

Background Population Exposure Estimates Using *E. coli* O157 Case Interviews

INTRODUCTION/INTENDED USE

The following data comprise exposure frequencies for sporadic culture-confirmed *Escherichia coli* O157 cases that occurred in Minnesota from 2011 through 2018. Cases were interviewed with a detailed questionnaire about exposures that occurred in the 7 days prior to their illness onset (<http://mnfoodsafetycoe.umn.edu/wp-content/uploads/2014/02/Salmonella-and-STEC-Interview-Form.pdf>).

Epidemiologists can use these frequencies to estimate the background exposure rate in the population for a particular food item or other exposure and then use this estimate in a binomial model comparison which is available in Epi Info 7 under StatCalc or as an excel spreadsheet at (<https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Outbreaks/Gastroenteritis/Pages/Outbreak-Investigation-Tools.aspx#binomial>). This can be useful to quickly evaluate potential hypotheses during the hypothesis generation phase of an investigation prior to conducting a more resource-intensive study method like a case-control study. Cases that were not interviewed, cases who reported international travel within the week prior to illness onset, and outbreak-associated cases, regardless of the transmission route, were not included in these data.

Epidemiologists should carefully consider any potential biases arising from the use of *E. coli* O157 case exposure information to estimate background population exposure rates. Using *E. coli* O157 cases to estimate the background exposure rate in the population will likely introduce bias toward the null hypothesis when evaluating exposures that are risk factors for *E. coli* O157. For example, the percentage of sporadic *E. coli* O157 cases that were exposed to a known *E. coli* O157 risk factor such as ground beef is potentially higher than the true background rate of exposure to ground beef in the population. Epidemiologists should also consider if the food item under evaluation has seasonal consumption patterns, or if consumption of the food varies by gender or age.

Another potential source for background exposure data is the FoodNet Population Survey Atlas of Exposures, 2006-2007 (http://www.cdc.gov/foodnet/surveys/FoodNetExposureAtlas0607_508.pdf).

For more specific exposure food frequencies to match the demographics of your current investigation, please contact Joshua.rounds@state.mn.us

DAIRY

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Eggs	546	63%	67%	65%	61%	61%	68%	60%	70%	64%	59%	67%	77%	75%
Shredded cheese	529	55%	61%	55%	54%	58%	57%	36%	57%	54%	54%	62%	N/A	N/A
Processed cheese slices	555	36%	41%	31%	42%	35%	37%	36%	30%	38%	36%	31%	57%	51%
Block cheese	583	17%	20%	17%	17%	16%	19%	18%	24%	17%	16%	15%	62%	61%
String cheese	569	20%	24%	24%	14%	27%	14%	8%	27%	20%	19%	12%	21%	16%
Cheese curds	598	9%	9%	9%	8%	9%	10%	3%	3%	11%	7%	5%	N/A	N/A
Queso fresco or other Mexican style cheese	595	3%	4%	3%	3%	4%	3%	2%	5%	4%	3%	0%	4%	6%
Gourmet cheese (gouda, blue, other cow, goat or sheep cheeses)	590	7%	9%	8%	7%	4%	11%	10%	9%	4%	11%	8%	N/A‡	N/A‡
Ice cream	541	45%	50%	45%	45%	52%	37%	43%	41%	52%	43%	16%	63%	59%
Frozen dessert treats	571	15%	20%	16%	14%	24%	8%	5%	10%	21%	13%	3%	N/A	NA
Yogurt	570	45%	48%	49%	40%	53%	36%	44%	49%	42%	48%	42%	45%	43%
Milk	605	80%	80%	77%	83%	94%	64%	74%	84%	80%	78%	79%	85%	79%
Unpasteurized milk	601	3%	3%	2%	3%	3%	2%	3%	2%	3%	3%	5%	2%	3%
Milk alternatives (soy, almond, rice milk)	591	11%	12%	14%	8%	7%	15%	15%	8%	12%	11%	13%	N/A	N/A
Other dairy (cottage cheese, cream cheese, sour cream)	546	30%	36%	34%	26%	26%	37%	23%	30%	30%	30%	32%	N/A‡	N/A‡

‡ Please refer to pages 13-15 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

MEAT / POULTRY / SEAFOOD

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Ground beef	547	67%	70%	62%	71%	69%	68%	48%	68%	71%	61%	61%	52%‡	40%‡
Other beef (steak)	555	30%	36%	27%	33%	25%	37%	28%	22%	30%	36%	22%	50%	46%
Meat from Hunting, private kill, live animal market, butcher shop	594	34%	34%	35%	32%	37%	32%	25%	45%	33%	30%	29%	N/A‡	N/A‡
Chicken (including ground)	546	74%	76%	75%	72%	74%	77%	61%	65%	76%	74%	74%	63%‡	65%‡
Stuffed chicken product	590	1%	2%	1%	2%	2%	1%	0%	0%	1%	1%	2%	N/A	N/A
Turkey (including ground)	561	25%	30%	23%	28%	24%	28%	22%	25%	24%	27%	24%	20%‡	22%‡
Pork (ham, bacon)	539	53%	58%	48%	58%	52%	53%	57%	48%	57%	49%	51%	49%‡	43%‡
Lamb	594	3%	4%	4%	3%	4%	3%	3%	2%	2%	5%	7%	3%	6%
Sausage	562	31%	36%	29%	34%	38%	27%	19%	22%	35%	32%	23%	29%‡	27%‡
Other meat/poultry	589	13%	15%	9%	17%	13%	14%	7%	9%	13%	15%	5%	N/A‡	N/A‡
Fish	571	20%	24%	20%	19%	17%	22%	25%	20%	21%	17%	23%	14%	23%
Shrimp	574	8%	11%	8%	8%	6%	10%	11%	6%	8%	9%	10%	24%	28%
Other seafood	590	2%	3%	3%	2%	1%	4%	5%	1%	4%	1%	2%	N/A‡	N/A‡

‡ Please refer to pages 16-19 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

FROZEN FOODS

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Frozen dinners/entrees	573	10%	13%	10%	10%	9%	11%	10%	11%	8%	11%	18%	27%	28%
Frozen pizza	504	31%	42%	29%	33%	36%	32%	9%	31%	32%	31%	29%	41%	25%
Other frozen microwaveable foods	561	12%	17%	12%	12%	14%	11%	7%	6%	15%	11%	17%	N/A‡	N/A‡

‡ Please refer to page 25 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

FRUITS

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Oranges	577	17%	20%	19%	15%	20%	15%	15%	20%	17%	14%	27%	49%	45%
Other citrus (grapefruit, lemon, lime, tangerine)	581	13%	16%	15%	11%	11%	14%	21%	23%	12%	10%	20%	N/A‡	N/A‡
Pears	582	11%	14%	13%	9%	16%	7%	8%	15%	10%	11%	10%	21%	20%
Apples	552	50%	54%	47%	53%	57%	45%	37%	41%	45%	57%	62%	65%	62%
Other tree fruit (apricot, plum, nectarine, peach)	574	18%	21%	18%	17%	21%	12%	27%	8%	23%	17%	13%	N/A‡	N/A‡
Strawberries	558	40%	45%	44%	36%	44%	37%	38%	35%	52%	32%	13%	46%	45%
Other berries (blue, black, raspberries)	558	27%	32%	31%	22%	26%	24%	45%	24%	33%	24%	12%	N/A‡	N/A‡
Grapes	559	42%	46%	44%	38%	49%	34%	40%	35%	46%	42%	26%	N/A‡	N/A‡
Bananas	553	57%	60%	57%	57%	61%	50%	68%	60%	56%	61%	49%	76%	70%
Watermelon	576	25%	28%	26%	24%	32%	19%	18%	9%	39%	17%	2%	27%	28%
Cantaloupe	578	13%	16%	15%	11%	13%	12%	21%	15%	14%	14%	5%	32%	32%
Honeydew or other melon	588	4%	6%	4%	4%	5%	4%	2%	1%	5%	4%	3%	14%	16%
Other fruit (pomegranate, kiwi, mango, pineapple)	583	19%	21%	21%	16%	19%	20%	13%	17%	18%	20%	24%	N/A‡	N/A‡
Unpasteurized apple cider	589	0.2%	0.5%	0%	0.4%	0%	0.4%	0%	0%	0%	0.5%	0%	3%	4%
Other unpasteurized juice	590	1%	2%	1%	1%	1%	1%	0%	1%	1%	2%	0%	N/A‡	N/A‡
Other juice	549	48%	52%	47%	50%	56%	41%	38%	57%	47%	48%	41%	N/A‡	N/A‡

‡ Please refer to pages 11-12 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

VEGETABLES

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Prepackaged salad	551	22%	29%	24%	20%	16%	30%	23%	21%	21%	24%	29%	37%	39%
Iceberg	547	28%	34%	27%	28%	20%	35%	37%	28%	28%	29%	20%	44%	46%
Romaine	544	24%	30%	28%	19%	14%	33%	36%	17%	24%	27%	25%	39%	47%
Other lettuce/leafy greens (red leaf, radicchio, mesclun, endive)	579	10%	12%	11%	7%	6%	14%	10%	8%	9%	10%	12%	N/A‡	N/A‡
Spinach	579	16%	19%	18%	13%	8%	23%	22%	18%	13%	18%	17%	20%	24%
Cabbage	579	10%	13%	9%	11%	6%	13%	19%	13%	9%	11%	5%	23%	28%
Tomatoes	564	41%	45%	45%	37%	29%	50%	66%	39%	38%	48%	39%	49%	60%
Cucumbers	574	24%	27%	31%	16%	19%	28%	38%	20%	25%	25%	24%	39%	47%
Peppers (green, yellow, red, jalapeno, serrano)	570	25%	29%	27%	22%	17%	32%	31%	26%	24%	25%	28%	N/A‡	N/A‡
Asparagus	583	7%	9%	6%	7%	4%	10%	5%	10%	6%	7%	5%	18%	21%
Celery	570	14%	18%	17%	12%	11%	18%	20%	22%	13%	14%	11%	43%	42%
Carrots	545	47%	52%	47%	46%	46%	44%	59%	52%	40%	54%	53%	N/A‡	N/A‡
Radishes	591	4%	5%	4%	4%	2%	5%	15%	5%	5%	3%	2%	N/A	N/A
Pea pods/snap peas	578	10%	12%	10%	10%	10%	10%	7%	2%	10%	11%	13%	N/A	N/A
Onions (red, white, yellow)	554	43%	47%	45%	40%	31%	54%	55%	47%	41%	44%	42%	67%	71%
Green onions/scallions	581	7%	9%	8%	5%	5%	7%	15%	7%	8%	4%	3%	23%	30%
Broccoli	560	24%	29%	22%	26%	25%	23%	24%	27%	23%	25%	21%	45%	53%
Cauliflower	576	11%	13%	11%	10%	9%	12%	18%	12%	10%	10%	13%	25%	23%
Sprouts (alfalfa, bean, radish, clover)	588	3%	3%	3%	2%	2%	3%	0%	3%	2%	3%	2%	N/A‡	N/A‡
Micro greens	484	0.2%	0.4%	0%	0.5%	0.4%	0%	0%	0.7%	0%	0%	0%	N/A	N/A
Cilantro/parsley	573	11%	10%	13%	8%	9%	15%	5%	7%	12%	8%	22%	N/A‡	N/A‡
Other fresh herbs (basil, thyme, mint, sage)	586	9%	10%	8%	9%	7%	11%	7%	9%	11%	6%	3%	N/A‡	N/A‡
Other vegetables	559	27%	30%	29%	24%	28%	26%	28%	18%	32%	25%	23%	N/A‡	N/A‡

‡ Please refer to pages 7-10 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

OTHER

Food Item	Denominator	Overall %	Overall % (including maybe)	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter	Pop Survey MN	Pop Survey National
Mushrooms	568	13%	16%	13%	13%	9%	18%	12%	11%	12%	13%	18%	30%	34%
Tofu	594	2%	2%	1%	3%	1%	3%	0%	2%	2%	2%	0%	4%	7%
Hummus or tahini	586	7%	8%	7%	7%	4%	13%	2%	6%	7%	6%	15%	N/A	N/A
Nuts (almonds, pecans, walnuts, peanuts, cashews)	556	34%	38%	35%	33%	23%	42%	55%	35%	36%	29%	39%	N/A‡	N/A‡
Sesame seeds	588	4%	4%	3%	4%	3%	4%	2%	3%	4%	3%	2%	N/A	N/A
Other seeds (flax, sunflower, alfalfa)	571	11%	15%	10%	13%	9%	13%	16%	8%	12%	10%	17%	N/A‡	N/A‡
Salsa	565	21%	25%	21%	21%	15%	29%	18%	18%	21%	21%	23%	29%	28%
Avocado	577	17%	20%	19%	14%	12%	25%	10%	16%	18%	18%	13%	16%	27%
Recently purchased spices (black pepper, white pepper, paprika, oregano, cumin)	577	15%	18%	16%	15%	14%	17%	17%	27%	17%	8%	10%	N/A	N/A
Spice rubs or blends	575	9%	12%	10%	7%	10%	9%	7%	13%	9%	7%	10%	N/A	N/A
Peanut butter	552	57%	60%	59%	54%	62%	50%	53%	57%	54%	58%	70%	65%	58%
Chocolate	522	46%	52%	47%	44%	47%	47%	33%	58%	45%	39%	52%	N/A	N/A
Trail mix	578	13%	14%	12%	14%	12%	16%	10%	12%	16%	10%	7%	N/A	N/A
Chips, crackers, snack foods	541	75%	77%	72%	77%	83%	68%	62%	77%	76%	70%	82%	N/A‡	N/A‡
Nutritional supplements	583	25%	25%	27%	22%	20%	27%	38%	24%	23%	28%	25%	N/A	N/A

‡ Please refer to pages 7-10 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

RESTAURANTS‡

(Note: Cases were not asked specifically about these restaurants by name. Cases were asked if they ate at a restaurant in the 7 days prior to illness onset. If the case reported eating at a restaurant, the case was asked to name the restaurant.)

Restaurant Name	Denominator	Overall %	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter
Applebee's	607	3%	5%	1%	2%	4%	3%	1%	3%	4%	7%
Arby's	607	1%	1%	1%	1%	2%	2%	0%	1%	2%	0%
Burger King	607	4%	3%	5%	5%	3%	2%	8%	4%	2%	0%
Buffalo Wild Wings	607	1%	1%	2%	1%	2%	0%	2%	1%	3%	0%
Chili's	607	1%	1%	0%	1%	1%	0%	0%	0%	2%	0%
Chipotle	607	3%	4%	1%	2%	4%	0%	1%	3%	2%	7%
Culver's	607	2%	2%	3%	2%	3%	2%	1%	3%	3%	0%
Dairy Queen	607	5%	5%	6%	7%	4%	2%	8%	6%	3%	2%
Denny's	607	0.3%	0.3%	0.4%	0%	0.4%	2%	1%	0%	0.5%	0%
Domino's Pizza	607	1%	0.3%	1%	1%	0.4%	0%	1%	1%	0.5%	0%
IHOP	607	0.3%	0.3%	0.4%	0.3%	0%	2%	1%	0%	0%	2%
Jimmy John's	607	1%	1%	1%	0.3%	2%	0%	0%	2%	0%	2%
KFC	607	1%	1%	1%	0%	1%	3%	1%	1%	1%	0%
McDonalds	607	18%	17%	18%	20%	17%	8%	15%	20%	18%	10%
Noodles and Company	607	0.2%	0.3%	0.0%	0.3%	0%	0%	0%	0.4%	0%	0%
Olive Garden	607	1%	1%	1%	1%	1%	2%	0%	1%	1%	0%
Outback Steakhouse	607	0.3%	0.6%	0%	0.3%	0.4%	0%	0%	0.4%	0.5%	0%
Papa John's Pizza	607	1%	1%	1%	1%	0%	0%	1%	1%	0.5%	0%
Panera	607	1%	1%	1%	1%	1%	0%	1%	0%	1%	5%
Perkins	607	2%	2%	2%	3%	0.4%	6%	0%	2%	2%	7%
Pizza Hut	607	1%	1%	1%	2%	0.4%	0%	0%	1%	1%	0%
Popeye's	607	0.2%	0%	0.4%	0%	0.4%	0%	1%	0%	0%	0%
Subway	607	7%	8%	7%	8%	6%	5%	3%	8%	9%	0%
Taco Bell	607	2%	2%	3%	2%	3%	0%	1%	3%	1%	2%
Taco John's	607	2%	2%	3%	1%	2%	6%	0%	3%	3%	0%
Red Lobster	607	0.3%	0.3%	0.4%	0%	1%	0%	0%	0.4%	0.5%	0%
Wendy's	607	1%	1%	2%	1%	1%	2%	1%	2%	1%	0%

‡ Please refer to page 26 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. The population survey did not include restaurant names but does have data of types of foods consumed at commercial establishments.

OTHER NON-FOOD TRANSMISSION ROUTES‡

Exposure	Denominator	Overall %	Female	Male	Age: <18	Age: 18 – 65	Age: >65	Spring	Summer	Fall	Winter
International Travel	719	7%	7%	7%	2%	13%	4%	16%	3%	4%	21%
Ill contact before onset	610	13%	15%	10%	18%	9%	6%	15%	14%	9%	17%
Well water	607	33%	35%	31%	37%	30%	29%	35%	37%	30%	21%
Other water (such as from a stream while camping)	604	5%	5%	5%	7%	3%	3%	2%	8%	3%	0%
Recreational water (swim in ocean, lake, river, or pool)	618	23%	22%	25%	36%	11%	12%	8%	38%	10%	17%
Live on Farm	609	14%	15%	13%	17%	12%	11%	16%	15%	13%	9%
Work on Farm	605	2%	2%	2%	1%	3%	0%	1%	3%	2%	0%
Visit Farm	610	14%	14%	15%	21%	8%	8%	18%	18%	8%	7%
Visit petting zoo, educational exhibit, fair or other venue with animals	615	13%	13%	13%	18%	8%	5%	7%	16%	13%	0%
Cow (present)	615	25%	25%	25%	35%	16%	12%	23%	30%	21%	12%
Cow (contact)	615	11%	12%	9%	15%	7%	3%	12%	13%	9%	2%
Goat (present)	615	9%	8%	9%	12%	7%	2%	4%	12%	7%	2%
Goat (contact)	615	5%	5%	4%	6%	3%	2%	2%	7%	4%	0%
Sheep (present)	615	7%	7%	8%	10%	6%	2%	1%	10%	7%	0%
Sheep (contact)	615	3%	2%	4%	5%	2%	2%	0%	4%	4%	0%
Pig (present)	615	8%	8%	8%	11%	6%	5%	2%	9%	11%	0%
Pig (contact)	615	3%	4%	3%	5%	3%	0%	1%	4%	5%	0%
Chicken (present)	615	10%	10%	10%	14%	7%	3%	9%	13%	8%	2%
Chicken (contact)	615	5%	4%	5%	8%	2%	0%	5%	7%	3%	0%
Turkey (present)	615	3%	3%	2%	3%	2%	2%	1%	3%	3%	0%
Turkey (contact)	615	0.3%	0.3%	0.4%	0.7%	0%	0%	0%	0.7%	0%	0%

‡ Please refer to pages 27-28 of the FoodNet Population Survey Atlas of Exposures, 2006-2007. Question asked by population survey may not have been compatible to MN hypothesis generating form or population survey may include additional details.

Technical Details

Exposure frequencies were calculated from *E. coli* O157:H7 case interviews from 2011-2018. Nine hundred and ninety laboratory confirmed *E. coli* O157:H7 cases were identified during that time period. Fifty-three (5%) cases were excluded because they were not interviewed. Two hundred seventeen (22%) cases that were determined to be part of a recognized outbreak were excluded. Fifty (5%) cases who reported international travel within the week prior to their illness onset were also excluded.

This left six hundred and seventy cases which were included. However, for each specific exposure if the case did not answer the question they were not included in the denominator for that exposure. Additionally, cases who reported “may have eaten” were only included in the column, “Overall % (including maybe).”