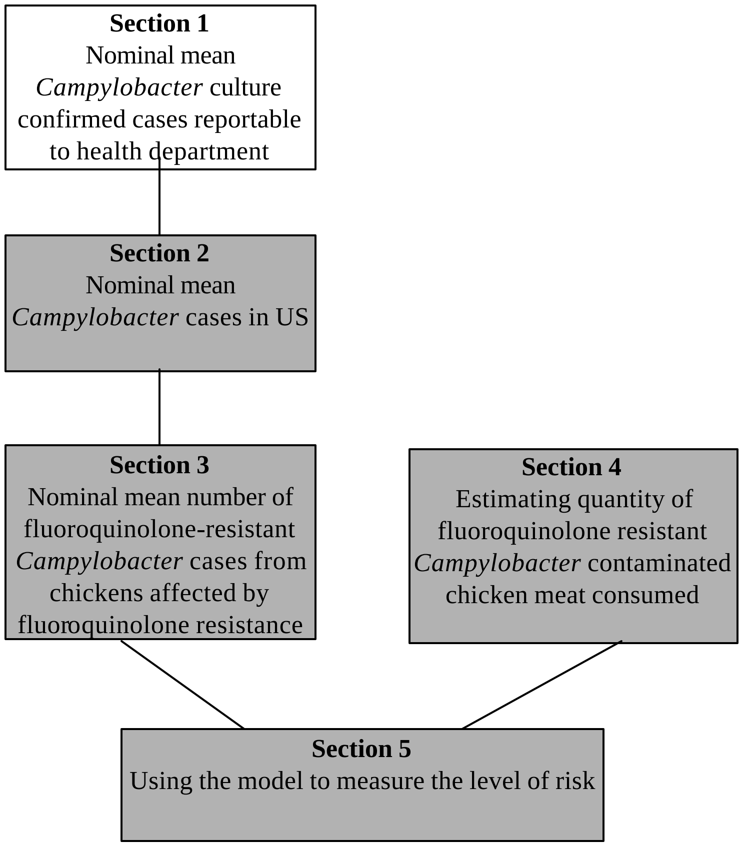
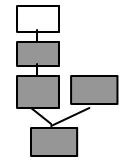
Section 1

Nominal mean *Campylobacter* culture confirmed cases reportable to health department





Overview for Sections 1 and 2

The Centers for Disease Control and Prevention (CDC) obtained data for the determination of the annual burden of *Campylobacter* infections through active surveillance, surveys and case control studies. These data sources will be described in detail in Sections 1 and 2. Assumptions made in the risk assessment are presented in the sections adjacent to the data points to which they apply and are listed separately in Appendix B.

Section 1 explains the process of determining the estimated number of reportable cases to the CDC's active surveillance system in the FoodNet catchment area from the total number of culture confirmed cases reported in a given year. It also details how the total number of culture-confirmed cases is apportioned into confirmed cases of invasive or enteric campylobacteriosis. The enteric cases are further apportioned into those with bloody diarrhea and those without. These three distinct categories of cases, confirmed cases with invasive disease and enteric cases with and without bloody diarrhea, are required in the next step of building the annual number of culture-confirmed *Campylobacter* cases in the U.S.

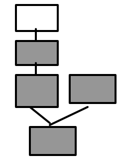
Section 2 uses the estimated number of reportable cases in the catchment, calculated in Section 1, to estimate the predicted total number of *Campylobacter* cases in the U.S. Only a small number of cases are reported in FoodNet surveillance, because only a small fraction of persons with campylobacteriosis will progress along the medical care path to the point of becoming a culture-confirmed case. The path includes: seeking health care, having a specimen requested, submitting a specimen when requested to do so, having the laboratory test for *Campylobacter*, and having the laboratory that tests for *Campylobacter* actually finding it. The probabilities of these events occurring differ at points among the three distinct categories listed above.

To illustrate the basic steps of the method used to determine the annual burden of *Camplyobacter* illness, the calculations for 1999 are described here using point estimates. Calculations for 1998 are similar. The risk analysis calculations of the annual burden of campylobacteriosis are described in Sections 1 and 2 and follow these basic steps but incorporate confidence distributions in place of the point estimates used for demonstration purposes in the pyramids below. These pyramids are provided for demonstration purposes only and show calculations of point estimates. Since the calculations in these examples do not use the distributions as is done in the model the output numbers will not exactly agree with the modeled values.

Example – Basic Steps in Calculation of total number of *Campylobacter* infections in the U.S. in 1999

The number of enteric culture-confirmed cases for the U.S. is calculated by multiplying the number of enteric culture-confirmed cases in the FoodNet sites for the year by the ratio of the U.S. population to the FoodNet catchment size. There were 3,884 *Campylobacter* culture-confirmed cases ascertained in FoodNet sites in 1999. Of these cases, 51 were isolated from body sites considered invasive and 3,833 were from stool samples or were of unknown origin. For a FoodNet population of 25,859,311 and a national population of 272,690,813 that translates into approximately 40,419 culture-confirmed enteric *Campylobacter* cases. Similarly, there are an estimated 538 culture-confirmed *Campylobacter* cases with invasive disease. Therefore, the total number of culture-confirmed cases, combining those with enteric disease and those with invasive disease, is the sum of these two estimates: 40,419 + 538 or 40,957.

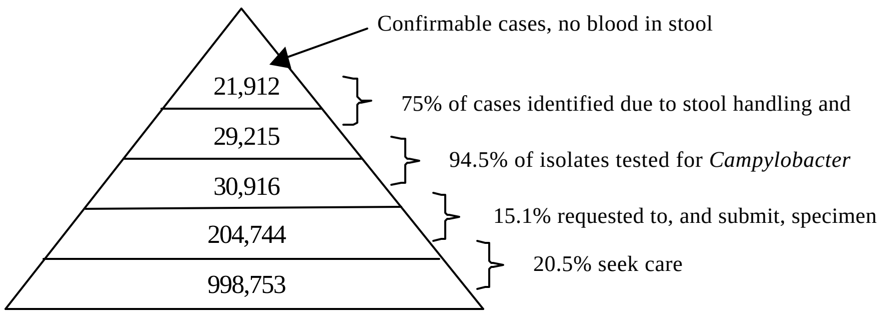
Of those culture confirmed cases in FoodNet in 1999, 46.5% came from cases with bloody diarrhea (see Section 1.9). This means that 40,957 x 0.465= 19,045 cultures came from cases with bloody diarrhea, and 21,912 cultures came from cases without blood in the stool.



The way the number of culture-confirmed cases is built up to the total number of cases is best illustrated by means of pyramids in the example given below. The values of parameters in the pyramid that apply to cases without bloody diarrhea are different from the values of parameters in the pyramid for cases with bloody diarrhea. The pyramid for *Campylobacter* cases without blood in the stool is as follows:

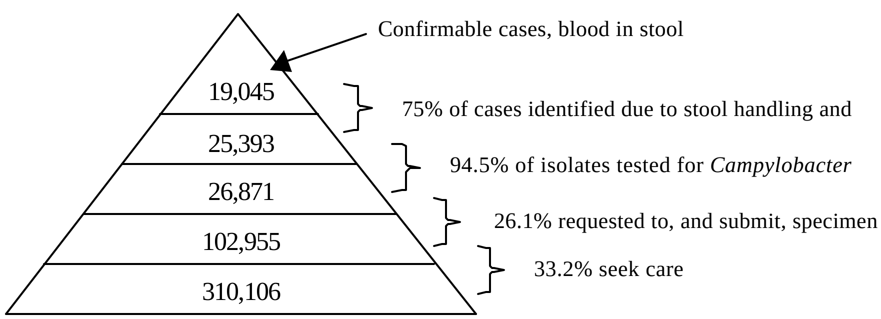
The calculation begins with the 21,912 cases one would have expected to be confirmed if FoodNet active surveillance were extended over the entire U.S. population. That number is divided by 0.75 to adjust for losses in isolations due to stool handling procedures and lack of test sensitivity, which are the cases that were tested but failed to yield a positive result. This process of adjustment for the various steps along the medical care path continues down the pyramid until the predicted number of campylobacteriosis cases without blood in the stool in the U.S. is attained at the bottom of the pyramid, 998,753 cases.

Non-bloody stool pyramid:



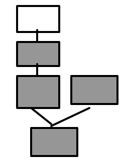
The pyramid for cases with bloody diarrhea contains the assumptions that a larger percentage of persons with bloody diarrhea will seek care, will be requested and will submit specimens when they are requested to do so (Section 2.3). This pyramid begins with 19,045 cases with bloody stool.

Bloody stool pyramid:



Finally, all cases of invasive campylobacteriosis were assumed to have been reported, obviating the need to use calculations. Thus, the estimated total burden of campylobacteriosis for 1999 is the sum of the three values for cases without bloody diarrhea, with bloody diarrhea, and with invasive disease. That is 998,753 + 310,106 + 538 = 1,309,387 cases.

This basic calculation makes use of point estimates derived from CDC data. Sections 1 and 2 describe the data points with their inherent uncertainty or confidence distributions that were used in modeling the risk to provide an estimate of the total annual burden of campylobacteriosis.



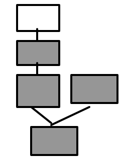
Symbol	Description	Formula
n_{US}	U.S. population	Data
n_{FN}	FoodNet catchment site total population	Data
o_{ej}, o_{ij}	Expected observed enteric/invasive disease by site {j}	Data
λ_e λ_i	Expected observed enteric/invasive disease in the U.S.	$= n_{US} / n_{FN} * \Sigma_j Gamma(o_{ej},1)$ $= n_{US} / n_{FN} * \Sigma_j Gamma(o_{ij},1)$
p_b	Proportion of culture confirmed enteric infections with bloody diarrhea	Beta distribution based on data
$\lambda 1_n$ $\lambda 1_b$ $\lambda 1_i$ $\mathbf{l\,1_T}$	Nominal mean *Campylobacter* culture confirmed cases reportable to health department (non-bloody, bloody and invasive and **total**)	$=\lambda_e*(1- p_b)$ $=\lambda_e* p_b$ $=\lambda_i$ $=\lambda 1_n+\lambda 1_b+\lambda 1_i$

Parameter estimations

<u>1.1</u> (n_{us}) – <u>U.S. population</u>
The numbers used in the calculation of FoodNet incidence rates for the catchment areas and the size of the total U.S. population are obtained from the U.S. Census Bureau post-census estimates. These post-census estimates are calculated annually, based upon the most recent census survey. More information about how these population estimates are calculated is available from the U.S. Census Bureau (114) (available at http://www.census.gov/).

For 1998, n_{US} = 270,248,003
For 1999, n_{US} = 272,690,813

<u>1.2</u> (n_{FN}) - <u>FoodNet Catchment site total population</u>
FoodNet is a sentinel surveillance network of Emerging Infections Program Sites. FoodNet was initiated in 1996 in five sites (California, Connecticut, Georgia, Minnesota, Oregon) to provide more accurate national estimates of the burden of foodborne disease than was previously available through passive surveillance (19). By 1998, the FoodNet catchment area had expanded to include the states of Minnesota (MN), Connecticut (CT), Oregon (OR), and selected counties in California (CA), Georgia (GA), Maryland (MD), and New York (NY) (21). Expansion in 1999 included the entire state of Georgia and additional counties in New York. The seven sites represented approximately 7.7%, and 9.5% of the U.S. population in 1998 and 1999 respectively. Because FoodNet is an active surveillance system, all clinical laboratories within the catchment areas and outside the catchment area, if they receive specimens from persons who reside within the catchment area, are contacted by FoodNet representatives to identify culture-confirmed cases of campylobacteriosis occurring among catchment area residents. Cases are identified from laboratory reports collected for the previous month or are collected more frequently, depending on laboratory volume. Active surveillance is considered more accurate than passive surveillance because it does not rely upon laboratories to provide reports of cases to the surveillance system. Instead, the system contacts and collects the information from the laboratories. FoodNet incidence rates are based upon laboratory-confirmed cases of campylobacteriosis and are being used to document the effectiveness of new food safety control measures. FoodNet incidence rates of culture-confirmed campylobacteriosis therefore include only those persons with campylobacteriosis who sought care for their illness and had a specimen submitted that was tested for and yielded the organism. FoodNet reporting limits case reports to a single report per affected individual within any 12-month period. If more than a single isolation of *Campylobacter* from a single individual occurs from multiple specimens, only one, with priority given to the most invasive isolation, is reported to FoodNet for incidence rate estimates. While this sentinel surveillance system is not designed specifically to be representative of the U.S. population, based on a comparison of the demographic characteristics the disease incidence is likely to be representative of the U.S. population. Although



comparison of risk factors is preferable to comparison of demographic characteristics for extrapolating data, the data are not available to make this comparison.

The comparison of FoodNet and U.S. populations by demographic characteristics (sex, age, race, and rural-to-urban distribution), indicated that the population distributions appeared to be similar (Table 1.1). The exception may be the lower proportion of Hispanics represented in FoodNet catchment areas compared to the U.S. population. The demographic characteristics available for comparison are, in most instances, only markers for other risk factors that influence the rates of disease in populations. The ideal extrapolation of FoodNet incidence rates to the U.S. population would require knowledge of the distribution of risk factors that affect the rates of disease. However, many of these risk factors are not well described. Some risk factors for campylobacteriosis are age (the most susceptible are the very young and elderly), immune status (the immunocompromised are most at risk), and antibiotic therapy in the month prior to illness onset (74). Because the comparison of demographic characteristics between the FoodNet and the U.S. populations was similar, this indicates that the risk factors that affect disease rates may also be distributed similarly. Therefore, the rates of disease obtained from FoodNet are likely to be representative of disease rates in the U.S.

Table 1.1. Comparison of the distribution of demographic characteristics by FoodNet total catchment to U.S. population (1998)

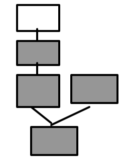
Demographic Characteristic		FoodNet Total Catchment Area	U.S. Population
Rural vs. Urban[1]	Rural	4,076,398 (21.78)	61,656,386 (24.80)
	Urban	14,637,400 (78.22)	187,053,487 (75.20)
Age Distribution	0-<1 year	280,015 (1.35)	3,776,389 (1.40)
	1-<10 years	2,907,058 (14.03)	39,050,749 (14.45)
	10-<20 years	2,865,920 (13.83)	38,050,749 (14.29)
	20-<30 years	2,767,848 (13.36)	36,296,139 (13.43)
	30-<40 years	3,591,391 (17.33)	43,608,568 (16.13)
	40-<50 years	3,201,640 (15.45)	39,778,258 (14.72)
	50-<60 years	2,047,441 (9.88)	26,692,895 (9.88)
	60+ years	3,062,669 (14.78)	42,472,248 (15.71)
Sex	Male	10,148,135 (48.97)	132,046,334 (48.85)
	Female	10,575,847 (51.03)	138,252,190 (51.15)
Race	Native American	126,418 (0.61)	2,000,000 (0.74)
	White	15,913,196 (76.79)	195,439,508 (72.31)
	Black	2,534,928 (12.23)	32,717,955 (12.10)
	Hispanic	1,147,715 (5.54)	30,250,255 (11.19)
	Asian	1,001,725 (4.83)	9,890,223 (3.66)

[1]1990 U.S. Census Estimates

ASSUMPTION: An extrapolation from FoodNet catchment populations to the U.S. population at large assumes that the FoodNet catchment populations will, in aggregate, be reasonably representative of the U.S. population (Table 1.1).

DISCUSSION: Although the incidence rates varied by site, from 6.8/100,000 in Maryland to 32.2/100,000 in California in 1999 (22), the overall rate of *Campylobacter* isolation is likely to reflect isolation rates in the U.S. population. Comparisons of demographic characteristics between the FoodNet sites and the U.S. population show similar distributions of sex, age, race and rural/urban distributions (Table 1.1).

In addition to demonstrating similarity in population composition, an evaluation of potential exposure is important. In a 1994-5 United States Department of Agriculture, Food Safety Inspection Service, survey, 88% of chicken carcasses were reported to carry *Campylobacter* at slaughter (Table 1.2)(104). Another estimate, of *Campylobacter* carriage on retail chicken products was demonstrated at a level of 88% in a Minnesota survey of chicken products in 1997 (92).



Sporadic cases of *Campylobacter* account for approximately 99% of all *Campylobacter* cases. Epidemiologic investigations of sporadic infections have indicated that chicken is the most common source of human infections (3, 92, 95). The frequency of chicken consumption was evaluated to assess exposure to this risk factor in the U.S. population. The National Chicken Council provided a chicken consumption survey, conducted by Bruskin Goldring Research in June 1999 (18). The survey utilized computer-assisted telephone interviewing and evaluated the frequency of chicken consumption at home or away from home by sex, age, income and region. The sample consisted of 1,019 completed interviews of males and females, at least 18 years of age, in approximately equal numbers. The selection of interviewees was based upon a computer-based random-digit dialing sample of all households with telephones in the continental U.S. There was equal probability of selection for each household with a telephone, including listed and unlisted numbers. Each number was subject to an original and at least four follow-up attempts to complete the interviews. Findings, at a 5% significance level, indicated that there was no difference in frequency of chicken consumption at home or away from home by sex. Frequency of chicken consumption at home or away from home was slightly greater for younger respondents 18-24 years of age (mean=8.3 times per month, $p<0.05$) compared to other age groups (range of means=6.6-7.6 times per month, $p<0.05$). Respondents from the Northeast (mean=8.2 times per month, $p<0.05$), consumed chicken at home more frequently compared to other parts of the country (range of means=6.1-7.5 times per month, $p<0.05$), but when eating chicken away from home all regions were similar. The proportion of people rarely or never consuming chicken was low and did not vary significantly by sex, age, income or region of the U.S. at a 5% significance level (18).

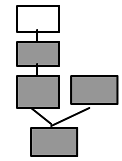
Table 1.2. Percent isolation of *Campylobacter* and level of contamination

Food Animal	Source	No. Sampled	Percent Positive	Concentration[1] MPN/cm^2	Year[2]	Ref
Cattle						
Slaughterhouse	Carcass (Strs[4] & Heifers)	2064	4	0.1 (CI NA)[3]	1992-3	106
Slaughterhouse	Carcass (Cows & Bulls)	2109	10	0.1 (CI 0.1- 0.2)	1993-4	105
Slaughterhouse	Ground Beef[5]	562	0	NA	1993-4	107
Swine						
Slaughterhouse	Carcasses	2,112	32	0.1 (CI 0.08-0.13)	1995-6	108
Broiler Chickens						
Slaughterhouse	Carcasses	1297	88	4.4 (CI 3.8-5.1)	1994-5	104
Processing Plant	Grd. Chicken[6]	283	60	4.8 (CI 4.0-5.7)	1995	109
Turkeys						
Slaughterhouse	Carcasses	1221	90	0.18 (CI 0.16-0.20)	1996-7	111
Slaughterhouse	Ground Turkey[7]	295	25	2.8 (CI 0.42-18.52)	1995	110

[1]MPN-Most Probable Number indicates most likely level of contamination, not actual level because enrichment steps were required to isolate *Campylobacter*. Carcass units are MPN/cm^2 and ground product units are MPN/g.
[2] These studies are nationally representative and well designed, more recently conducted surveys were not available.
[3] Strs=Steers, CI- 95% Confidence Interval
[4] Not applicable
[5] Sampling period omitted sampling between March through August
[6] Grd=Ground, Sampling period omitted collection between June through September.
[7]Sampling period omitted collection between March through and September.

ASSUMPTION: The incidence rates for culture-confirmed *Campylobacter* infections in the FoodNet catchment are representative of incidence rates for culture-confirmed *Campylobacter* infections in the U. S.

For 1998, $n_{FN} = 20,723,982$



For 1999, n_{FN} = 25,859,311

<u>1.3</u> (o_{ej} , o_{ij}) – <u>Expected observable FoodNet enteric/invasive disease by site {j}</u>

Culture-confirmed cases of campylobacteriosis represent only a fraction of all *Campylobacter* illnesses. The majority of persons with *Campylobacter* illnesses do not seek care and most patients who do seek care are not asked and do not submit specimens for culture (70).

(o_{ej}) – Expected o*bserved FoodNet* ***enteric*** *cases of Campylobacter by site*
FoodNet reported the number of laboratory-confirmed isolations from stools submitted by persons ill and visiting a health care provider. A FoodNet case is defined as an isolation of *Campylobacter* from a catchment area resident without an isolation in the preceding 12 months.

Table 1.3 Total number of enteric cases of *Campylobacter* by FoodNet site, 1998 and 1999

Year	CA[1]	CT	GA	MD	MN	NY	OR	Total
1998	780	595	460	240	998	221	691	3985
1999	685	553	715	156	782	356	586	3833

[1]CA-California, CT-Connecticut, GA-Georgia, MD-Maryland, MN-Minnesota, NY-New York, OR-Oregon

For 1998, the total number of enteric cases of *Campylobacter* was 3985. For 1999, the total number observed was 3833. Uncertainty distributions for the numbers of expected observable reportable cases, o_{ej}, where j is the index for site, were modeled as Gamma distributions with $o\blacksquare_{ej}$, the actual observed number of enteric cases of *Campylobacter*, as input. This was done for the data for each year.

o_{ej} = Gamma($o\blacksquare_{ej}$, 1).

(o_{ij}) – *Expected Observable FoodNet* ***invasive*** *cases of Campylobacter by site*
Invasive *Campylobacter* infections were ascertained in FoodNet as an isolation of *Campylobacter* from blood, cerebrospinal fluid (CSF), or other normally sterile site. Invasive isolations represent approximately 1.0% of all culture-confirmed *Campylobacter* cases and the vast majority are bloodborne infections (19, 20, 21, 95).

DISCUSSION: It is not precisely known the completeness of ascertainment of invasive *Campylobacter* infections. However, because persons with invasive *Campylobacter* infections will be moderately to severely ill, it is likely that most of these patients will seek care and the cases reported.

Little is known about the completeness of ascertainment of invasive campylobacteriosis. We do not know the frequency with which laboratories are requested to test blood, CSF or other sterile specimens for *Campylobacter*, and we do not know the sensitivity of the diagnostic tests used for isolation from blood and other sterile sites. The lack of this information may result in an underestimate of actual invasive disease rates. However, an increase in isolation of specimens classified as invasive is unlikely to have much impact on the overall number of cases of campylobacteriosis in the U.S. because the currently ascertained proportion of invasive cases is approximately 1.0% of all confirmed cases, and most cases are likely to seek care.

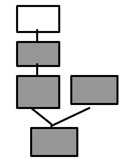
ASSUMPTION: All invasive campylobacteriosis cases seek care, have a specimen collected that yields *Campylobacter*, and are ascertained by FoodNet.

DATA GAP: Data are not available describing rates or cases of invasive disease seeking care, requests for diagnostic tests, and the sensitivity of diagnostic procedures, such as blood culture.

Table 1.4 Total number of invasive cases of *Campylobacter* by FoodNet Site, 1998 and 1999

Year	CA[1]	CT	GA	MD	MN	NY	OR	Total

Nominal mean *Campylobacter* culture confirmed cases reportable to health department



1998	10	8	9	8	6	0	2	43
1999	11	11	8	10	3	2	6	51

[1]CA-California, CT-Connecticut, GA-Georgia, MD-Maryland, MN-Minnesota, NY-New York, OR-Oregon

For 1998, the total number of observed invasive cases of *Campylobacter* was 43. For 1999, the total number was 51. Uncertainty distributions for the expected numbers of observable reportable cases, o_{ij}, where j is the index for site, were modeled as Gamma distributions with o■$_{ij}$, the actual observed number of invasive cases of *Campylobacter*, as input[1]. This was done for the data for each year.

o_{ij} = Gamma(o■$_{ij}$, 1).

<u>1.4</u> (λ_e) and (λ_i) - <u>Expected observed enteric/invasive disease in U.S.</u>

The number of enteric and invasive infections in the FoodNet catchment sites that are observed is affected by random chance. The true measure of the health burden is the mean number of observations we would see if we were able to repeat each year many times. The confirmed cases of *Campylobacter* are rare events when compared to the population size, so it is reasonable to assume that the frequency of confirmed cases is a Poisson process. In this case, the mean number of observations are the Poisson means l_i and l_e for invasive and enteric infections respectively.

(λ_e and λ_e) *Nominal mean **enteric** and **invasive** Campylobacter culture confirmed infections reportable to health department*

The FoodNet sites cover only (n_{FN} / n_{US}) of the population, so estimates of the mean number of cases that would apply to the population are calculated by dividing the sum of the modeled FoodNet mean observable cases by this fraction. That is,

$$l_e = \frac{n_{US}}{n_{FN}} \sum_j \text{Gamma}\left(o_{ej}\right)$$

and

$$l_i = \frac{n_{US}}{n_{FN}} \sum_j \text{Gamma}\left(o_{ij}\right).$$

<u>1.5</u> (p_b) - <u>Proportion of culture confirmed enteric infections with bloody diarrhea</u>

The proportion of culture-confirmed enteric infections with patients reporting bloody diarrhea was calculated from the *Campylobacter* Case Control study for each FoodNet site (CA=18.2% (2/11), CT=40.2% (70/174), GA=53.6% (15/28), MD=47.6% (10/21), MN=49.1% (113/230), NY=50.8% (32/63), OR=54.6% (6/11) and weighted by catchment site population (18). The estimate weighted by catchment population was 46.2%, and the crude estimate was 46.1%. See Table 1.5.

[1] One exception occurred for NY in 1998 where there were no reported invasive cases. The uncertainty distribution for o_{ij} in that case was taken to be –ln(Beta(2,1) because a Gamma(0,1) model is not possible.

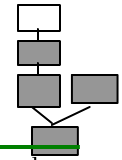


Table 1.5. Catchment populations and cases reporting blood in their stools. (*Campylobacte*r Case Control Study)

Site j	Catchment population	Weighting Fraction W_j	Number for whom response was known A_j	Number who had bloody diarrhea B_j
CA	2,146,096	0.103556	11	2
CT	3,274,069	0.157985	174	70
GA	3,746,059	0.18076	28	15
MD	2,444,280	0.117945	21	10
MN	4,725,419	0.228017	230	113
NY	1,106,085	0.053372	63	32
OR	3,281,974	0.158366	11	6
Total	20,723,982	1	538	248

The FoodNet data for reporting blood in the stool was used as follows to determine an estimate for p_b:

$$p_b = \sum_j W_j * Beta(B_j + 1, A_j - B_j + 1)$$

where W_j is the weight for site j (site j size divided by total catchment size), B_j is the site-specific number of cases reporting bloody diarrhea and A_j is the site-specific number of cases providing a response to whether blood had been observed in their stools. The Beta distribution is used here to describe the uncertainty about a proportion, as explained in Appendix A. Each of the summed Beta distributions is approximately normally distributed because there are reasonably large samples (94) and because the Beta distributions are centered at values near 0.5 (i.e. B_j/A_j are approximately 0.5). The distribution of p_b can thus be approximated by first replacing each Beta distribution with a Normal:

$$Beta(B_j + 1, A_j - B_j + 1) \approx Normal(m_j, s_j)$$

where

$$m_j = \frac{B_j + 1}{A_j + 2} \text{ and } s_j = \sqrt{\frac{(B_j + 1)(A_j - B_j + 1)}{(A_j + 2)^2 (A_j + 3)}}$$

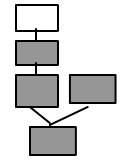
and then noting the identity:

$$p_b \approx \sum_j W_j * Normal(m_j, s_j) = Normal\left(\sum_j W_j m_j , \sqrt{\sum_j (W_j s_j)^2} \right)$$

<u>1.6</u> ($\lambda 1_n$, $\lambda 1_b$, $\lambda 1_i$) - <u>Nominal mean number of *Campylobacter* culture confirmed enteric infections in the FoodNet catchment area with self reported bloody and non-bloody diarrhea and the nominal mean number of culture confirmed invasive infections in the catchment reportable to health department</u>

These enteric infection parameters are calculated by multiplying the nominal observed mean enteric infections in the population by the probabilities a case will report visible blood in the diarrhea p_b and $(1-p_b)$ the probability of reporting no visible blood in the diarrhea respectively. The number of invasive cases is not subdivided, thus:

$\lambda 1_b = \lambda_e * p_b$



$\lambda 1_n = \lambda_e *(1- p_b)$
$\lambda 1_i = \lambda_i$

In mathematical terms, $\lambda 1_b$ and $\lambda 1_n$ are the mean values (intensities) of Poisson distributions and p_b has been interpreted as the probability that an individual contracting campylobacteriosis will report visibly bloody stools. An alternative interpretation of p_b would be the predictably constant fraction of the population contracting campylobacteriosis that would report visibly bloody stools because of some mechanism. The approach used in this model allows for greater variability in the observable incidence of bloody diarrhea and, therefore, produces greater uncertainty in our estimates of the mean incidence.

1.7 (**$\lambda 1_T$**) - Nominal total mean number of *Campylobacter* culture confirmed cases reportable to health department in the FoodNet catchment area

The total number of reportable cases is the sum of the reportable cases of the three types, enteric non-bloody, enteric bloody, and invasive. The parameter for the nominal total mean is modeled as the sum of the parameters for numbers of reportable cases of the three types.

$\lambda 1_T = \lambda 1_n + \lambda 1_b + \lambda 1_i$.

$\lambda 1_T$ was modeled for 1998 and for 1999. The results are displayed here.

Year	Model output	5th percentile	Mean	95th percentile
1998	$\lambda 1_T$	51,160	52,533	53,912
1999	$\lambda 1_T$	39,879	40,957	42,044
Difference (99-98)			-11,576	

Section 1 Summary

The model predicts that in 1999 there was a mean estimate of 21,630 reportable cases of campylobacteriosis with non-bloody diarrhea with a 5th percentile estimate of 19,393 and a 95th percentile estimate of 23,913 in the FoodNet catchment area. In 1999 there was a mean estimate of 18,789 reportable cases with bloody diarrhea with a 5th percentile estimate of 16,570 and a 95th percentile estimate of 21,071 and a mean estimate of 538 confirmed invasive disease cases with a 5th percentile estimate of 420 and a 95th percentile estimate of 668 in the catchment. Relative contributions of the various components of the model to the total model uncertainty will be presented in Section 5, Sensitivity Analysis. The total sum of non-bloody, bloody and invasive cases and their distributions are shown in the table above.

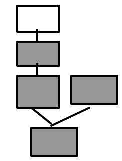


Table 1.6. 1998 and 1999 FoodNet active surveillance for *Campylobacter* from culture confirmed cases

Site	Catchment Population Estimate		Enteric Cases		Invasive Cases	
	1998	1999	1998	1999	1998	1999
CA	2,146,096	2,162,359	780	685	10	11
CT	3,274,069	3,282,031	595	553	8	11
GA	3,746,059	7,788,240	460	715	9	8
MD	2,444,280	2,450,566	240	156	8	10
MN	4,725,419	4,775,508	998	782	6	3
NY	1,106,085	2,084,453	221	356	0	2
OR	3,281,974	3,316,154	691	586	2	6
Totals for Catchment	20,723,982	25,859,311	3985	3833	43	51