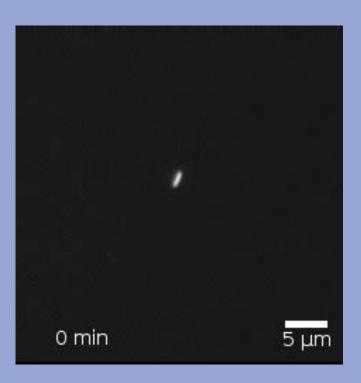
## when romaine bites back

an investigation of E.coli outbreaks

Camellia Hilker

### What is E.coli?

- Naturally found in gut
- Can cause foodborne illness
  - O O157:H7/Shiga toxin
  - No direct treatment
- Optimally grows from 35-42°C (~95-107°F)
- Reproduces fast



recent/notable E.coli outbreaks

- 2018 Romaine Lettuce
  - 210 cases
  - o O157:H7
- 2015 Chipotle Restaurants
  - 55 cases
  - o **O26**
- Beef
  - Happens periodically
  - More common in packaged ground beef



## can we predict how many illnesses will occur?

- Data from CDC website
- US Climate Data
- State stats
  - Number of restaurants in State
  - % Adults who eat fruit/veg
  - Land area
  - Population density
  - Human Development Index
- Strain specific data
  - %GC content, %Protein coding genes



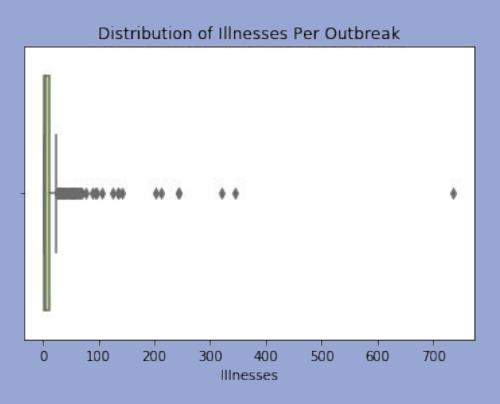
(not modeling an actual E.coli outbreak)

## How many people "usually" get sick?

Mean: 13.7

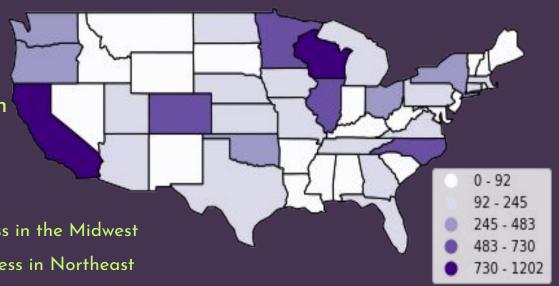
#### Outliers

- O Wisconsin 736 illnesses in 2000
  - Sizzler restaurants
- Oklahoma 344 illnesses in 2008
  - Country Cottage restaurants
- Ollinois 321 illnesses in 1999
  - Downstate Labor Day party



#### "best" model

- Keep outliers
- Lasso and log(y)
- Dummy Strain and Region
- Train and Test  $R^2 = 0.031$
- Regional differences
  - Slightly higher rate of illness in the Midwest
  - Slightly reduced rate of illness in Northeast
- Slightly higher rate of illness if strain is O157:H7



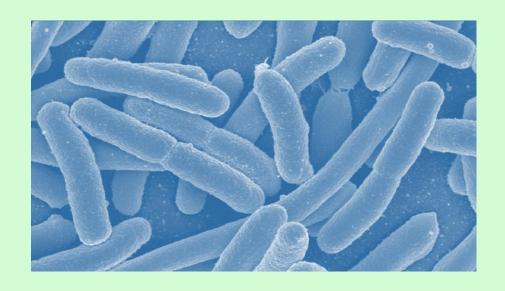
#### conclusions/future considerations

#### Better data

- Illnesses Reported vs. Actual
- FDA regulated O157:H7 in 1994
- Restaurant vs. consumer product

#### E.coli infection is unpredictable

- Proper food handling
- Weaker populations are more susceptible
- Can be transmitted from sources other than food



# appendix

Person is exposed to *E. coli* O157

Time to Illness

1-3 days

Stool sample requested

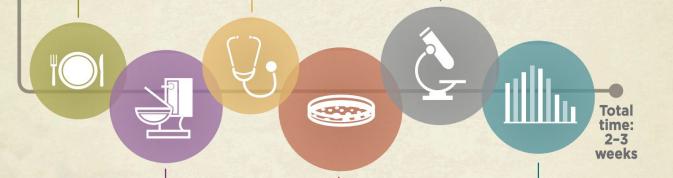
Time to Diagnosis

1-3 days

Public health lab receives *E.coli* O157 strain

Serotyping and "DNA Fingerprinting" Time

2-4 days



Person becomes ill

Time to Health Care

1-5 days

E. coli O157 identified

Shipping Time

0-7 days

Case reported as part of outbreak

llinesses -	1	-0.0081	0.031	0.0036	0.036	-0.042	0.027	-0.0094	-0.036	-0.8							
Density (Pop./ mi2) -	-0.0081	i	-0.36	0.22	-0.048	0.01	-0.067	-0.03	0.023	- 0.8	staurants		0.39	0.071	0.11	0.25	- 0.8
Landarea(mi2) <sup>-</sup>	0.031	-0.36	1	0.057	0.057	0.011	-0.028	0.012	0.02	- 0.4	%Fruit Veg Amount Restaurants	0.39	1	-0.022	0.057	-0.059	
HDI (2017)[note 1] -	0.0036	0.22	0.057	1	-0.12	-0.06	-0.027	-0.095	-0.08		%Fruit Veg	0.39	1	-0.022	0.057	-0.059	- 0.4
Average High (F) -	0.036	-0.048	0.057	-0.12	1	-0.045	-0.027	-0.02	0.014	- 0.0	ees -	0.071	-0.022		0.044	0.031	- 0.0
Length of Genome -	-0.042	0.01	0.011	-0.06	-0.045	1	0.11	0.43	0.22		Illnesses						
%GC -	0.027	-0.067	-0.028	-0.027	-0.027	0.11	1	0.27	-0.48	0.4	ow (F)	0.11	0.057	0.044	1	-0.044	0.4
tRNA Genes -	-0.0094	-0.03	0.012	-0.095	-0.02	0.43	0.27		0.62		Average Low						
%Protein Coding -	-0.036	0.023	0.02	-0.08	0.014	0.22	-0.48	0.62	1	0.8	ındarea(mi2)	0.25	-0.059	0.031	-0.044	1	0.8
	Illnesses -	Density (Pop./ mi2) –	Landarea(mi2) -	HDI (2017)[note 1] -	Average High (F) –	Length of Genome –	- 25%	tRNA Genes –	%Protein Coding –		Landar	nount Restaurant	ts %Fruit Veg	Illnesses	Average Low (F)	Landarea(mi2)	