	0.28	1.00	14901	14889
## reg_f_muckspreader1	0.14	1.00	15233	16298
## reg_f_muckspreader3	0.17	1.00	14699	15280
## reg_f_aiexternal1	0.21	1.00	14041	15388
## reg_f_machinery1	0.08	1.00	14336	14955
## reg_f_bedmilk_1yes	0.07	1.00	12780	13848
## reg_f_bedmilk_2yes	0.24	1.00	14793	15073
## reg_f_bedmilk_3yes	0.13	1.00	14572	14841
## reg_f_bedmilk_4yes	0.30	1.00	14795	14485
## reg_f_bedmilk_6yes	0.43	1.00	14227	14267
## reg_f_bedmilk_8yes	0.19	1.00	15305	14681
## reg_f_foragetype_1yes	0.29	1.00	15111	15165
## reg_f_foragetype_2yes	0.08	1.00	9588	10915
## reg_f_foragetype_3yes	0.49	1.00	12802	12925
## reg_f_foragetype_4yes	0.22	1.00	15066	14983
## reg_f_foragetype_5yes	0.14	1.00	15191	15851
## reg_f_foragetype_6yes	0.23	1.00	15572	15191
## reg_f_foragetype_7yes	0.12	1.00	14592	15019
## reg_f_foragetype_8yes	0.14	1.00	14031	14930
## reg_f_manure_1yes	0.41	1.00	11979	12291
## reg_f_manure_2yes	0.15	1.00	15319	15134
## reg_f_manure_3yes	0.32	1.00	14653	14673
## reg_f_manure_4yes	0.06	1.00	11777	13215
## reg_f_manure_5yes	0.14	1.00	15706	16055
## reg_f_manure_6yes	0.25	1.00	15047	16194
## reg_f_manure_7yes	0.31	1.00	14876	14709
## reg_f_manure_8yes	0.21	1.00	14967	15129
## reg_f_manure_9yes	0.52	1.00	14235	12668
## reg_s_housed_outdooroutdoor	-0.99	1.00	16704	17067
## reg_f_cefq_dct1	0.16	1.00	15128	15600
## reg_f_ceph_dct1	0.16	1.00	14186	15277
## reg_f_fram_dct1	0.12	1.00	14680	16601
## reg_f_clox_dct1	0.14	1.00	15218	15005
## reg_s_calving_now1	0.32	1.00	13435	16059

```

## reg_f_water1                0.16 1.00    15475    15840
## reg_preweaned_heifer1      1.09 1.00    14460    14131
## main_mes_temp0.61          0.85 1.00    14065    15924
##
## Samples were drawn using sampling(NUTS). For each
parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the
potential
## scale reduction factor on split chains (at convergence, Rhat = 1).

```

Cipro

```

## Family: bernoulli
## Links: mu = identity
## Formula: cipro ~ (sens + spec - 1)/(1 + exp(-eta)) + (1 - spec)
##           eta ~ main + reg + rand
##           main ~ total_mg_pcu + ceph_3_4 + fq + novobiocin + me(s_temp,
0.61)
##           rand ~ 0 + (1 | farm)
##           reg ~ 0 + weaned_heifer + adult + dry + footpath
+ f_anything_waste + f_heifers_waste + f_whichclinresp + f_firstmastitis +
f_poultry + f_equine + f_total_cattle + f_yield + f_herd_size + f_bought_
pre + f_scc + f_pneum_vacc + f_diarrvacc + f_anticocc + f_halocur + f_nsai
ddiarr + f_trough_clean + f_time_dam + f_um_spray + f_give_col + f_wean +
f_geographical_area + f_pattern + s_rain + f_percentdryoff + f_calving_gro
up + f_calf_housing_type + f_calf_housing_older + f_hectares + f_othergraz
e + f_bvdvacc + f_ibrvacc + f_leptovacc + f_salmvacc + f_lungvacc + f_clos
tvacc + f_organic + f_daystreatmast + f_timesfirstmast + f_injectmast + f_
nsaidmast + f_treatfoot + f_abcalve + f_nsaidcalve + f_calveclean + f_milk
graze + f_lime + f_predip + f_acf + f_cleancluster + f_drytrough + f_premi
ses + f_shows + f_market + f_hostfarmwalk + f_starling + f_deer + f_badger
+ f_rook + f_pigeon + f_fox + f_pheasant + f_rat + f_shoot + f_hunt + f_o
utsource + f_feedlorry + f_muckspreader + f_aiexternal + f_machinery +
f_bedmilk_1 + f_bedmilk_2 + f_bedmilk_3 + f_bedmilk_4 + f_bedmilk_6 +
f_bedmilk_8 + f_foragetype_1 + f_foragetype_2 + f_foragetype_3 +
f_foragetype_4 + f_foragetype_5 + f_foragetype_6 + f_foragetype_7 +
f_foragetype_8 + f_manure_1 + f_manure_2 + f_manure_3 + f_manure_4 +
f_manure_5 + f_manure_6 + f_manure_7 + f_manure_8 + f_manure_9
+ s_housed_outdoor + f_cefq_dct + f_ceph_dct + f_fram_dct + f_clox_dct + s
_calving_now + f_water + preweaned_heifer
## Data: df (Number of observations: 4145)
## Samples: 4 chains, each with iter = 10000; warmup = 1000; thin = 2;
##           total post-warmup samples = 18000
##
## Group-Level Effects:
## ~farm (Number of levels: 53)
##           Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS
## sd(rand_Intercept)    0.57    0.25    0.06    1.03 1.00    2827
##           Tail_ESS
## sd(rand_Intercept)    4968
##
## Population-Level Effects:
##           Estimate Est.Error l-95% CI
## main_Intercept          -3.05    0.84    -4.68

```

## main_total_mg_pcu	0.10	0.16	-0.21
## main_ceph_3_4	0.07	0.15	-0.24
## main_fq	0.36	0.18	-0.00
## main_novobiocin	0.14	0.17	-0.20
## reg_weaned_heifer0	0.28	0.35	-0.12
## reg_weaned_heifer1	-0.29	0.35	-1.02
## reg_adult1	0.03	0.12	-0.15
## reg_dry1	-0.01	0.11	-0.26
## reg_footpath1	0.02	0.10	-0.16
## reg_f_anything_waste1	0.03	0.13	-0.17
## reg_f_heifers_waste1	0.02	0.12	-0.19
## reg_f_whichclinrespMacrolide	0.02	0.12	-0.16
## reg_f_whichclinrespOtherDdontknow	-0.05	0.34	-0.77
## reg_f_whichclinrespPenicillimoxycillin	-0.01	0.23	-0.44
## reg_f_whichclinrespTetracycline	0.03	0.14	-0.17
## reg_f_firstmastitisCobactan	0.02	0.19	-0.29
## reg_f_firstmastitisMastiplanLC	-0.01	0.22	-0.44
## reg_f_firstmastitisOrbeninLA	-0.02	0.23	-0.56
## reg_f_firstmastitistdDmultiject	0.03	0.13	-0.17
## reg_f_firstmastitisUbroYellow	-0.32	0.45	-1.46
## reg_f_firstmastitisUbrolexin	-0.02	0.17	-0.42
## reg_f_poultry1	-0.06	0.16	-0.54
## reg_f_equine1	0.14	0.24	-0.09
## reg_f_total_cattle	-0.01	0.08	-0.20
## reg_f_yield	0.02	0.08	-0.10
## reg_f_herd_size	0.01	0.08	-0.15
## reg_f_bought_pre	-0.02	0.08	-0.24
## reg_f_scc	-0.02	0.08	-0.24
## reg_f_pneum_vacc1	0.08	0.19	-0.11
## reg_f_diarrvaccY	-0.01	0.10	-0.26
## reg_f_anticocc1	-0.01	0.11	-0.28
## reg_f_halocur1	-0.02	0.11	-0.32
## reg_f_nsaiddiarr1	-0.19	0.33	-1.10
## reg_f_trough_clean.L	0.01	0.09	-0.17
## reg_f_time_dam.L	0.03	0.11	-0.12
## reg_f_um_spray1	0.15	0.35	-0.13
## reg_f_give_col1	-0.01	0.11	-0.28
## reg_f_wean2	0.04	0.16	-0.18
## reg_f_wean3	0.02	0.12	-0.18
## reg_f_geographical_area2	-0.08	0.19	-0.67
## reg_f_geographical_area3	0.05	0.16	-0.13
## reg_f_pattern2	0.01	0.12	-0.22
## reg_s_rain	0.13	0.10	-0.01
## reg_f_percentdryoff	-0.02	0.07	-0.20
## reg_f_calving_group1	-0.01	0.14	-0.36
## reg_f_calf_housing_type2	0.04	0.15	-0.17
## reg_f_calf_housing_type3	-0.36	0.45	-1.40
## reg_f_calf_housing_older1	-0.10	0.22	-0.76
## reg_f_hectares	-0.04	0.09	-0.28
## reg_f_othersgrazeY	0.03	0.12	-0.16
## reg_f_bvdvaccY	0.01	0.11	-0.22
## reg_f_ibrvaccY	-0.00	0.10	-0.23
## reg_f_leptovaccY	0.01	0.12	-0.21
## reg_f_salmvaccY	-0.03	0.20	-0.51

## reg_f_lungvaccY	0.01	0.11	-0.19
## reg_f_clostvaccY	-0.02	0.13	-0.34
## reg_f_organic1	0.06	0.24	-0.20
## reg_f_daystreatmast	-0.07	0.12	-0.40
## reg_f_timesfirstmast	0.07	0.11	-0.06
## reg_f_injectmast	-0.02	0.08	-0.24
## reg_f_nsaidmast	-0.03	0.08	-0.27
## reg_f_treatfoot1	-0.01	0.11	-0.28
## reg_f_abcalve1	0.01	0.13	-0.25
## reg_f_nsaidcalve1	-0.08	0.17	-0.60
## reg_f_calveclean.L	0.02	0.10	-0.15
## reg_f_milkgraze1	0.01	0.13	-0.26
## reg_f_lime1	-0.09	0.21	-0.73
## reg_f_predip1	0.03	0.13	-0.16
## reg_f_acf1	0.01	0.11	-0.21
## reg_f_cleancluster.L	-0.02	0.09	-0.26
## reg_f_drytrough.L	0.03	0.10	-0.12
## reg_f_premises2	-0.02	0.11	-0.32
## reg_f_shows1	-0.08	0.26	-0.94
## reg_f_market1	-0.04	0.13	-0.42
## reg_f_hostfarmwalk1	0.02	0.11	-0.18
## reg_f_starling2	0.16	0.26	-0.09
## reg_f_deer2	0.05	0.16	-0.14
## reg_f_badger2	-0.15	0.32	-1.12
## reg_f_rook2	0.02	0.12	-0.19
## reg_f_pigeon2	0.01	0.10	-0.19
## reg_f_fox2	0.05	0.17	-0.15
## reg_f_pheasant2	-0.01	0.13	-0.32
## reg_f_rat2	0.03	0.12	-0.16
## reg_f_shoot2	0.06	0.17	-0.12
## reg_f_hunt2	-0.02	0.12	-0.34
## reg_f_outsource1	-0.01	0.14	-0.33
## reg_f_feedlorry1	-0.01	0.11	-0.28
## reg_f_muckspreader1	-0.02	0.12	-0.33
## reg_f_muckspreader3	-0.00	0.21	-0.42
## reg_f_aiexternal1	-0.00	0.10	-0.23
## reg_f_machinery1	0.03	0.13	-0.14
## reg_f_bedmilk_1yes	0.03	0.13	-0.18
## reg_f_bedmilk_2yes	-0.04	0.15	-0.48
## reg_f_bedmilk_3yes	-0.04	0.14	-0.43
## reg_f_bedmilk_4yes	0.04	0.24	-0.25
## reg_f_bedmilk_6yes	0.06	0.27	-0.24
## reg_f_bedmilk_8yes	0.01	0.22	-0.37
## reg_f_foragetype_1yes	0.02	0.18	-0.26
## reg_f_foragetype_2yes	0.01	0.14	-0.23
## reg_f_foragetype_3yes	-0.05	0.17	-0.54
## reg_f_foragetype_4yes	0.04	0.13	-0.13
## reg_f_foragetype_5yes	0.00	0.12	-0.24
## reg_f_foragetype_6yes	-0.12	0.28	-1.00
## reg_f_foragetype_7yes	0.04	0.15	-0.16
## reg_f_foragetype_8yes	0.17	0.52	-0.19
## reg_f_manure_1yes	0.02	0.11	-0.17
## reg_f_manure_2yes	-0.02	0.14	-0.39
## reg_f_manure_3yes	-0.02	0.12	-0.35

## reg_f_manure_4yes	-0.02		0.10	-0.28	
## reg_f_manure_5yes	-0.24		0.34	-1.09	
## reg_f_manure_6yes	-0.03		0.13	-0.42	
## reg_f_manure_7yes	0.05		0.22	-0.21	
## reg_f_manure_8yes	-0.02		0.15	-0.42	
## reg_f_manure_9yes	-0.04		0.24	-0.70	
## reg_s_housed_outdooroutdoor	-0.03		0.10	-0.30	
## reg_f_cefq_dct1	-0.01		0.12	-0.29	
## reg_f_ceph_dct1	0.01		0.11	-0.21	
## reg_f_fram_dct1	-0.00		0.11	-0.24	
## reg_f_clox_dct1	0.04		0.14	-0.15	
## reg_s_calving_now1	0.02		0.11	-0.16	
## reg_f_water1	0.00		0.11	-0.22	
## reg_preweaned_heifer1	1.42		0.21	1.03	
## main_mes_temp0.61	0.76		0.14	0.49	
##		u-95% CI	Rhat	Bulk_ESS	Tail_ESS
## main_Intercept	-1.34	1.00		7780	11780
## main_total_mg_pcu	0.41	1.00		10545	14938
## main_ceph_3_4	0.37	1.00		13575	15856
## main_fq	0.72	1.00		10789	13074
## main_novobiocin	0.48	1.00		13003	15413
## reg_weaned_heifer0	1.00	1.00		6841	13923
## reg_weaned_heifer1	0.10	1.00		7041	15597
## reg_adult1	0.40	1.00		14398	14700
## reg_dry1	0.21	1.00		16670	16153
## reg_footpath1	0.28	1.00		15471	15464
## reg_f_anything_waste1	0.39	1.00		15130	14501
## reg_f_heifers_waste1	0.31	1.00		15484	15292
## reg_f_whichclinrespMacrolide	0.35	1.00		14875	15220
## reg_f_whichclinrespOtherDdontknow	0.31	1.00		14736	12843
## reg_f_whichclinrespPenicillimoxycillin	0.37	1.00		16589	15678
## reg_f_whichclinrespTetracycline	0.41	1.00		14403	14946
## reg_f_firstmastitisCobactan	0.48	1.00		14846	14608
## reg_f_firstmastitisMastiplanLC	0.37	1.00		15975	15876
## reg_f_firstmastitisOrbeninLA	0.32	1.00		14162	13345
## reg_f_firstmastitistdDmultiject	0.40	1.00		14814	14518
## reg_f_firstmastitisUbroYellow	0.09	1.00		8330	12817
## reg_f_firstmastitisUbrolexin	0.24	1.00		15411	15461
## reg_f_poultry1	0.12	1.00		12207	12712
## reg_f_equine1	0.82	1.00		8030	13501
## reg_f_total_cattle	0.15	1.00		14505	15269
## reg_f_yield	0.24	1.00		14423	14543
## reg_f_herd_size	0.20	1.00		15946	15840
## reg_f_bought_pre	0.10	1.00		14828	15102
## reg_f_scc	0.12	1.00		13976	14497
## reg_f_pneum_vacc1	0.65	1.00		12335	12273
## reg_f_diarrvaccY	0.19	1.00		16410	16250
## reg_f_anticocc1	0.21	1.00		15161	14804
## reg_f_halocur1	0.17	1.00		15284	15940
## reg_f_nsaiddiarr1	0.09	1.00		7261	10004
## reg_f_trough_clean.L	0.22	1.00		15464	14222
## reg_f_time_dam.L	0.34	1.00		14025	15224
## reg_f_um_spray1	1.24	1.00		8243	9265
## reg_f_give_coll	0.21	1.00		15970	16032

## reg_f_wean2	0.48	1.00	14288	15157
## reg_f_wean3	0.35	1.00	14502	14967
## reg_f_geographical_area2	0.12	1.00	12006	13732
## reg_f_geographical_area3	0.53	1.00	12941	13302
## reg_f_pattern2	0.28	1.00	16408	15788
## reg_s_rain	0.34	1.00	10611	15141
## reg_f_percentdryoff	0.10	1.00	14397	16269
## reg_f_calving_group1	0.25	1.00	16023	15593
## reg_f_calf_housing_type2	0.49	1.00	13250	13163
## reg_f_calf_housing_type3	0.07	1.00	4477	10283
## reg_f_calf_housing_older1	0.11	1.00	10820	13396
## reg_f_hectares	0.08	1.00	14566	15801
## reg_f_othergrazeY	0.37	1.00	14111	14864
## reg_f_bvdvaccY	0.25	1.00	15171	15781
## reg_f_ibrvaccY	0.20	1.00	16743	15672
## reg_f_leptovaccY	0.31	1.00	14730	14775
## reg_f_salmvaccY	0.27	1.00	14997	14397
## reg_f_lungvaccY	0.28	1.00	14441	16107
## reg_f_clostvaccY	0.21	1.00	15697	15248
## reg_f_organic1	0.83	1.00	14190	13093
## reg_f_daystreatmast	0.07	1.00	8453	12675
## reg_f_timesfirstmast	0.35	1.00	11534	14103
## reg_f_injectmast	0.12	1.00	15176	15591
## reg_f_nsaidmast	0.09	1.00	14051	16320
## reg_f_treatfoot1	0.19	1.00	15474	16554
## reg_f_abcalve1	0.31	1.00	15204	14468
## reg_f_nsaidcalve1	0.11	1.00	12738	13981
## reg_f_calveclean.L	0.30	1.00	15049	13919
## reg_f_milkgraze1	0.32	1.00	15871	15433
## reg_f_lime1	0.13	1.00	11018	11967
## reg_f_predip1	0.39	1.00	14376	14597
## reg_f_acf1	0.27	1.00	15789	15322
## reg_f_cleancluster.L	0.13	1.00	15390	16313
## reg_f_drytrough.L	0.30	1.00	14370	14186
## reg_f_premises2	0.17	1.00	14403	14122
## reg_f_shows1	0.17	1.00	12089	10648
## reg_f_market1	0.14	1.00	13968	14494
## reg_f_hostfarmwalk1	0.31	1.00	15808	15489
## reg_f_starling2	0.90	1.00	7280	11170
## reg_f_deer2	0.53	1.00	13817	14294
## reg_f_badger2	0.13	1.00	7910	9951
## reg_f_rook2	0.35	1.00	15772	15580
## reg_f_pigeon2	0.25	1.00	15636	15837
## reg_f_fox2	0.57	1.00	10562	8466
## reg_f_pheasant2	0.22	1.00	15681	15022
## reg_f_rat2	0.37	1.00	13793	13584
## reg_f_shoot2	0.58	1.00	11085	12573
## reg_f_hunt2	0.19	1.00	16353	15635
## reg_f_outsource1	0.25	1.00	15479	15020
## reg_f_feedlorry1	0.20	1.00	15056	15364
## reg_f_muckspreader1	0.16	1.00	14734	14592
## reg_f_muckspreader3	0.40	1.00	15333	14817
## reg_f_aiexternal1	0.21	1.00	15511	15293
## reg_f_machinery1	0.40	1.00	15113	15582

## reg_f_bedmilk_1yes	0.38	1.00	15561	15190
## reg_f_bedmilk_2yes	0.15	1.00	14426	13928
## reg_f_bedmilk_3yes	0.15	1.00	14656	15250
## reg_f_bedmilk_4yes	0.67	1.00	14770	13509
## reg_f_bedmilk_6yes	0.82	1.00	14339	12792
## reg_f_bedmilk_8yes	0.46	1.00	16273	15852
## reg_f_foragetype_1yes	0.47	1.00	15704	14746
## reg_f_foragetype_2yes	0.34	1.00	15960	15240
## reg_f_foragetype_3yes	0.14	1.00	12964	11536
## reg_f_foragetype_4yes	0.44	1.00	14997	14443
## reg_f_foragetype_5yes	0.28	1.00	15952	16036
## reg_f_foragetype_6yes	0.14	1.00	11125	11455
## reg_f_foragetype_7yes	0.50	1.00	12692	13050
## reg_f_foragetype_8yes	1.99	1.00	9838	9013
## reg_f_manure_1yes	0.32	1.00	15471	15932
## reg_f_manure_2yes	0.21	1.00	14596	14179
## reg_f_manure_3yes	0.19	1.00	14613	15276
## reg_f_manure_4yes	0.17	1.00	14224	14259
## reg_f_manure_5yes	0.07	1.00	5807	10435
## reg_f_manure_6yes	0.15	1.00	12647	11564
## reg_f_manure_7yes	0.66	1.00	15169	13528
## reg_f_manure_8yes	0.23	1.00	15708	14392
## reg_f_manure_9yes	0.25	1.00	14945	13664
## reg_s_housed_outdooroutdoor	0.13	1.00	15334	14803
## reg_f_cefq_dct1	0.23	1.00	15340	16046
## reg_f_ceph_dct1	0.28	1.00	14520	15492
## reg_f_fram_dct1	0.24	1.00	15780	15529
## reg_f_clox_dct1	0.44	1.00	14654	14524
## reg_s_calving_now1	0.31	1.00	15797	16061
## reg_f_water1	0.25	1.00	16346	15471
## reg_preweaned_heifer1	1.87	1.00	15840	16120
## main_mes_temp0.61	1.06	1.00	12054	15102

Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
is a crude measure of effective sample size, and Rhat is the potential
scale reduction factor on split chains (at convergence, Rhat = 1).

Tet

```
## Family: bernoulli
## Links: mu = identity
## Formula: tetR ~ (sens + spec - 1)/(1 + exp(-eta)) + (1 - spec)
##           eta ~ main + reg + rand
##           main ~ total_mg_pcu + tet + fq + amox + cefalexin + strep +
me(s_temp, 0.61)
##           rand ~ 0 + (1 | farm)
##           reg ~ 0 + weaned_heifer + adult + dry + footpath
+ f_anything_waste + f_heifers_waste + f_whichclinresp + f_firstmastitis +
f_poultry + f_equine + f_total_cattle + f_yield + f_herd_size + f_bought_
pre + f_scc + f_pneum_vacc + f_diarrvacc + f_anticocc + f_halocur + f_nsai
ddiarr + f_trough_clean + f_time_dam + f_um_spray + f_give_col + f_wean +
f_geographical_area + f_pattern + s_rain + f_percentdryoff + f_calving_gro
```



```

up + f_calf_housing_type + f_calf_housing_older + f_hectares + f_othergraze
+ f_bvdvacc + f_ibrvacc + f_leptovacc + f_salmvacc + f_lungvacc + f_clostrvacc
+ f_organic + f_daystreatmast + f_timesfirstmast + f_injectmast + f_nsaidsmast
+ f_treatfoot + f_abcalve + f_nsaidscalve + f_calveclean + f_milkgraze
+ f_lime + f_predip + f_acf + f_cleancluster + f_drytrough + f_premises
+ f_shows + f_market + f_hostfarmwalk + f_starling + f_deer + f_badger
+ f_rook + f_pigeon + f_fox + f_pheasant + f_rat + f_shoot + f_hunt + f_outsource
+ f_feedlorry + f_muckspreader + f_aiexternal + f_machinery + f_bedmilk_1
+ f_bedmilk_2 + f_bedmilk_3 + f_bedmilk_4 + f_bedmilk_6 + f_bedmilk_8
+ f_foragetype_1 + f_foragetype_2 + f_foragetype_3 + f_foragetype_4
+ f_foragetype_5 + f_foragetype_6 + f_foragetype_7 + f_foragetype_8
+ f_manure_1 + f_manure_2 + f_manure_3 + f_manure_4 + f_manure_5
+ f_manure_6 + f_manure_7 + f_manure_8 + f_manure_9
+ s_housed_outdoor + f_cefq_dct + f_ceph_dct + f_fram_dct + f_clox_dct + s_calving_now
+ f_water + preweaned_heifer
## Data: df (Number of observations: 4145)
## Samples: 4 chains, each with iter = 10000; warmup = 1000; thin = 2;
## total post-warmup samples = 18000
##
## Group-Level Effects:
## ~farm (Number of levels: 53)
## Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS Tail_ESS
## sd(rand_Intercept) 0.20 0.15 0.01 0.55 1.00 7391
## sd(rand_Intercept) 11365
##
## Population-Level Effects:
## Estimate Est.Error l-95% CI
## main_Intercept 0.96 0.89 -0.76
## main_total_mg_pcu 0.38 0.19 0.01
## main_tet -0.00 0.15 -0.30
## main_fq -0.00 0.19 -0.40
## main_amox -0.19 0.16 -0.50
## main_cefalexin 0.05 0.17 -0.29
## main_strep -0.27 0.12 -0.51
## reg_weaned_heifer0 -0.23 0.27 -0.81
## reg_weaned_heifer1 0.23 0.28 -0.13
## reg_adult1 0.01 0.11 -0.23
## reg_dry1 -0.30 0.27 -0.86
## reg_footpath1 0.14 0.21 -0.10
## reg_f_anything_waste1 -0.05 0.13 -0.41
## reg_f_heifers_waste1 -0.01 0.12 -0.31
## reg_f_whichclinrespMacrolide 0.02 0.11 -0.19
## reg_f_whichclinrespOtherDdontknow 0.03 0.23 -0.34
## reg_f_whichclinrespPenicillimoxycillin -0.08 0.31 -1.04
## reg_f_whichclinrespTetracycline 0.03 0.13 -0.18
## reg_f_firstmastitisCobactan -0.06 0.24 -0.75
## reg_f_firstmastitisMastiplanLC -0.08 0.30 -0.99
## reg_f_firstmastitisOrbeninLA -0.03 0.24 -0.65
## reg_f_firstmastitistdDmultiject 0.11 0.19 -0.11
## reg_f_firstmastitisUbroYellow 0.04 0.14 -0.18
## reg_f_firstmastitisUbrolexin -0.09 0.23 -0.79
## reg_f_poultry1 0.04 0.13 -0.16
## reg_f_equine1 0.09 0.17 -0.11

```

## reg_f_total_cattle	0.03	0.09	-0.12
## reg_f_yield	0.16	0.17	-0.05
## reg_f_herd_size	0.03	0.09	-0.12
## reg_f_bought_pre	-0.05	0.09	-0.27
## reg_f_scc	-0.02	0.06	-0.17
## reg_f_pneum_vacc1	0.04	0.13	-0.17
## reg_f_diarrvaccY	0.01	0.11	-0.22
## reg_f_anticocc1	0.04	0.14	-0.17
## reg_f_halocur1	-0.01	0.11	-0.26
## reg_f_nsaiddiarr1	0.01	0.11	-0.20
## reg_f_trough_clean.L	0.02	0.09	-0.15
## reg_f_time_dam.L	0.04	0.13	-0.17
## reg_f_um_spray1	-0.02	0.13	-0.37
## reg_f_give_col1	0.06	0.15	-0.16
## reg_f_wean2	-0.03	0.15	-0.43
## reg_f_wean3	-0.05	0.13	-0.42
## reg_f_geographical_area2	0.13	0.21	-0.10
## reg_f_geographical_area3	-0.00	0.12	-0.28
## reg_f_pattern2	-0.06	0.16	-0.53
## reg_s_rain	0.23	0.08	0.08
## reg_f_percentdryoff	0.07	0.09	-0.05
## reg_f_calving_group1	0.02	0.15	-0.24
## reg_f_calf_housing_type2	0.12	0.20	-0.11
## reg_f_calf_housing_type3	-0.18	0.25	-0.84
## reg_f_calf_housing_older1	-0.31	0.30	-0.97
## reg_f_hectares	0.06	0.09	-0.07
## reg_f_othergrazeY	-0.02	0.11	-0.31
## reg_f_bvdvaccY	0.01	0.12	-0.24
## reg_f_ibrvaccY	0.04	0.13	-0.16
## reg_f_leptovaccY	-0.03	0.13	-0.36
## reg_f_salmvaccY	0.08	0.27	-0.25
## reg_f_lungvaccY	-0.01	0.11	-0.27
## reg_f_clostvaccY	0.11	0.21	-0.13
## reg_f_organic1	-0.02	0.19	-0.49
## reg_f_daystreatmast	0.01	0.07	-0.13
## reg_f_timesfirstmast	0.02	0.07	-0.12
## reg_f_injectmast	0.05	0.10	-0.11
## reg_f_nsaidmast	0.01	0.07	-0.13
## reg_f_treatfoot1	0.07	0.15	-0.12
## reg_f_abcalve1	0.03	0.15	-0.23
## reg_f_nsaidcalve1	-0.03	0.11	-0.34
## reg_f_calveclean.L	0.03	0.11	-0.15
## reg_f_milkgraze1	0.00	0.14	-0.29
## reg_f_lime1	0.16	0.23	-0.08
## reg_f_predip1	0.04	0.11	-0.15
## reg_f_acf1	-0.01	0.11	-0.28
## reg_f_cleancluster.L	-0.04	0.10	-0.30
## reg_f_drytrough.L	0.01	0.08	-0.17
## reg_f_premises2	0.00	0.11	-0.24
## reg_f_shows1	0.10	0.23	-0.17
## reg_f_market1	0.03	0.12	-0.17
## reg_f_hostfarmwalk1	0.03	0.12	-0.17
## reg_f_starling2	0.00	0.11	-0.23
## reg_f_deer2	0.02	0.12	-0.21

## reg_f_badger2	0.04	0.16	-0.22	
## reg_f_rook2	0.03	0.12	-0.16	
## reg_f_pigeon2	-0.02	0.10	-0.30	
## reg_f_fox2	-0.02	0.11	-0.30	
## reg_f_pheasant2	-0.01	0.13	-0.33	
## reg_f_rat2	0.01	0.11	-0.20	
## reg_f_shoot2	-0.04	0.12	-0.38	
## reg_f_hunt2	0.06	0.15	-0.13	
## reg_f_outsource1	-0.00	0.15	-0.33	
## reg_f_feedlorry1	-0.03	0.12	-0.34	
## reg_f_muckspreader1	0.04	0.13	-0.18	
## reg_f_muckspreader3	-0.04	0.25	-0.69	
## reg_f_aiexternal1	0.00	0.11	-0.23	
## reg_f_machinery1	0.05	0.13	-0.15	
## reg_f_bedmilk_1yes	-0.03	0.13	-0.37	
## reg_f_bedmilk_2yes	0.09	0.18	-0.12	
## reg_f_bedmilk_3yes	-0.00	0.11	-0.25	
## reg_f_bedmilk_4yes	0.00	0.20	-0.41	
## reg_f_bedmilk_6yes	-0.03	0.21	-0.55	
## reg_f_bedmilk_8yes	-0.09	0.32	-1.10	
## reg_f_foragetype_1yes	0.01	0.16	-0.32	
## reg_f_foragetype_2yes	-0.41	0.47	-1.50	
## reg_f_foragetype_3yes	0.77	0.44	-0.02	
## reg_f_foragetype_4yes	0.05	0.12	-0.13	
## reg_f_foragetype_5yes	0.07	0.16	-0.13	
## reg_f_foragetype_6yes	0.00	0.17	-0.36	
## reg_f_foragetype_7yes	-0.08	0.18	-0.59	
## reg_f_foragetype_8yes	-0.06	0.25	-0.76	
## reg_f_manure_1yes	0.01	0.11	-0.22	
## reg_f_manure_2yes	-0.02	0.14	-0.37	
## reg_f_manure_3yes	-0.01	0.12	-0.31	
## reg_f_manure_4yes	-0.08	0.15	-0.48	
## reg_f_manure_5yes	-0.03	0.13	-0.37	
## reg_f_manure_6yes	0.03	0.12	-0.17	
## reg_f_manure_7yes	0.17	0.38	-0.19	
## reg_f_manure_8yes	0.03	0.17	-0.23	
## reg_f_manure_9yes	0.04	0.21	-0.30	
## reg_s_housed_outdooroutdoor	-1.44	0.22	-1.91	
## reg_f_cefq_dct1	0.06	0.17	-0.16	
## reg_f_ceph_dct1	-0.07	0.15	-0.49	
## reg_f_fram_dct1	0.02	0.12	-0.21	
## reg_f_clox_dct1	-0.02	0.12	-0.34	
## reg_s_calving_now1	0.70	0.27	0.10	
## reg_f_water1	0.06	0.16	-0.14	
## reg_preweaned_heifer1	1.22	0.27	0.69	
## main_mes_temp0.61	0.68	0.13	0.44	
##	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
## main_Intercept	2.78	1.00	8747	11650
## main_total_mg_pcu	0.75	1.00	10614	13883
## main_tet	0.29	1.00	12258	14608
## main_fq	0.35	1.00	7406	11706
## main_amox	0.14	1.00	10185	13592
## main_cefalexin	0.38	1.00	9216	12232
## main_strep	-0.03	1.00	10500	13827

## reg_weaned_heifer0	0.14	1.00	9264	15443
## reg_weaned_heifer1	0.82	1.00	9271	15628
## reg_adult1	0.27	1.00	14327	15005
## reg_dry1	0.05	1.00	11391	14558
## reg_footpath1	0.70	1.00	12742	15718
## reg_f_anything_waste1	0.15	1.00	14253	14524
## reg_f_heifers_waste1	0.22	1.00	15405	15104
## reg_f_whichclinrespMacrolide	0.30	1.00	15695	17025
## reg_f_whichclinrespOtherDdontknow	0.60	1.00	15608	14888
## reg_f_whichclinrespPenicillimoxycillin	0.27	1.00	13993	13316
## reg_f_whichclinrespTetracycline	0.40	1.00	14733	15606
## reg_f_firstmastitisCobactan	0.26	1.00	15161	14416
## reg_f_firstmastitisMastiplanLC	0.29	1.00	13831	12661
## reg_f_firstmastitisOrbeninLA	0.36	1.00	16610	15880
## reg_f_firstmastitistdDmultiject	0.62	1.00	12480	13953
## reg_f_firstmastitisUbroYellow	0.41	1.00	15274	15986
## reg_f_firstmastitisUbrolexin	0.18	1.00	12693	12724
## reg_f_poultry1	0.41	1.00	14158	13340
## reg_f_equine1	0.55	1.00	11860	15258
## reg_f_total_cattle	0.25	1.00	15110	15655
## reg_f_yield	0.56	1.00	6661	10123
## reg_f_herd_size	0.26	1.00	15711	16010
## reg_f_bought_pre	0.08	1.00	13787	15887
## reg_f_scc	0.10	1.00	15289	17441
## reg_f_pneum_vacc1	0.37	1.00	14927	16183
## reg_f_diarrvaccY	0.25	1.00	15641	16065
## reg_f_anticocc1	0.41	1.00	14815	15452
## reg_f_halocur1	0.21	1.00	15180	16129
## reg_f_nsaidiarr1	0.29	1.00	15659	16107
## reg_f_trough_clean.L	0.23	1.00	15033	15863
## reg_f_time_dam.L	0.38	1.00	11822	13812
## reg_f_um_spray1	0.23	1.00	14539	14287
## reg_f_give_coll	0.48	1.00	14122	14537
## reg_f_wean2	0.21	1.00	14321	13988
## reg_f_wean3	0.14	1.00	13670	15030
## reg_f_geographical_area2	0.72	1.00	10919	14109
## reg_f_geographical_area3	0.26	1.00	14951	15568
## reg_f_pattern2	0.17	1.00	14114	14808
## reg_s_rain	0.38	1.00	15814	15950
## reg_f_percentdryoff	0.29	1.00	12694	16619
## reg_f_calving_group1	0.42	1.00	15668	15472
## reg_f_calf_housing_type2	0.66	1.00	11278	14161
## reg_f_calf_housing_type3	0.09	1.00	9940	14570
## reg_f_calf_housing_older1	0.06	1.00	8885	14454
## reg_f_hectares	0.29	1.00	13292	15903
## reg_f_othergrazeY	0.19	1.00	14860	14864
## reg_f_bvdvaccY	0.29	1.00	14430	14865
## reg_f_ibrvaccY	0.40	1.00	14453	14679
## reg_f_leptovaccY	0.20	1.00	14392	15565
## reg_f_salmvaccY	0.90	1.00	13343	13404
## reg_f_lungvaccY	0.21	1.00	14784	16192
## reg_f_clostvaccY	0.72	1.00	12841	14134
## reg_f_organic1	0.32	1.00	15254	14692
## reg_f_daystreatmast	0.19	1.00	15927	17130

## reg_f_timesfirstmast	0.20	1.00	13185	14381
## reg_f_injectmast	0.32	1.00	14245	15401
## reg_f_nsaidmast	0.18	1.00	15115	16324
## reg_f_treatfoot1	0.50	1.00	12994	14817
## reg_f_abcalve1	0.43	1.00	15274	15289
## reg_f_nsaidcalve1	0.15	1.00	14736	15886
## reg_f_calveclean.L	0.31	1.00	14507	14816
## reg_f_milkgraze1	0.32	1.00	15278	14803
## reg_f_lime1	0.76	1.00	10083	13374
## reg_f_predip1	0.35	1.00	13977	16083
## reg_f_acf1	0.20	1.00	15943	15221
## reg_f_cleancluster.L	0.11	1.00	14236	16687
## reg_f_drytrough.L	0.20	1.00	16096	16774
## reg_f_premises2	0.26	1.00	15374	15881
## reg_f_shows1	0.80	1.00	12737	15056
## reg_f_market1	0.36	1.00	15045	15477
## reg_f_hostfarmwalk1	0.37	1.00	14950	15283
## reg_f_starling2	0.26	1.00	15973	16685
## reg_f_deer2	0.31	1.00	15328	16451
## reg_f_badger2	0.46	1.00	14121	14492
## reg_f_rook2	0.37	1.00	15999	16285
## reg_f_pigeon2	0.16	1.00	15925	16057
## reg_f_fox2	0.19	1.00	15540	16240
## reg_f_pheasant2	0.25	1.00	15030	15909
## reg_f_rat2	0.26	1.00	15951	16409
## reg_f_shoot2	0.16	1.00	14432	15899
## reg_f_hunt2	0.48	1.00	14078	15249
## reg_f_outsource1	0.33	1.00	15348	15865
## reg_f_feedlorry1	0.17	1.00	14618	15909
## reg_f_muckspreader1	0.40	1.00	13910	16215
## reg_f_muckspreader3	0.33	1.00	14898	15744
## reg_f_aiexternal1	0.25	1.00	14070	14577
## reg_f_machinery1	0.41	1.00	14689	14770
## reg_f_bedmilk_1yes	0.20	1.00	14768	15479
## reg_f_bedmilk_2yes	0.60	1.00	13080	14046
## reg_f_bedmilk_3yes	0.24	1.00	15735	16463
## reg_f_bedmilk_4yes	0.44	1.00	15502	15669
## reg_f_bedmilk_6yes	0.33	1.00	13869	14896
## reg_f_bedmilk_8yes	0.25	1.00	14348	13233
## reg_f_foragetype_1yes	0.36	1.00	15227	15558
## reg_f_foragetype_2yes	0.08	1.00	7281	12210
## reg_f_foragetype_3yes	1.51	1.00	5981	6738
## reg_f_foragetype_4yes	0.37	1.00	14646	15879
## reg_f_foragetype_5yes	0.51	1.00	14249	16154
## reg_f_foragetype_6yes	0.38	1.00	15372	15831
## reg_f_foragetype_7yes	0.13	1.00	13815	15252
## reg_f_foragetype_8yes	0.28	1.00	14946	15285
## reg_f_manure_1yes	0.28	1.00	14784	15325
## reg_f_manure_2yes	0.23	1.00	15789	15647
## reg_f_manure_3yes	0.22	1.00	15749	15214
## reg_f_manure_4yes	0.11	1.00	12735	14662
## reg_f_manure_5yes	0.18	1.00	14830	16246
## reg_f_manure_6yes	0.36	1.00	14070	13354
## reg_f_manure_7yes	1.35	1.00	11104	12883

```

## reg_f_manure_8yes          0.47 1.00    15453    14552
## reg_f_manure_9yes          0.59 1.00    15096    14725
## reg_s_housed_outdoor        -1.06 1.00    14835    16854
## reg_f_cefq_dct1            0.54 1.00    13995    15171
## reg_f_ceph_dct1            0.13 1.00    12552    12593
## reg_f_fram_dct1            0.33 1.00    15485    15537
## reg_f_clox_dct1            0.21 1.00    15132    15575
## reg_s_calving_now1         1.19 1.00    11732    10019
## reg_f_water1                0.51 1.00    12814    14114
## reg_preweaned_heifer1      1.76 1.00    16375    17001
## main_mes_temp0.61          0.93 1.00    11845    14453
##
## Samples were drawn using sampling(NUTS). For each
parameter, Eff.Sample
## is a crude measure of effective sample size, and Rhat is the
potential
## scale reduction factor on split chains (at convergence, Rhat = 1).

```

Strep

```

## Family: bernoulli
## Links: mu = identity
## Formula: strepR ~ (sens + spec - 1)/(1 + exp(-eta)) + (1 - spec)
##          eta ~ main + reg + rand
##          main ~ total_mg_pcu + tet + fq + amox + cefalexin + strep +
me(s_temp, 0.61)
##          rand ~ 0 + (1 | farm)
##          reg ~ 0 + weaned_heifer + adult + dry + footpath
+ f_anything_waste + f_heifers_waste + f_whichclinresp + f_firstmastitis +
f_poultry + f_equine + f_total_cattle + f_yield + f_herd_size + f_bought_
pre + f_scc + f_pneum_vacc + f_diarrvacc + f_anticocc + f_halocur + f_nsai
ddiarr + f_trough_clean + f_time_dam + f_um_spray + f_give_col + f_wean +
f_geographical_area + f_pattern + s_rain + f_percentdryoff + f_calving_gro
up + f_calf_housing_type + f_calf_housing_older + f_hectares + f_othergraz
e + f_bvdvacc + f_ibrvacc + f_leptovacc + f_salmvacc + f_lungvacc + f_clos
tvacc + f_organic + f_daystreatmast + f_timesfirstmast + f_injectmast + f_
nsaidmast + f_treatfoot + f_abcalve + f_nsaidcalve + f_calveclean + f_milk
graze + f_lime + f_predip + f_acf + f_cleancluster + f_drytrough + f_premi
ses + f_shows + f_market + f_hostfarmwalk + f_starling + f_deer + f_badger
+ f_rook + f_pigeon + f_fox + f_pheasant + f_rat + f_shoot + f_hunt + f_o
utsource + f_feedlorry + f_muckspreader + f_aiexternal + f_machinery +
f_bedmilk_1 + f_bedmilk_2 + f_bedmilk_3 + f_bedmilk_4 + f_bedmilk_6 +
f_bedmilk_8 + f_foragetype_1 + f_foragetype_2 + f_foragetype_3 +
f_foragetype_4 + f_foragetype_5 + f_foragetype_6 + f_foragetype_7 +
f_foragetype_8 + f_manure_1 + f_manure_2 + f_manure_3 + f_manure_4 +
f_manure_5 + f_manure_6 + f_manure_7 + f_manure_8 + f_manure_9
+ s_housed_outdoor + f_cefq_dct + f_ceph_dct + f_fram_dct + f_clox_dct + s
_calving_now + f_water + preweaned_heifer
## Data: df (Number of observations: 4145)
## Samples: 4 chains, each with iter = 10000; warmup = 1000; thin = 2;
##          total post-warmup samples = 18000
##
## Group-Level Effects:
## ~farm (Number of levels: 53)

```

```

##          Estimate Est.Error l-95% CI u-95% CI Rhat Bulk_ESS
## sd(rand_Intercept)    0.36    0.11    0.10    0.57 1.00    4062
##          Tail_ESS
## sd(rand_Intercept)    4444
##
## Population-Level Effects:
##
##          Estimate Est.Error l-95% CI
## main_Intercept      -0.81    0.52   -1.97
## main_total_mg_pcu    0.12    0.14   -0.15
## main_tet             0.09    0.10   -0.11
## main_fq              0.00    0.11   -0.21
## main_amox            0.03    0.11   -0.17
## main_cefalexin      -0.10    0.09   -0.28
## main_strep           0.01    0.10   -0.18
## reg_weaned_heifer0  -0.01    0.06   -0.16
## reg_weaned_heifer1  0.01    0.06   -0.10
## reg_adult1          -0.05    0.09   -0.31
## reg_dry1            0.14    0.18   -0.03
## reg_footpath1      -0.57    0.34   -1.11
## reg_f_anything_waste1 -0.00    0.06   -0.15
## reg_f_heifers_waste1 0.03    0.09   -0.08
## reg_f_whichclinrespMacrolide -0.02    0.07   -0.20
## reg_f_whichclinrespOtherDdontknow -0.01    0.13   -0.27
## reg_f_whichclinrespPenicillimoxycillin -0.05    0.23   -0.75
## reg_f_whichclinrespTetracycline -0.03    0.10   -0.33
## reg_f_firstmastitisCobactan -0.01    0.11   -0.25
## reg_f_firstmastitisMastiplanLC -0.05    0.22   -0.73
## reg_f_firstmastitisOrbeninLA 0.01    0.13   -0.22
## reg_f_firstmastitistdDmultiject 0.04    0.11   -0.07
## reg_f_firstmastitisUbroYellow 0.00    0.07   -0.14
## reg_f_firstmastitisUbrolexin -0.10    0.23   -0.81
## reg_f_poultry1      0.01    0.07   -0.12
## reg_f_equine1       -0.02    0.07   -0.21
## reg_f_total_cattle  0.04    0.07   -0.05
## reg_f_yield          0.01    0.05   -0.08
## reg_f_herd_size      0.02    0.06   -0.06
## reg_f_bought_pre     0.01    0.04   -0.07
## reg_f_scc           -0.02    0.05   -0.16
## reg_f_pneum_vacc1   0.13    0.20   -0.05
## reg_f_diarrvaccY    0.01    0.06   -0.11
## reg_f_anticoccc1    0.01    0.07   -0.12
## reg_f_halocur1     -0.06    0.12   -0.41
## reg_f_nsaidiarr1    0.01    0.06   -0.11
## reg_f_trough_clean.L 0.02    0.06   -0.07
## reg_f_time_dam.L    0.03    0.08   -0.07
## reg_f_um_spray1     0.01    0.08   -0.12
## reg_f_give_coll     0.01    0.07   -0.11
## reg_f_wean2        -0.10    0.19   -0.65
## reg_f_wean3        -0.01    0.06   -0.17
## reg_f_geographical_area2 -0.03    0.09   -0.31
## reg_f_geographical_area3 0.01    0.07   -0.10
## reg_f_pattern2     -0.01    0.08   -0.21
## reg_s_rain          0.01    0.03   -0.04
## reg_f_percentdryoff 0.01    0.04   -0.06

```

## reg_f_calving_group1	0.02	0.09	-0.12
## reg_f_calf_housing_type2	-0.02	0.07	-0.24
## reg_f_calf_housing_type3	-0.00	0.06	-0.15
## reg_f_calf_housing_older1	0.00	0.06	-0.13
## reg_f_hectares	0.00	0.04	-0.07
## reg_f_othergrazeY	-0.02	0.08	-0.24
## reg_f_bvdvaccY	0.03	0.09	-0.07
## reg_f_ibrvaccY	0.01	0.06	-0.10
## reg_f_leptovaccY	0.03	0.09	-0.09
## reg_f_salmvaccY	0.01	0.11	-0.16
## reg_f_lungvaccY	0.01	0.06	-0.10
## reg_f_clostvaccY	0.02	0.08	-0.10
## reg_f_organic1	-0.04	0.16	-0.54
## reg_f_daystreatmast	0.01	0.05	-0.06
## reg_f_timesfirstmast	-0.00	0.04	-0.09
## reg_f_injectmast	-0.01	0.05	-0.14
## reg_f_nsaidmast	-0.05	0.08	-0.26
## reg_f_treatfoot1	0.01	0.06	-0.11
## reg_f_abcalve1	-0.12	0.22	-0.74
## reg_f_nsaidcalve1	0.01	0.06	-0.11
## reg_f_calveclean.L	0.02	0.07	-0.07
## reg_f_milkgraze1	0.04	0.12	-0.09
## reg_f_lime1	0.00	0.06	-0.12
## reg_f_predip1	0.01	0.06	-0.09
## reg_f_acf1	-0.02	0.09	-0.28
## reg_f_cleancluster.L	-0.08	0.11	-0.37
## reg_f_drytrough.L	-0.01	0.05	-0.14
## reg_f_premises2	-0.01	0.07	-0.18
## reg_f_shows1	0.06	0.16	-0.09
## reg_f_market1	0.00	0.06	-0.14
## reg_f_hostfarmwalk1	0.00	0.06	-0.13
## reg_f_starling2	0.02	0.07	-0.09
## reg_f_deer2	0.01	0.07	-0.11
## reg_f_badger2	-0.01	0.08	-0.21
## reg_f_rook2	0.03	0.09	-0.08
## reg_f_pigeon2	0.01	0.06	-0.10
## reg_f_fox2	-0.00	0.06	-0.13
## reg_f_pheasant2	0.06	0.15	-0.08
## reg_f_rat2	0.01	0.06	-0.11
## reg_f_shoot2	0.01	0.07	-0.13
## reg_f_hunt2	0.00	0.06	-0.12
## reg_f_outsource1	-0.00	0.08	-0.18
## reg_f_feedlorry1	-0.01	0.07	-0.19
## reg_f_muckspreader1	0.01	0.06	-0.12
## reg_f_muckspreader3	-0.03	0.15	-0.43
## reg_f_aiexternal1	0.02	0.08	-0.08
## reg_f_machinery1	0.01	0.07	-0.10
## reg_f_bedmilk_1yes	-0.01	0.07	-0.19
## reg_f_bedmilk_2yes	0.01	0.07	-0.12
## reg_f_bedmilk_3yes	-0.00	0.06	-0.14
## reg_f_bedmilk_4yes	0.07	0.25	-0.12
## reg_f_bedmilk_6yes	-0.00	0.12	-0.23
## reg_f_bedmilk_8yes	-0.01	0.14	-0.30
## reg_f_foragetype_1yes	0.02	0.11	-0.13

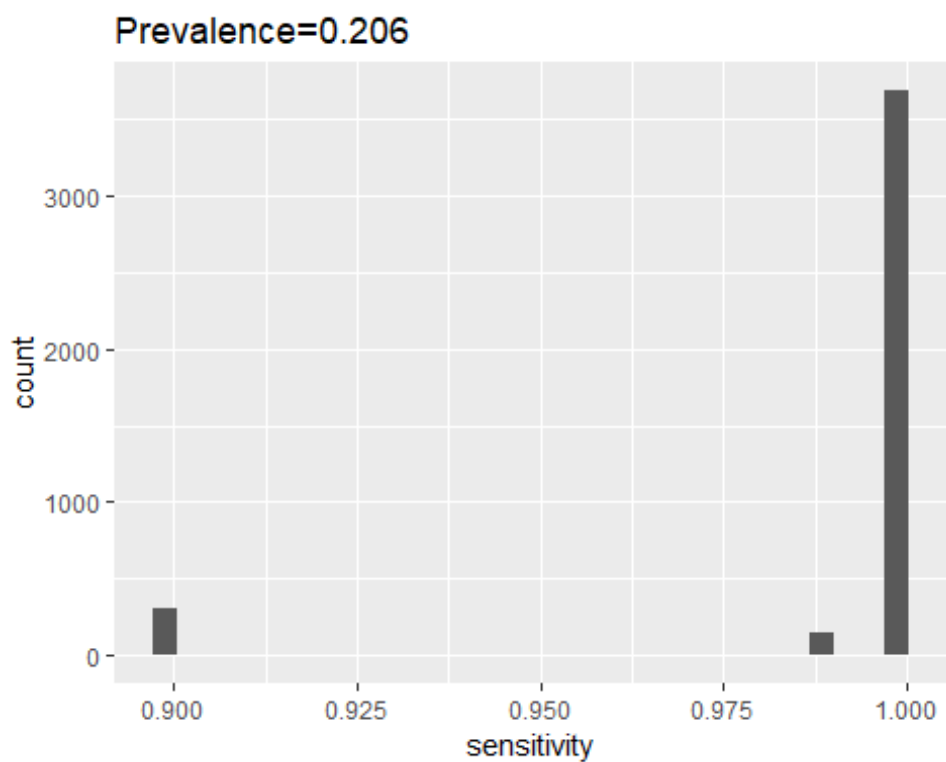
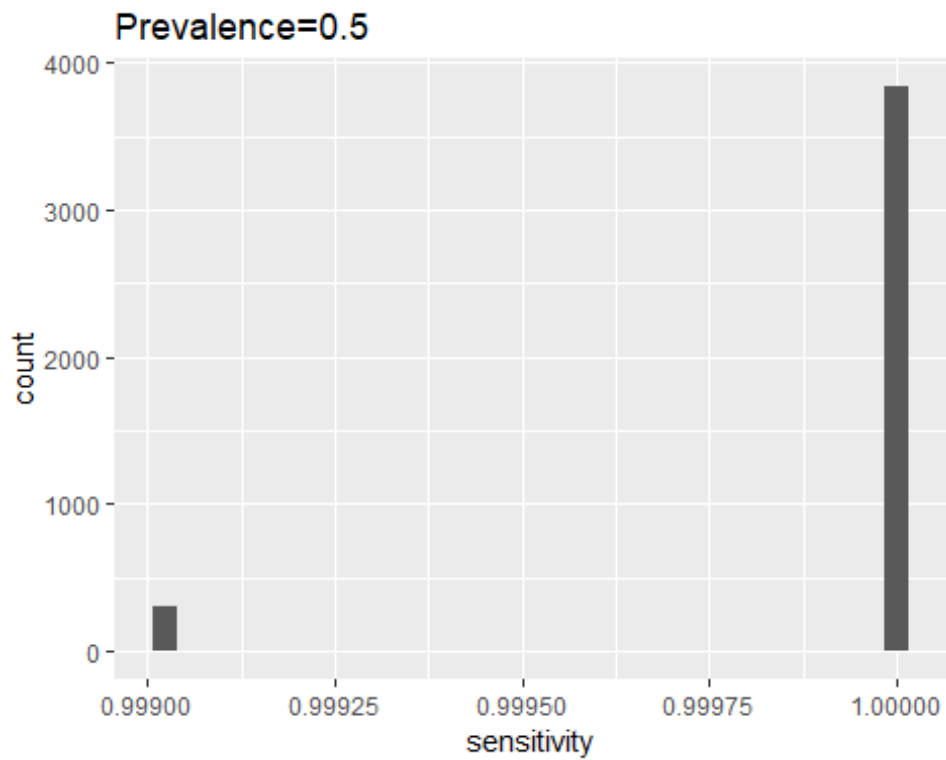
## reg_f_foragetype_2yes	-0.04	0.12	-0.40	
## reg_f_foragetype_3yes	0.13	0.22	-0.05	
## reg_f_foragetype_4yes	-0.01	0.06	-0.19	
## reg_f_foragetype_5yes	0.07	0.14	-0.06	
## reg_f_foragetype_6yes	0.03	0.11	-0.12	
## reg_f_foragetype_7yes	0.01	0.07	-0.12	
## reg_f_foragetype_8yes	-0.03	0.18	-0.51	
## reg_f_manure_1yes	-0.01	0.07	-0.20	
## reg_f_manure_2yes	0.01	0.07	-0.13	
## reg_f_manure_3yes	0.04	0.11	-0.08	
## reg_f_manure_4yes	0.01	0.06	-0.09	
## reg_f_manure_5yes	-0.00	0.06	-0.15	
## reg_f_manure_6yes	0.01	0.07	-0.10	
## reg_f_manure_7yes	0.00	0.10	-0.18	
## reg_f_manure_8yes	0.01	0.08	-0.15	
## reg_f_manure_9yes	0.01	0.10	-0.18	
## reg_s_housed_outdooroutdoor	-0.28	0.27	-0.83	
## reg_f_cefq_dct1	-0.03	0.10	-0.33	
## reg_f_ceph_dct1	0.04	0.10	-0.07	
## reg_f_fram_dct1	-0.02	0.08	-0.27	
## reg_f_clox_dct1	-0.00	0.07	-0.16	
## reg_s_calving_now1	0.24	0.22	-0.02	
## reg_f_water1	-0.00	0.07	-0.16	
## reg_preweaned_heifer1	0.67	0.14	0.38	
## main_mes_temp0.61	0.42	0.07	0.28	
##	u-95% CI	Rhat	Bulk_ESS	Tail_ESS
## main_Intercept	0.06	1.00	7321	10751
## main_total_mg_pcu	0.40	1.00	12573	14821
## main_tet	0.30	1.00	12164	15701
## main_fq	0.22	1.00	12469	14767
## main_amox	0.25	1.00	12813	15318
## main_cefalexin	0.09	1.00	12798	14383
## main_strep	0.20	1.00	12870	15466
## reg_weaned_heifer0	0.10	1.00	14253	15333
## reg_weaned_heifer1	0.16	1.00	13769	15464
## reg_adult1	0.04	1.00	13998	15646
## reg_dry1	0.58	1.00	12528	16309
## reg_footpath1	0.01	1.00	8582	9831
## reg_f_anything_waste1	0.12	1.00	15377	15590
## reg_f_heifers_waste1	0.31	1.00	12356	12552
## reg_f_whichclinrespMacrolide	0.09	1.00	13899	15873
## reg_f_whichclinrespOtherDdontknow	0.20	1.00	14639	15592
## reg_f_whichclinrespPenicillimoxycillin	0.15	1.00	13090	13395
## reg_f_whichclinrespTetracycline	0.08	1.00	14297	14621
## reg_f_firstmastitisCobactan	0.18	1.00	14228	15707
## reg_f_firstmastitisMastiplanLC	0.14	1.00	13845	13010
## reg_f_firstmastitisOrbeninLA	0.26	1.00	14861	15672
## reg_f_firstmastitistdDmultiject	0.36	1.00	13839	14471
## reg_f_firstmastitisUbroYellow	0.16	1.00	13766	15633
## reg_f_firstmastitisUbrolexin	0.09	1.00	11638	12641
## reg_f_poultry1	0.16	1.00	13547	15466
## reg_f_equine1	0.09	1.00	13516	14792
## reg_f_total_cattle	0.23	1.00	13370	15177
## reg_f_yield	0.13	1.00	14825	15382

## reg_f_herd_size	0.18	1.00	15194	16039
## reg_f_bought_pre	0.12	1.00	15979	16427
## reg_f_scc	0.05	1.00	15057	16080
## reg_f_pneum_vacc1	0.65	1.00	7413	12394
## reg_f_diarrvaccY	0.17	1.00	14523	16212
## reg_f_anticocc1	0.18	1.00	14644	15233
## reg_f_halocur1	0.06	1.00	11606	13084
## reg_f_nsaiddiarr1	0.17	1.00	15150	16283
## reg_f_trough_clean.L	0.18	1.00	14300	15696
## reg_f_time_dam.L	0.29	1.00	10431	10373
## reg_f_um_spray1	0.21	1.00	14988	15623
## reg_f_give_coll	0.17	1.00	14462	15068
## reg_f_wean2	0.06	1.00	11334	13836
## reg_f_wean3	0.11	1.00	14838	15563
## reg_f_geographical_area2	0.07	1.00	14255	14913
## reg_f_geographical_area3	0.19	1.00	14948	15018
## reg_f_pattern2	0.12	1.00	14065	12754
## reg_s_rain	0.08	1.00	15615	16450
## reg_f_percentdryoff	0.13	1.00	14862	16756
## reg_f_calving_group1	0.25	1.00	15404	15050
## reg_f_calf_housing_type2	0.08	1.00	14807	16063
## reg_f_calf_housing_type3	0.13	1.00	15690	16652
## reg_f_calf_housing_older1	0.14	1.00	14825	15535
## reg_f_hectares	0.10	1.00	14370	15877
## reg_f_othergrazeY	0.09	1.00	14462	15400
## reg_f_bvdvaccY	0.30	1.00	13807	14099
## reg_f_ibrvaccY	0.17	1.00	14892	16020
## reg_f_leptovaccY	0.32	1.00	12056	12766
## reg_f_salmvaccY	0.27	1.00	14364	14766
## reg_f_lungvaccY	0.18	1.00	13585	14958
## reg_f_clostvaccY	0.24	1.00	15218	14779
## reg_f_organic1	0.12	1.00	13284	12889
## reg_f_daystreatmast	0.14	1.00	14479	16013
## reg_f_timesfirstmast	0.08	1.00	15304	16253
## reg_f_injectmast	0.09	1.00	14611	15908
## reg_f_nsaidmast	0.03	1.00	13198	15185
## reg_f_treatfoot1	0.16	1.00	13671	14945
## reg_f_abcalve1	0.07	1.00	10842	14542
## reg_f_nsaidcalve1	0.16	1.00	14347	15788
## reg_f_calveclean.L	0.24	1.00	14793	15151
## reg_f_milkgraze1	0.41	1.00	12489	12254
## reg_f_lime1	0.14	1.00	15758	16445
## reg_f_predip1	0.17	1.00	15007	15367
## reg_f_acf1	0.09	1.00	14487	14926
## reg_f_cleancluster.L	0.04	1.00	11413	15158
## reg_f_drytrough.L	0.09	1.00	14546	15107
## reg_f_premises2	0.11	1.00	14295	15208
## reg_f_shows1	0.58	1.00	14011	13381
## reg_f_market1	0.14	1.00	15691	16332
## reg_f_hostfarmwalk1	0.16	1.00	14381	16334
## reg_f_starling2	0.21	1.00	14770	14988
## reg_f_deer2	0.20	1.00	14417	15780
## reg_f_badger2	0.13	1.00	13919	15385
## reg_f_rook2	0.28	1.00	13904	15973

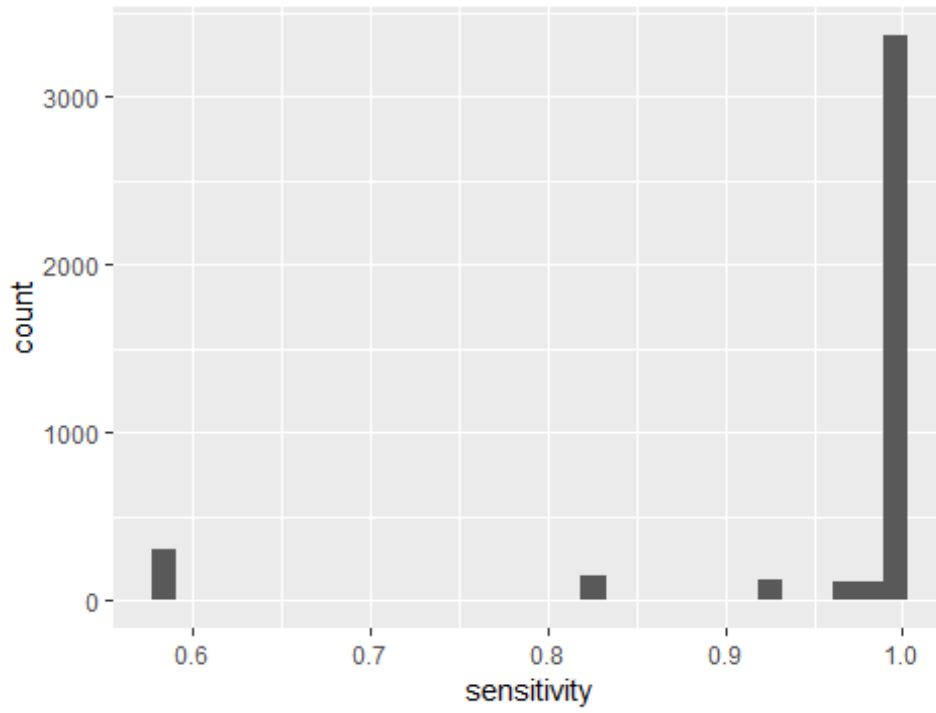
## reg_f_pigeon2	0.18	1.00	14645	16368
## reg_f_fox2	0.13	1.00	15014	15272
## reg_f_pheasant2	0.53	1.00	12052	12762
## reg_f_rat2	0.16	1.00	14106	16231
## reg_f_shoot2	0.17	1.00	14419	16147
## reg_f_hunt2	0.14	1.00	14760	16104
## reg_f_outsource1	0.16	1.00	14808	16126
## reg_f_feedlorry1	0.10	1.00	14972	15800
## reg_f_muckspreader1	0.16	1.00	15360	15778
## reg_f_muckspreader3	0.15	1.00	13839	14825
## reg_f_aiexternal1	0.24	1.00	14465	15744
## reg_f_machinery1	0.20	1.00	14707	15525
## reg_f_bedmilk_1yes	0.11	1.00	14115	15586
## reg_f_bedmilk_2yes	0.17	1.00	14930	15563
## reg_f_bedmilk_3yes	0.11	1.00	15163	16568
## reg_f_bedmilk_4yes	0.92	1.00	12641	11406
## reg_f_bedmilk_6yes	0.23	1.00	14255	15385
## reg_f_bedmilk_8yes	0.19	1.00	14108	14970
## reg_f_foragetype_1yes	0.32	1.00	14294	15244
## reg_f_foragetype_2yes	0.09	1.00	13982	13409
## reg_f_foragetype_3yes	0.73	1.00	6926	8987
## reg_f_foragetype_4yes	0.08	1.00	14610	15380
## reg_f_foragetype_5yes	0.50	1.00	12153	14166
## reg_f_foragetype_6yes	0.36	1.00	14443	13947
## reg_f_foragetype_7yes	0.17	1.00	14601	14993
## reg_f_foragetype_8yes	0.15	1.00	13591	14346
## reg_f_manure_1yes	0.10	1.00	13613	13246
## reg_f_manure_2yes	0.19	1.00	13820	15694
## reg_f_manure_3yes	0.36	1.00	12336	12951
## reg_f_manure_4yes	0.18	1.00	15112	15585
## reg_f_manure_5yes	0.12	1.00	14838	16288
## reg_f_manure_6yes	0.20	1.00	13869	14869
## reg_f_manure_7yes	0.22	1.00	13605	15142
## reg_f_manure_8yes	0.20	1.00	14965	15620
## reg_f_manure_9yes	0.23	1.00	14470	15547
## reg_s_housed_outdooroutdoor	0.03	1.00	8428	13167
## reg_f_cefq_dct1	0.08	1.00	14984	15398
## reg_f_ceph_dct1	0.34	1.00	13563	15333
## reg_f_fram_dct1	0.09	1.00	13237	13811
## reg_f_clox_dct1	0.14	1.00	14439	15756
## reg_s_calving_now1	0.69	1.00	8740	14721
## reg_f_water1	0.13	1.00	15053	15394
## reg_preweaned_heifer1	0.92	1.00	15758	16629
## main_mes_temp0.61	0.57	1.00	13442	15781

Samples were drawn using sampling(NUTS). For each parameter, Eff.Sample
is a crude measure of effective sample size, and Rhat is the potential
scale reduction factor on split chains (at convergence, Rhat = 1).

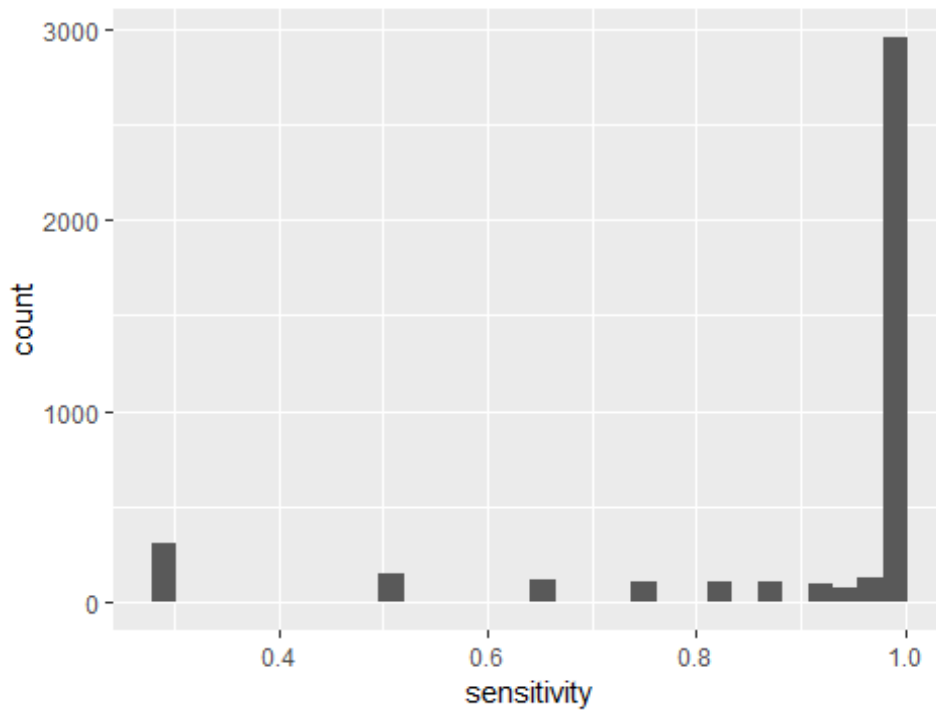
Figure S4: Sensitivity of *bla*_{CTX-M} *E. coli* detection at different minimum prevalence of *bla*_{CTX-M}-positive *E. coli* (*q*) as a proportion of total *E. coli* in a sample.

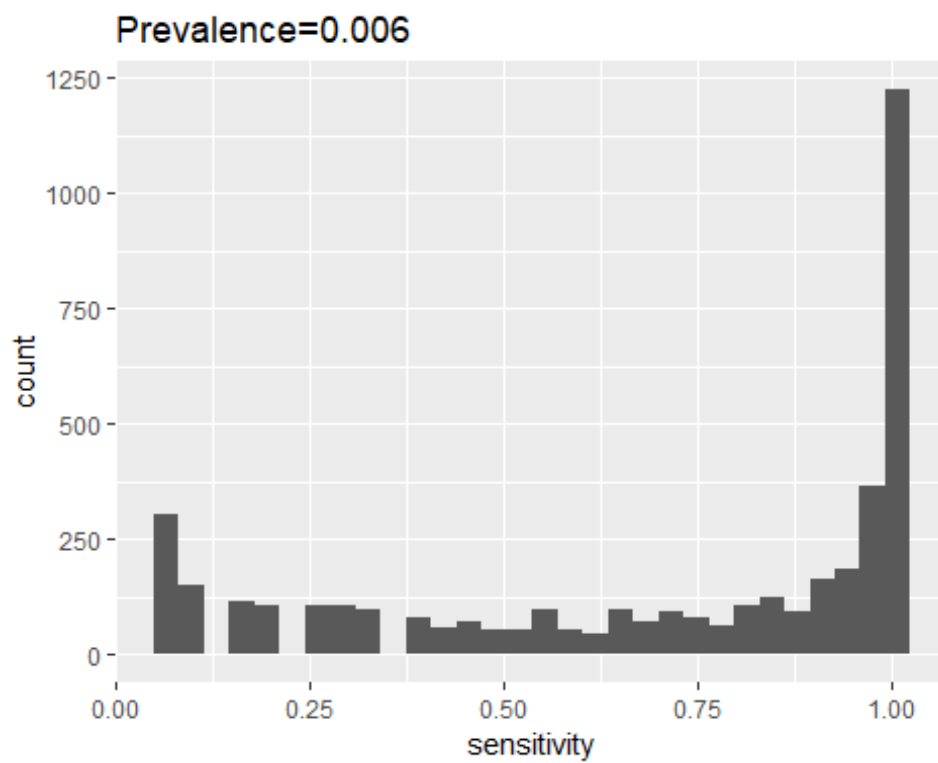
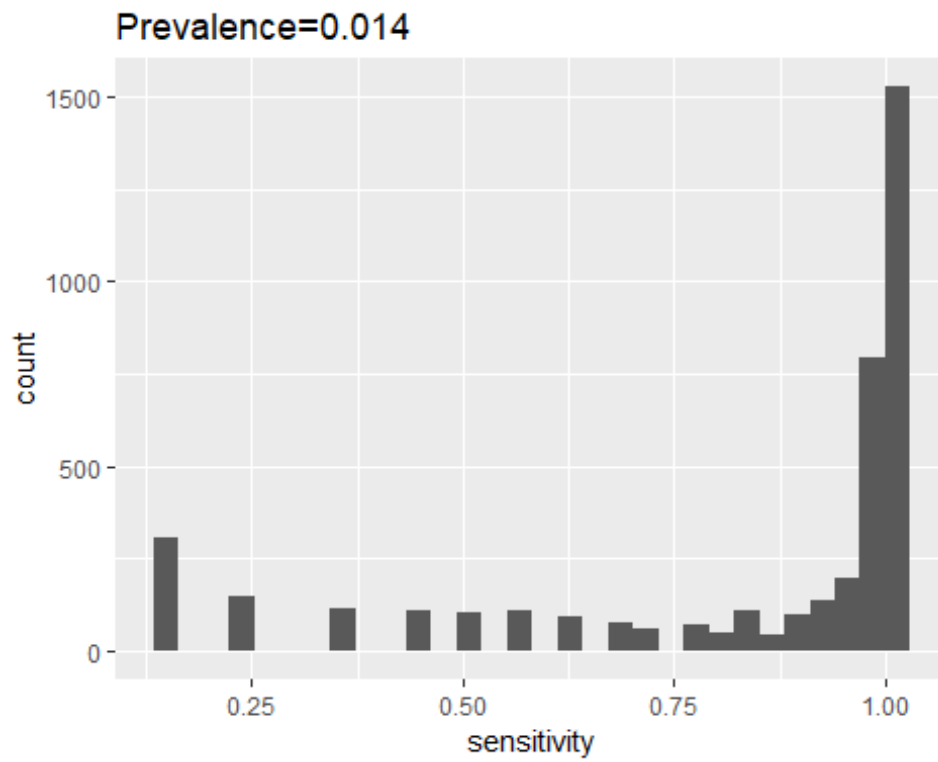


Prevalence=0.085

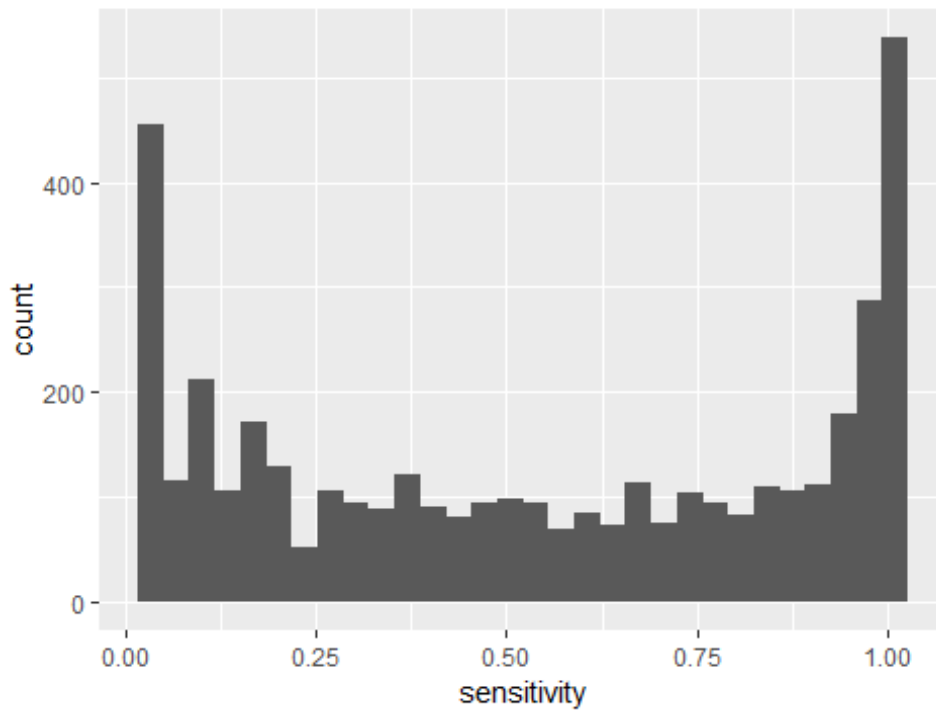


Prevalence=0.035





Prevalence=0.002



Prevalence=0.001

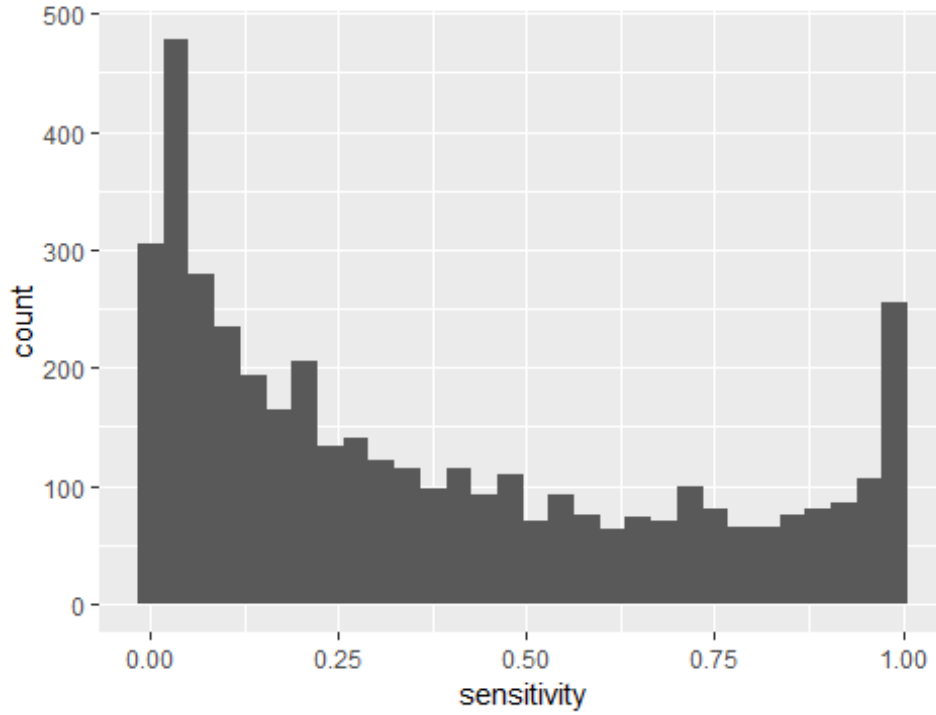
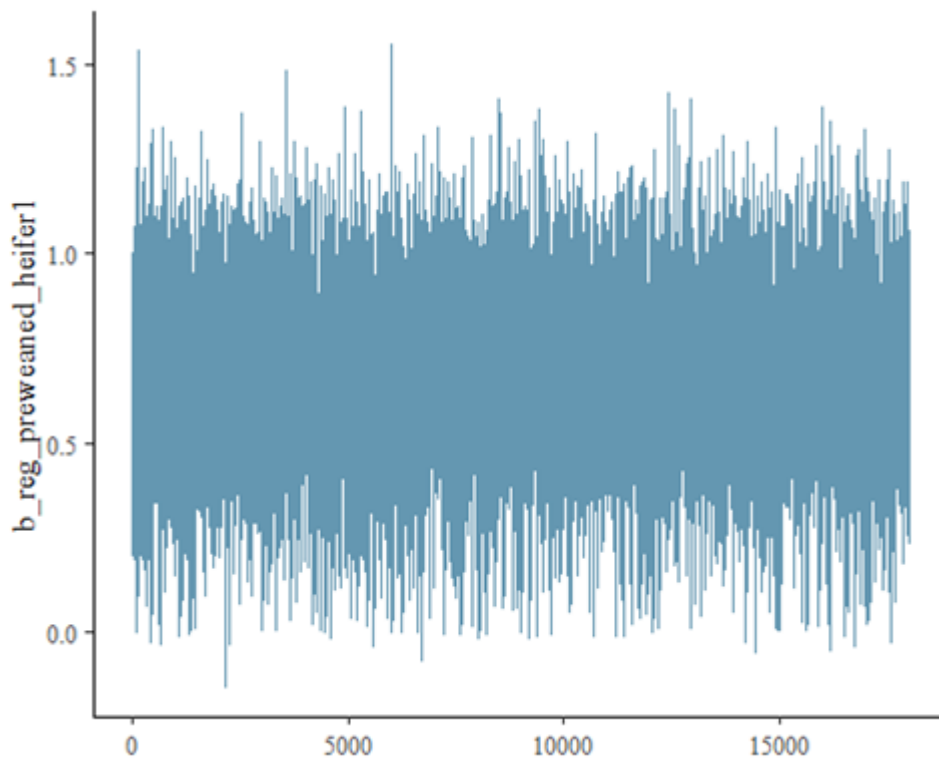
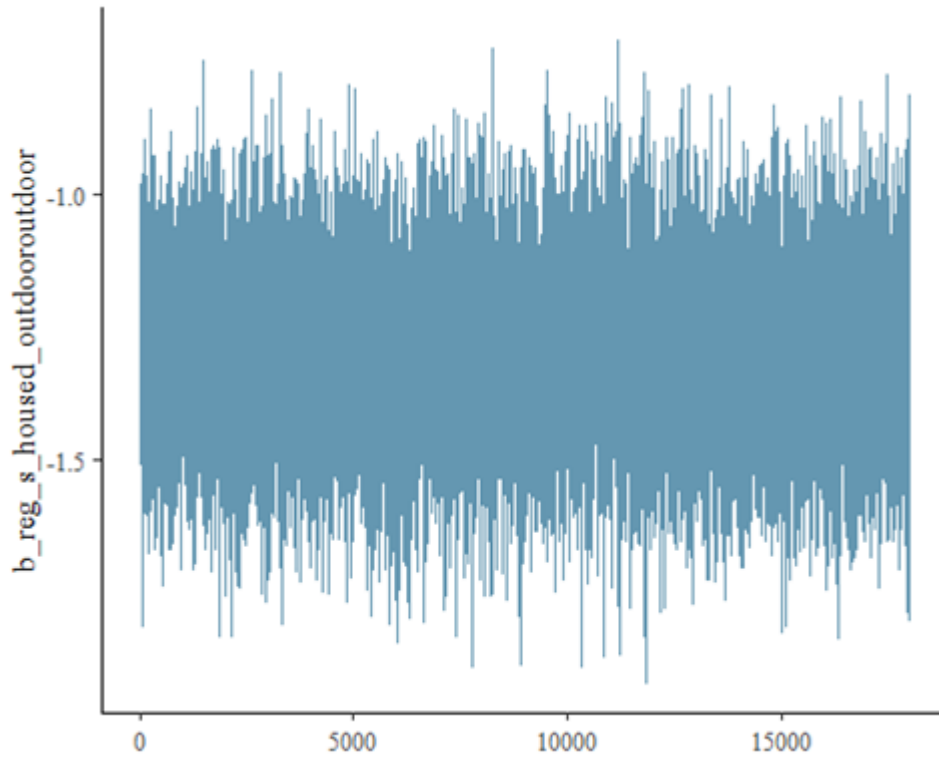


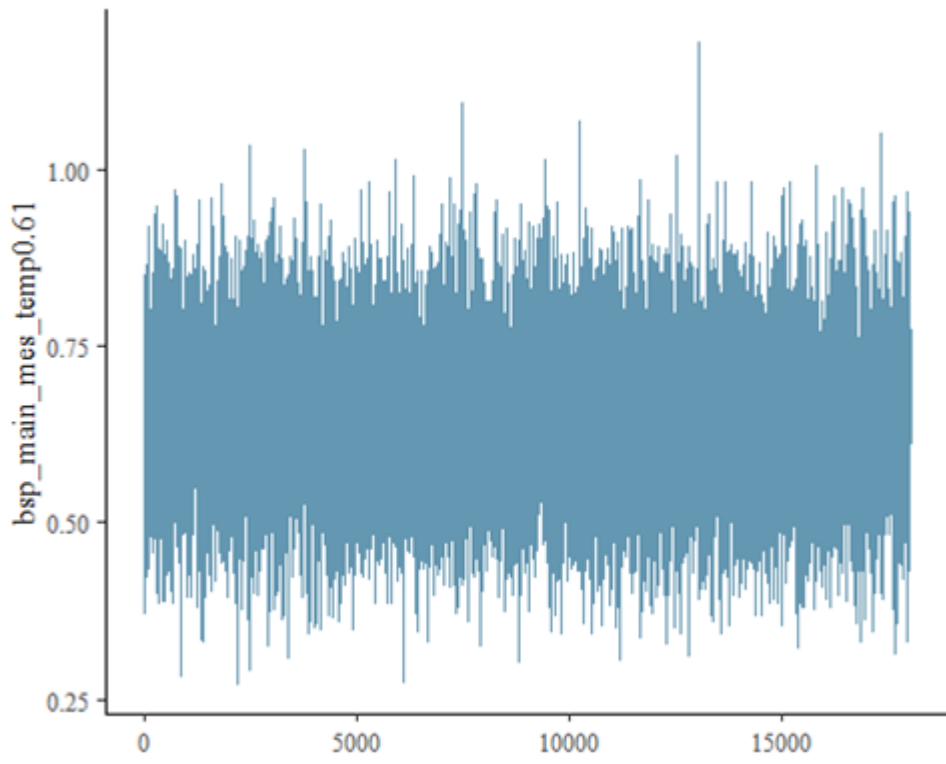
Figure S5: R-code for link function used to account for measurement error for resistant *E. coli* in samples due to sensitivity issues.

```
logitse <- function(s=1, e=1)
{
  linkfun <- function(mu) qllogis((mu+e-1)/(s+e-1))
  linkinv <- function(eta) plogis(eta) * (s+e-1) + 1 - e
  logit_mu_eta <- function(eta) {
    ifelse(abs(eta)>30, .Machine$double.eps,
           exp(eta)/(1+exp(eta))^2)
  }
  mu.eta <- function(eta) (s + e - 1) *logit_mu_eta(eta)
  valideta <- function(eta) TRUE
  link <- paste("logitse(", deparse(substitute(s)), ", ",
               deparse(substitute(e)), ")", sep="")
  structure(list(linkfun = linkfun,
                 linkinv = linkinv,
                 mu.eta = mu.eta,
                 logit_mu_eta = logit_mu_eta,
                 valideta = valideta,
                 name = link),
            class = "link-glm")
}
```

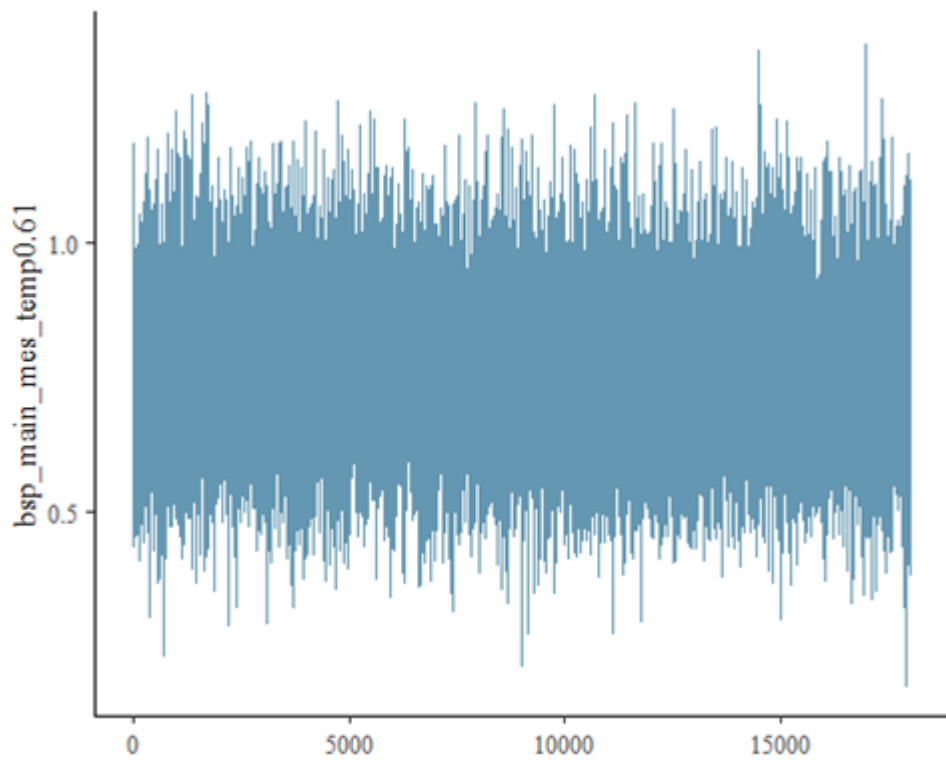
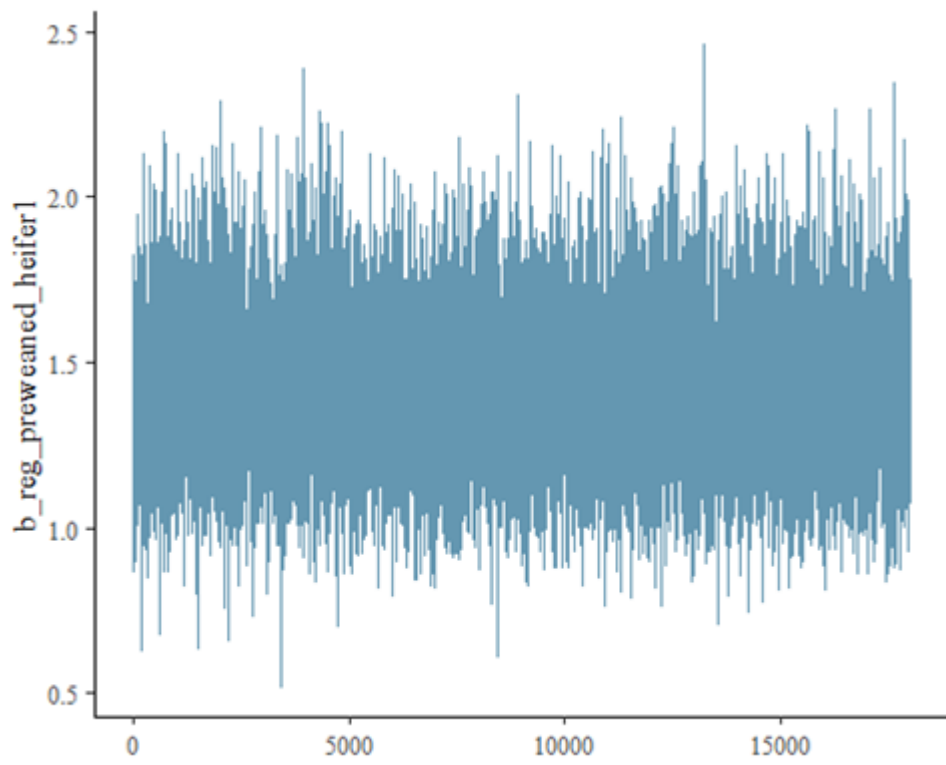

Figure S6: Trace plots from the Bayesian models of the variables that were identified as associated with resistance, all showing evidence of good convergence.

Amoxicillin

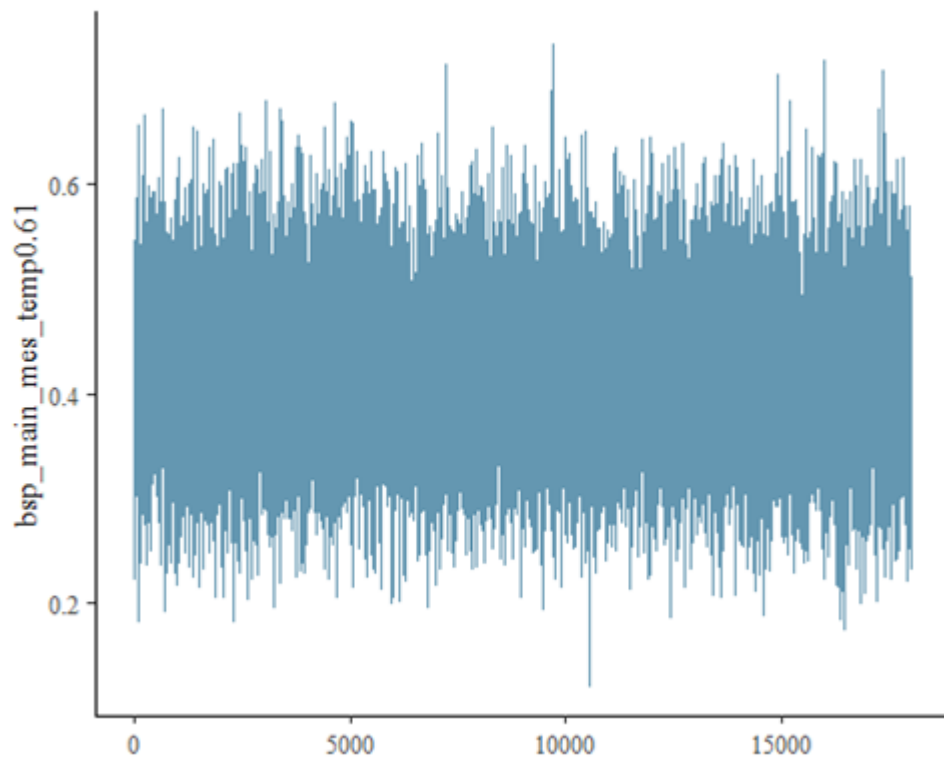
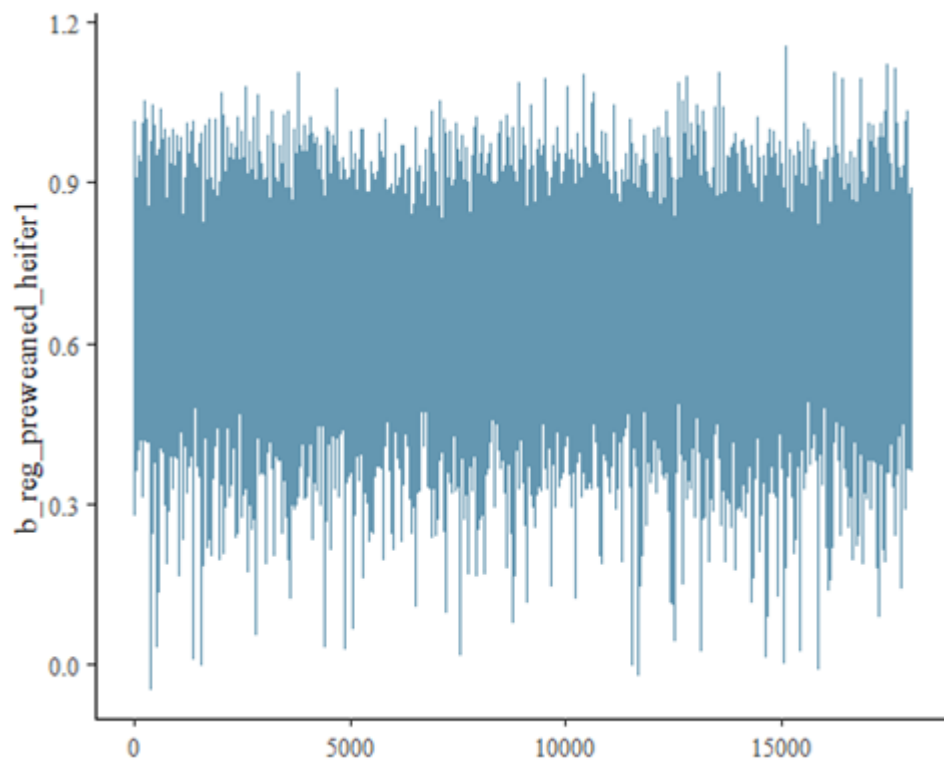




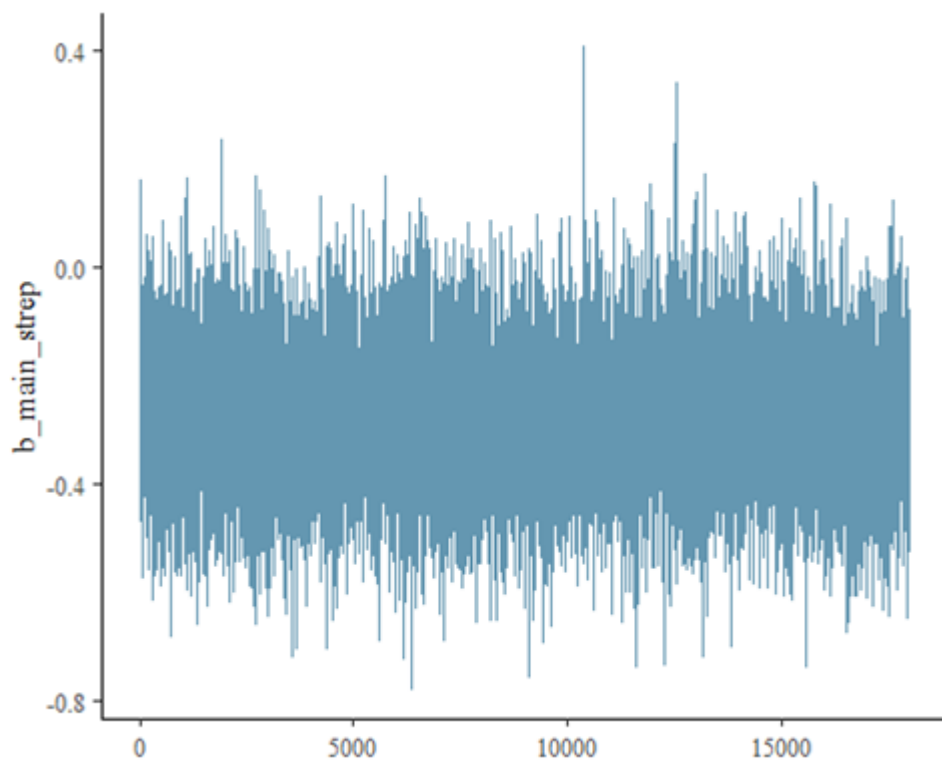
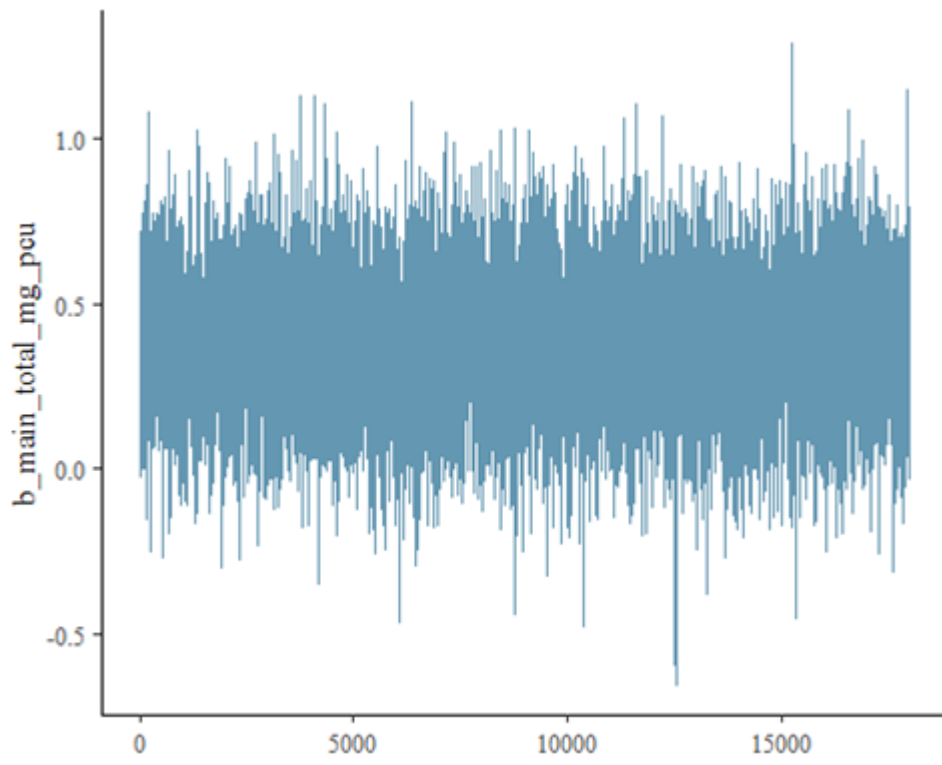
Ciprofloxacin

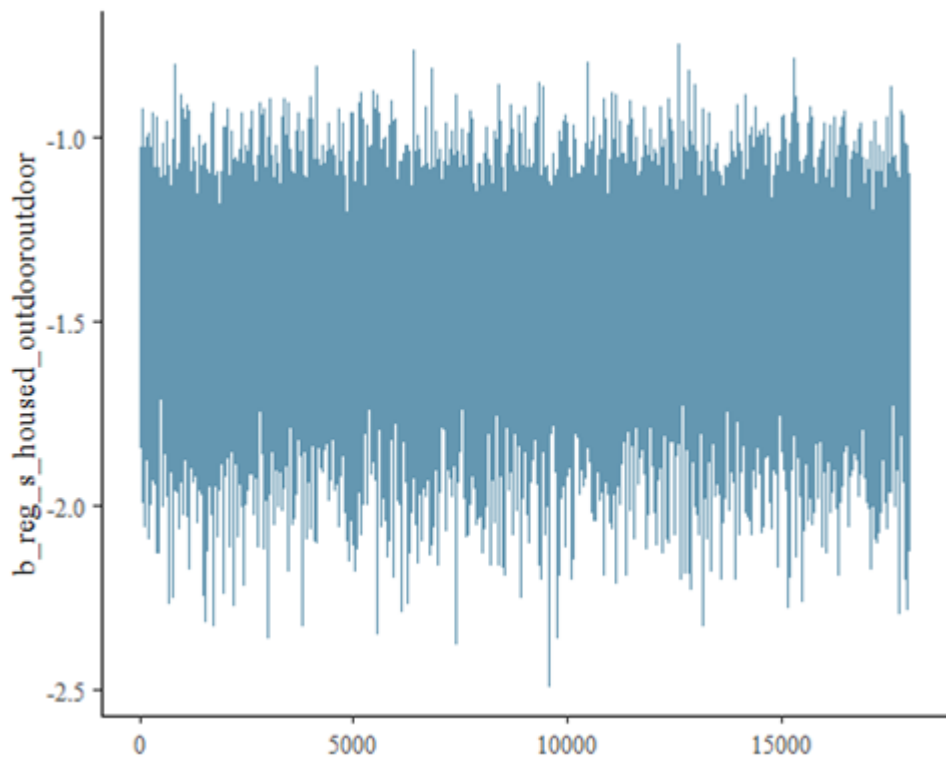
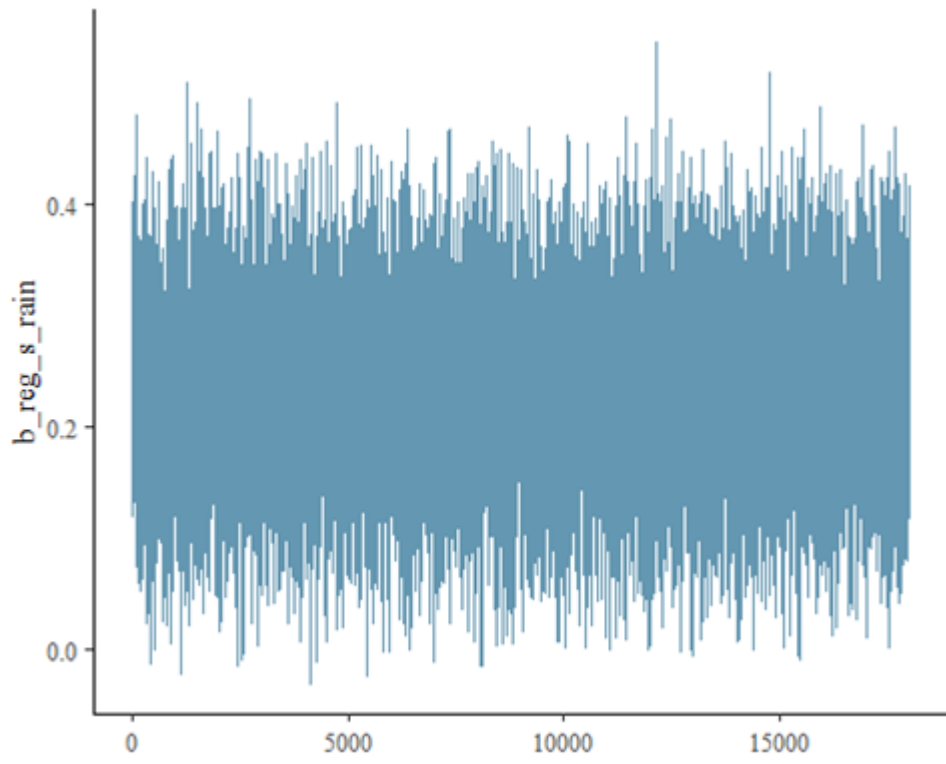


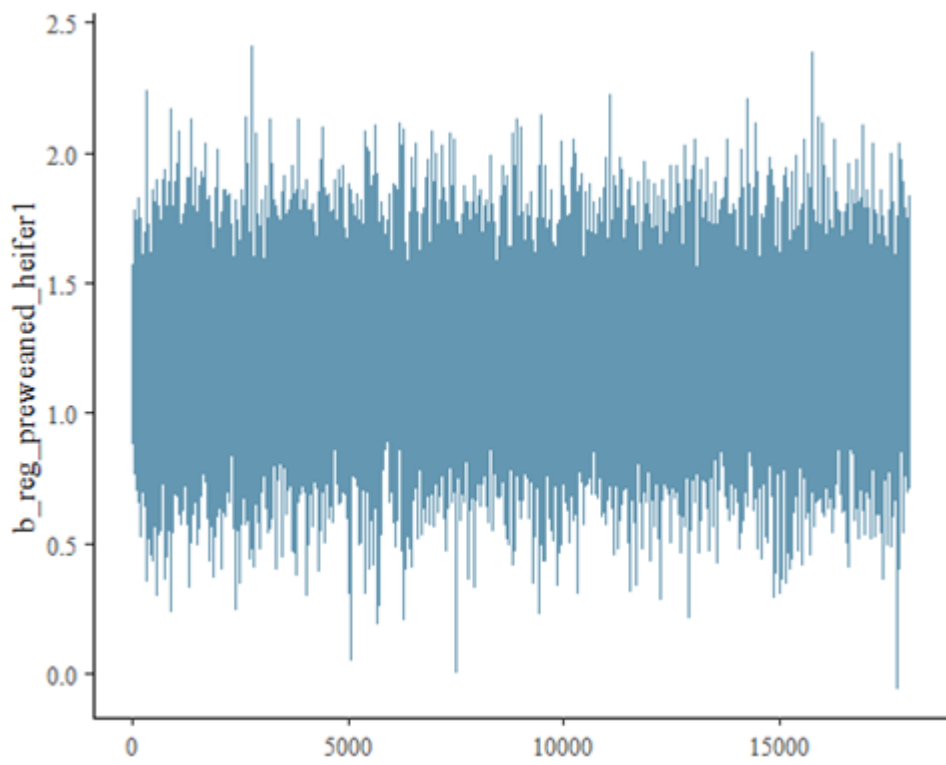
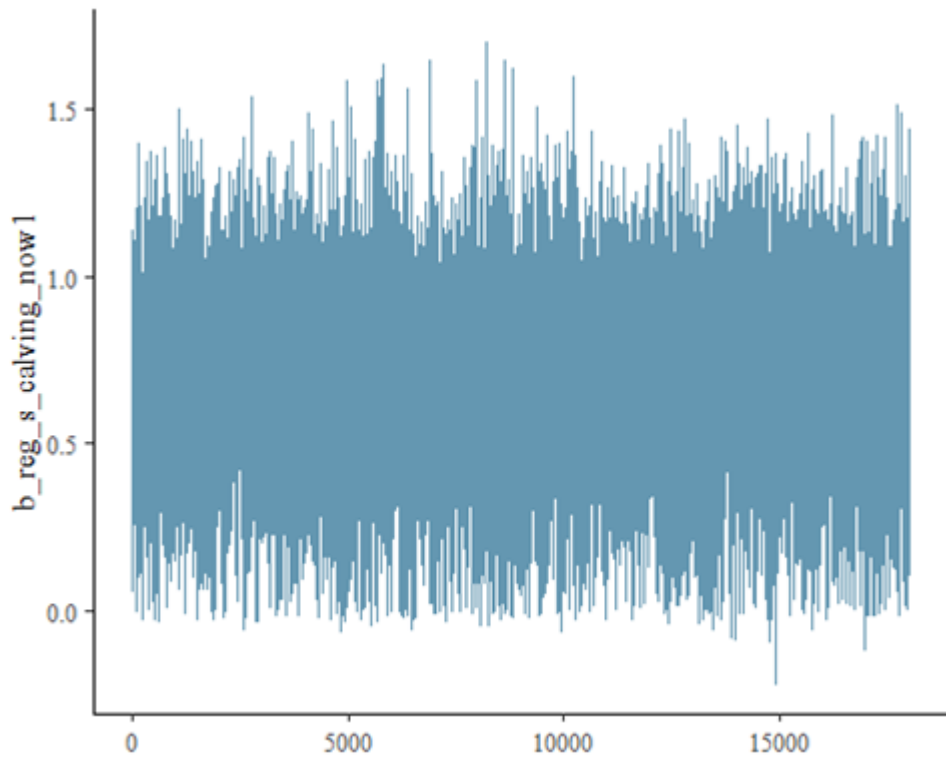
Streptomycin



Tetracycline







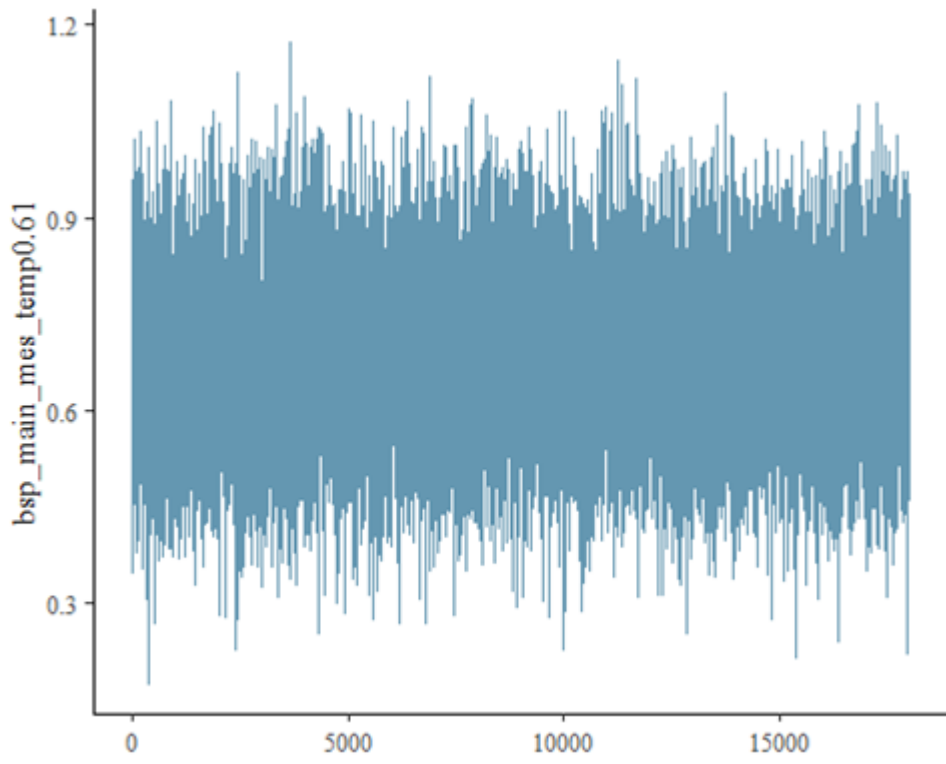
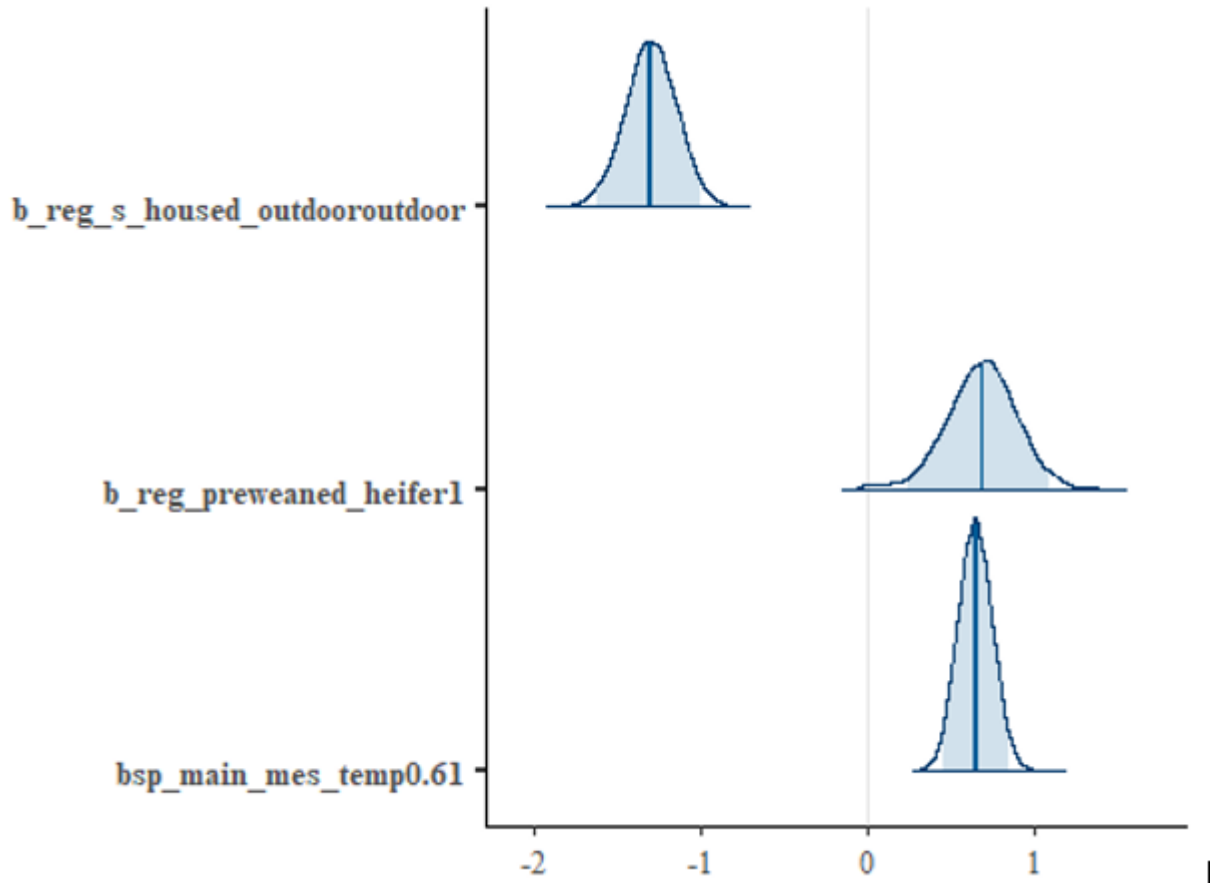
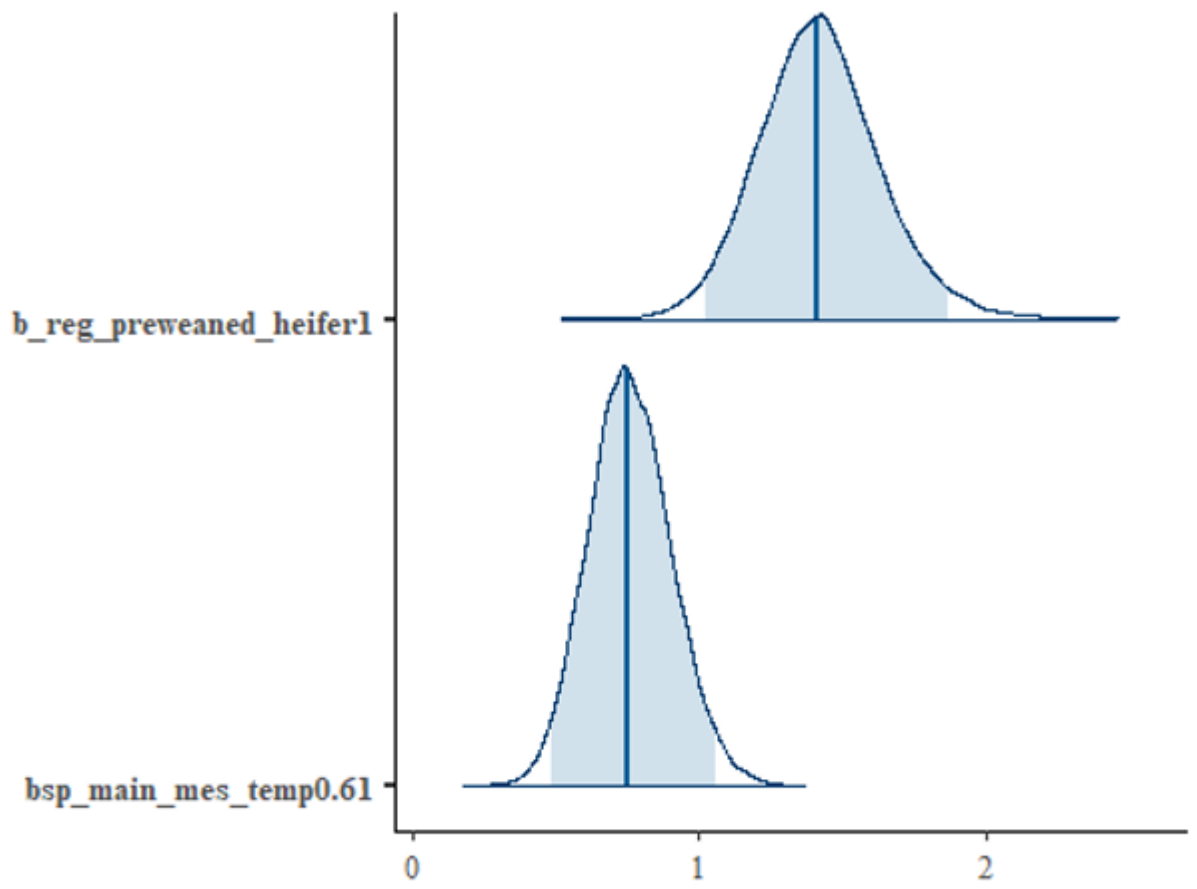


Figure S7: Posterior distributions with medians and 95% credible intervals of the variables that were associated with resistance.

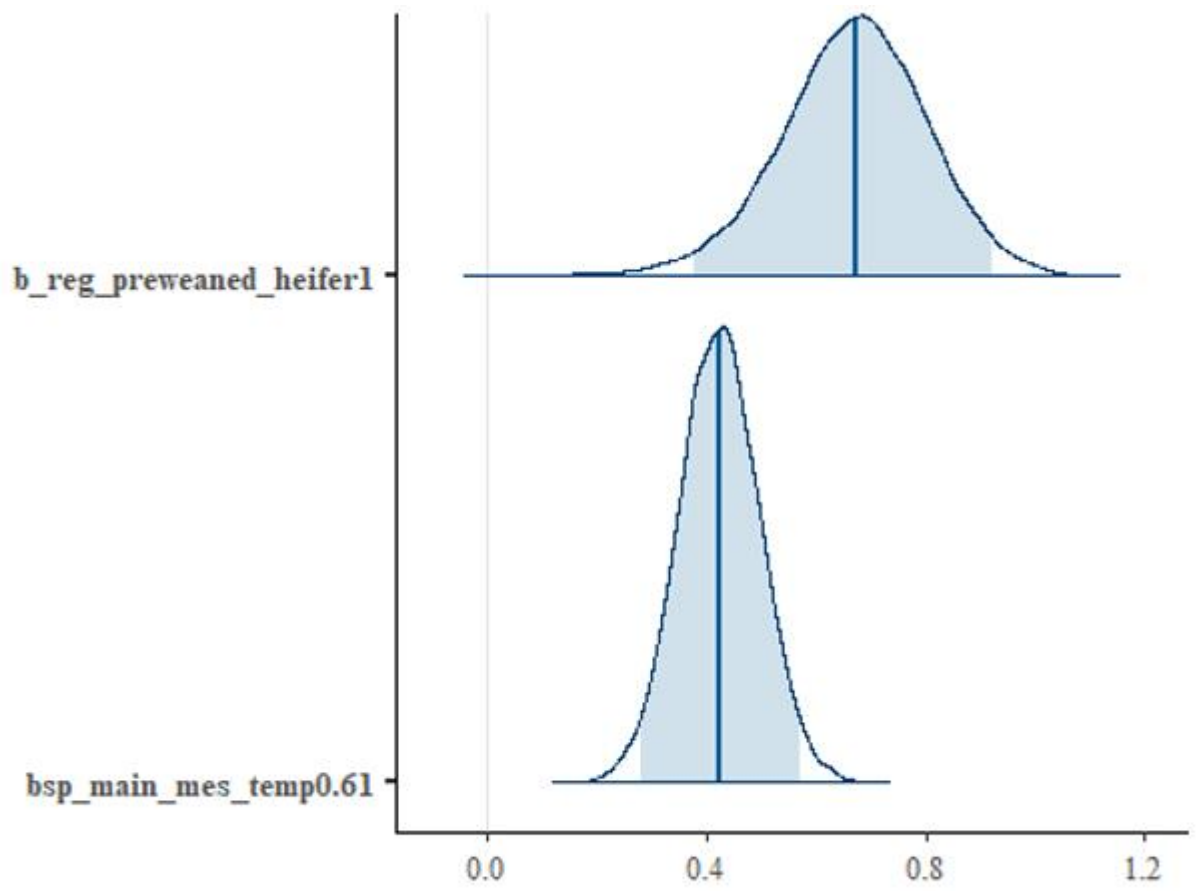
Amoxicillin



Ciprofloxacin



Streptomycin



Tetracycline

