Web Appendix 1: Sample Calculations

1. Addtive Interaction Model

```
. ic casectr RforG GforR age sex, rrby(or)
```

Summary measures	Estimates	P-value	Lower bound	Upper bound
RforG_NOT_GforR	3.7998	0.0000	2.1482	6.7210
GforR_NOT_RforG	0.0783	0.0150	0.0101	0.6103
RforG_AND_GforR	7.1160	0.0656	0.8814	57.4527
RERI	4.2379	0.5797	-10.7607	19.2366
AP	0.5955	0.1923	-0.2998	1.4909
S	3.2565	0.3881	0.2230	47.5469

Interaction exists if RERI != 0 or AP != 0 or S != 1

Command in STATA is IC casectr RforG GforR age sex, rrby(or)

Casectr is case and control variable

Rfor G is a variable containing rotavirus positive, single or in combination with giardia only

GforR is a variable containing Giardia positive, single or in combination with rotavirus only

Age is age as a continuous variable

Sex is a sex variable

From the table

RERI is relative excessive risk ratio

AP is Attributable Proportion

2. Multiplicative Interaction Model

```
. logit casectr i.RforG##i.GforR age sex, or

Iteration 0:   log likelihood = -882.2336
Iteration 1:   log likelihood = -854.22251
Iteration 2:   log likelihood = -853.90422
Iteration 3:   log likelihood = -853.90234
Iteration 4:   log likelihood = -853.90234

Logistic regression                             Number of obs    =      1,287
                                                LR chi2(5)       =      56.66
                                                Prob > chi2      =     0.0000
Log likelihood = -853.90234                     Pseudo R2        =     0.0321
```

casectr	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
RforG						
absence of rotavirus	1	(base)				
presence of rotavirus	3.799774	1.105636	4.59	0.000	2.148227	6.721022
GforR						
absence of giardia	1	(base)				
presence of giradia	.0783328	.0820526	-2.43	0.015	.0100536	.6103323
RforG#GforR						
presence of rotavirus#presence of giradia	23.90761	36.3357	2.09	0.037	1.21576	470.1373
age	.9748801	.0099438	-2.49	0.013	.9555842	.9945656
sex	.7706528	.0894285	-2.25	0.025	.6138795	.967463
_cons	2.261944	.4667746	3.96	0.000	1.509482	3.3895

The command in STATA is logit casectr i.RforG##i.GforR age sex, or

Casectr is case and control variable

Rfor G is a variable containing rotavirus positive, single or in combination with giardia only

GforR is a variable containing Giardia positive, single or in combination with rotavirus only

Age is age as a continuous variable

Sex is a sex variable

From the table above multiplicative interaction value (95%CI) is 23.90 (1.21, 470.14)

3. A) Regression model to obtain OR for AF estimation for age ages

```
. logistic casectr Rotavirus2 Norovirus2 Crypto2 bfpA2 Sth2 Shigella2 Salmo2 age sex, vce (robust)

Logistic regression                              Number of obs   =      1,287
                                                 Wald chi2(9)    =     218.83
                                                 Prob > chi2     =     0.0000
Log pseudolikelihood = -716.56494                Pseudo R2       =     0.1878
```

	Odds Ratio	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
Rotavirus2	8.291716	1.607454	10.91	0.000	5.670589	12.12441
Norovirus2	4.791897	1.031974	7.28	0.000	3.141914	7.308372
Crypto2	9.571388	2.672242	8.09	0.000	5.537674	16.54331
bfpA2	2.597965	1.033279	2.40	0.016	1.191483	5.664721
Sth2	4.315598	1.427866	4.42	0.000	2.256374	8.254122
Shigella2	5.997339	2.163272	4.97	0.000	2.957506	12.16162
Salmo2	4.163688	3.137071	1.89	0.058	.950939	18.23071
age	.9777293	.0111309	-1.98	0.048	.9561547	.9997907
sex	.7532739	.097687	-2.18	0.029	.5842064	.971269
_cons	.9439911	.2188963	-0.25	0.804	.5992224	1.487126

This the regression model you need to run before running specific command to obtain AF for each variable

The command in STATA is:

 logistic casectr Rotavirus2 Norovirus2 Crypto2 bfpA2 Sth2 Shigella2 Salmo2 age sex, vce (robust)

From the model above

Caectr is a case and control variable

Rotavirus2, Norovirus2, Crytpo2, bfpA2, sth2, Shigella2, Salmo2, are the variables of pathogens included in the model

Rotavirus2 is a variable containing rotavirus positive in cases and control

Norovirus2 is a variable containing norovirus positive in cases and control

Crytpo2 is a variable containing cryptosporidium positive in cases and control

bfpA2 is a variable containing Typical EPEC positive in cases and control

sth2 is a variable containing STh-ETEC positive in cases and control

Shigella2 is a variable containing Shigella spp./EIEC positive in cases and control

Salmo2 is a variable containing Salmonella spp. positive in cases and control

2 (B) e.g. AF for rotavirus for all ages

```
. punafcc, at (Rotavirus2=0) eform vce (unconditional)
Scenario 0: (asobserved) _all
Scenario 1: Rotavirus2=0
Confidence interval for the population unattributable faction (PUF)
Total number of observations used: 1287
```

	Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
PUF	.7275448	.0193043	-11.99	0.000	.6906761	.7663816

```
95% CI for the population attributable fraction (PAF)
            Estimate    Minimum    Maximum
      PAF   .2724552   .2336184   .3093239
```

This is the model to obtain AF for individual pathogen using OR from 2(A) above

The command in STATA is punafcc, at (Rotavirus2=0) eform vce (unconditional)

From the calculations above AF (95% CI) is 27.24 (23.36, 30.93)

Web Table 1. Demographic and Clinical Characteristics of the Study Population (N=723 and 564 in the Cases and Controls respectively, in Tanzania, 2010-2011

Characteristic	Cases		Controls	
	n	%	n	%
Sex				
Male	444	61.4	308	54.6
Female	279	38.6	256	45.4
Age groups				
0-11 months	500	69.2	291	51.6
>11 to 24 months	223	30.8	273	48.4
Malnutrition (WAZ)				
Normal	307	42.5	342	60.6
Underweight	416	57.5	222	39.4
Malnutrition (LAZ)				
Normal	233	32.2	257	45.6
Stunted	490	67.8	307	54.4
Malnutrition (WLZ)				
Normal	505	69.8	447	79.3
Wasted	218	30.2	117	20.7
HIV test results (n=426)				
HIV negative (n=391)	79	75.2	312	97.8
HIV positive (n=33)	26	24.8	7	2.2
Breast feeding (aged 7-12 months)				
Breast fed (n=375)	230	81.6	145	71.4
Not breast fed (n=110)	52	18.4	58	28.6
Type of diarrhoea				
Acute diarrhoea	644	89.1	N/A	N/A
Persistent diarrhoea	79	10.9	N/A	N/A
Presence of blood in stool (dysentery)				
Yes	30	4.1	N/A	N/A
No	693	95.9	N/A	N/A
Hydration status				
Non to moderate dehydration	559	77.3	N/A	N/A
Severe dehydration	164	22.7	N/A	N/A

Abbreviations: N/A: Not Applicable for controls; WAZ: Weight-for-age-Z-score; LAZ: Length-for-age-Z-score; WLZ: Weight-for-length-Z-score

Web Table 2. Sample Size for Different Infection Categories in Cases and Controls, in Tanzania, 2010-2011

Pathogen	Cases (n=723)			Controls (n=564)		
	Any infection	Mono-infection	Co-infections	Any infection	Mono-infection	Co-infections
Rotavirus	224	71	153	42	15	27
Norovirus GII	129	47	82	40	14	26
Enteric adenovirus	12	1	11	6	2	4
Non-enteric adenovirus	12	3	9	7	3	4
Cryptosporidium	113	35	78	17	6	11
Giardia	24	1	23	34	11	23
Typical EPEC	43	14	29	16	3	13
Atypical EPEC	139	23	116	107	39	68
STh-ETEC	51	8	43	13	5	8
LT-ETEC	48	5	43	39	9	30
EAEC	281	50	231	181	86	95
Shigella spp./EIEC	53	13	40	12	3	9
Salmonella spp.	11	2	9	3	3	0
C.jejuni	39	2	37	26	8	18
Exclusive dual infections						
Rotavirus + *Giardia*	N/A	N/A	8	N/A	N/A	1
Rotavirus + Norovirus GII	N/A	N/A	18	N/A	N/A	4
Rotavirus + *Shigella* Spp./EIEC	N/A	N/A	8	N/A	N/A	1
Rotavirus + *C.jejuni*	N/A	N/A	18	N/A	N/A	2
Cryptosporidium + Norovirus GII	N/A	N/A	6	N/A	N/A	2
Cryptosporidium + Atypical EPEC	N/A	N/A	25	N/A	N/A	2
Norovrius GII + EAEC	N/A	N/A	53	N/A	N/A	11
Norovirus GII + Typical EPEC	N/A	N/A	3	N/A	N/A	2

Abbreviations: N/A not applicable in that category

Web Table 3. Clinical Characteristics of Mono-infection (N=263) and Co-infections (N=365) for Children Admitted with Diarrhoea in Dar es Salaam, Tanzania, 2010-2011

Clinical characteristic	Mono-infection		Co-infections		P value
	n	%	n	%	
Type of diarrhoea					
Acute diarrhoea	227	86.3	332	91.0	0.06
Persistent diarrhoea	36	13.7	33	9.0	
Dehydration					
None to moderate	206	78.3	279	76.4	0.58
Severe	57	21.7	86	23.6	
Presence of blood in stool	8	3.0	17	4.7	0.31
Malnutrition					
Underweight	157	59.7	204	55.9	0.57
Stunting	181	68.8	244	66.8	0.60
Wasting	84	31.9	104	28.5	0.35
Death (n=40)a	18\278	6.7	22\253	8.7	0.42
HIV status [b]					
HIV negative(n=273)	143\154	92.9	130\143	90.9	0.54
HIV positive (n=24)	11\154	7.1	13\143	9.1	

Footnote: [a] Number of children who died and pathogens identified; [b] total number of children differs from the rest because it represents children who tested for HIV