

Supplementary data:

Appendix: Model parameters

The parameter for each model are set out below:

Model 1: Enhanced surveillance

Pathogen	Number of deaths	Sources	Year
Bacteria			
<i>E. coli</i> O157	2	Public Health England, Public Health Agency (Northern Ireland), Health Protection Scotland, Public Health Wales	2018
<i>L. monocytogenes</i>	28		

Model 2: Modelling using Outbreak data

Model structure: $D_p = L_p \times AR_p \times DP_p$ or $D_p = CR_p \times Pop \times DP_p$

Pathogen	Confirmed laboratory cases		Ascertainment ratio (AR _p)			Community rate (CR _p)			Proportion of cases that result in death (DP _p)	
	Cases (L _p)	Source	Ratio	95% CrI	Source	Community rate	95% CI	Source	Alpha ¹	Beta ¹
Bacteria										
<i>Campylobacter</i>	69,636		9.3	(6 - 14.4)	IID2 study				1.92	2723.32
<i>C. perfringens</i>		Public Health England, Public Health Agency (Northern Ireland), Public Health Wales, Health Protection Scotland				1.5	(0.5 - 3.9)	IID2 extension	1.22	2955.71
<i>E. coli</i> O157			7.4	(0.5 to 105.4)					6.24	1509.10
<i>L. monocytogenes</i>			1	NA	IID2 extension				10.17	43.49
<i>Salmonella</i>	10,124		4.7	(1.2 - 18.2)	IID2 study				9.73	2015.12
<i>Shigella</i>	2,812		2.55	NA	IID1 study				0.77	174.31
Protozoa										
<i>Cryptosporidium</i>	6,039		8.2	(2.1 - 31.7)	IID2 study				0.00	0.00
<i>Giardia</i>	6,216		14	(4 - 49)	IID2 study				0.00	0.00
Viruses										
Adenovirus						10.2	(6.8 - 15.4)	IID2 extension	0.00	0.00
Norovirus						47.0	(39.1 - 56.5)	IID2 extension	11.88	9945.04
Rotavirus	2,651		42.9	(29.5 - 62.4)	IID2 study				0.00	0.00

[1]

Note:

¹ Modelled using Public Health England outbreak data for 2001 to 2016

Other parameter used: Pop = 66,435,600. Source: ONS mid-year population estimate

Model 3: Death certificate data plus expert assessments

Model structure: $D_p = (DM_p + DPT_p) \times POPADJ_{EW}$

ONS mortality data was used to produce DM_p and DPT_p using a Monte Carlo simulation model and bootstrapping respectively. This underlying data was purchased under a data sharing agreement and cannot be shared

$POPADJ_{EW} = 1.17$. Based on ONS mid-year population estimates: 2018 UK population 66,435,600, 2018 England & Wales population 5,911,800.

Model 4: Hospital Episode Statistics – Proportion of discharges due to death

Model structure: $D_p = L_p \times AR_p \times HP_p \times HES_p \times NHU_p$ or $D_p = CR_p \times Pop \times HP_p \times HES_p \times NHU_p$

Pathogen	Proportion of illness that results in hospital admissions		Death rate		Uplifting factor for deaths that don't occur in hospital	
	Alpha ¹	Beta ¹	Alpha ²	Beta ²	Alpha ³	Beta ³
Bacteria						
<i>Campylobacter</i>	21.33	1751.97	218.31	38784.37	0.92	51.43
<i>C. perfringens</i>	6.96	1465.70	5.57	22.20	0.69	0.87
<i>E.coli</i> O157	56.63	207.67	167.97	5674.84	0.94	13.60
<i>L. monocytogenes</i>	3.04	1.23	149.60	786.42	0.95	140.40
<i>Salmonella</i>	69.34	967.95	192.74	13246.27	0.90	137.74
<i>Shigella</i>	2.76	120.59	4.55	1642.81	1.00	13.60
Protozoa						
<i>Cryptosporidium</i>	21.01	751.60	14.20	1483.51	0.90	7.04
<i>Giardia</i>	1.10	338.82	9.72	3282.83	0.76	1.70
Viruses						
Adenovirus	9.91	596.51	7.30	2044.17	0.78	13.92
Norovirus	28.71	4989.42	36.25	1104.76	0.82	17.98
Rotavirus	9.9	596.5	8.66	7571.78	0.78	13.92

Notes:

¹ Modelled using Public Health England outbreak data for 2001 to 2016. Coverage England

² Modelled using Health and Social Care Information centre hospital discharge data for 2000-01 to 2017-18. Coverage England

³ Modelled using ONS mortality data from 2001-2012. Coverage England & Wales

Foodborne proportion

Pathogen	Proportion of cases attributable to food	
	Alpha	Beta
Bacteria		
<i>Campylobacter</i>	6.12	6.55
<i>C. perfringens</i>	22.68	3.97
<i>E.coli</i> O157	14.13	12.58
<i>L. monocytogenes</i>	43.47	3.03
<i>Salmonella</i>	116.95	12.51
<i>Shigella</i>	1.22	3.40
Protozoa		
<i>Cryptosporidium</i>	4.27	63.48
<i>Giardia</i>	3.19	11.51
Viruses		
Adenovirus	3.40	162.46
Rotavirus	3.40	162.46

Modelled using Public Health England outbreak data for 2001 to 2008. These are very similar to those used in the IID2 extension. The analysis was model were recreated for this study so numbers are slightly different

For norovirus the proportion attributable to food was based an the estimates of 383,182 foodborne norovirus cases in 2018 divided by all norovirus cases using parameters $CR_p \times Pop$ given in model 2.[1]