

# Preliminary Results of an Investigation of an Outbreak of *Shigella sonnei* — Genesee and Saginaw Counties, Michigan, 2016

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# Shigellosis Investigation Team

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## Goals of the Investigation

1. Characterize the outbreak.
2. Identify risk factors for shigellosis.
3. Determine the need for further study.
4. Engage the community, incorporate input, provide updates.

## **Methods: Case Series**

- **Identified case-households**
  - **Cases reported March 1 to October 29**
  - **Michigan Disease Surveillance System**
- **Interviewed case-households**
  - **Phone interviews**
  - **Collected demographic and illness information on all household members**
  - **Identified index cases (earliest onset in HH) and secondary cases**
  - **Assessed risk factors among index cases**

## Exposures of Interest among Index Cases

- **Childcare**
- **Occupation**
- **Diaper contact**
- **Sick contacts**
- **Travel**
- **Mode of transportation**
- **Attendance of activities/events**
- **Meals outside the home**
- **Recreational water**
- **Drinking water source**
- **Household water use**
  - **Handwashing**
  - **Bathing/showering**
  - **Drinking**
  - **Food preparation**
  - **Cleaning**
- **Changes in handwashing or bathing habits**

## **Case-household Recruitment**

**115 Households with working contact information,  
83 Households interviewed,  
353 HH members,  
158 cases  
(83 index cases, 75 secondary cases)**

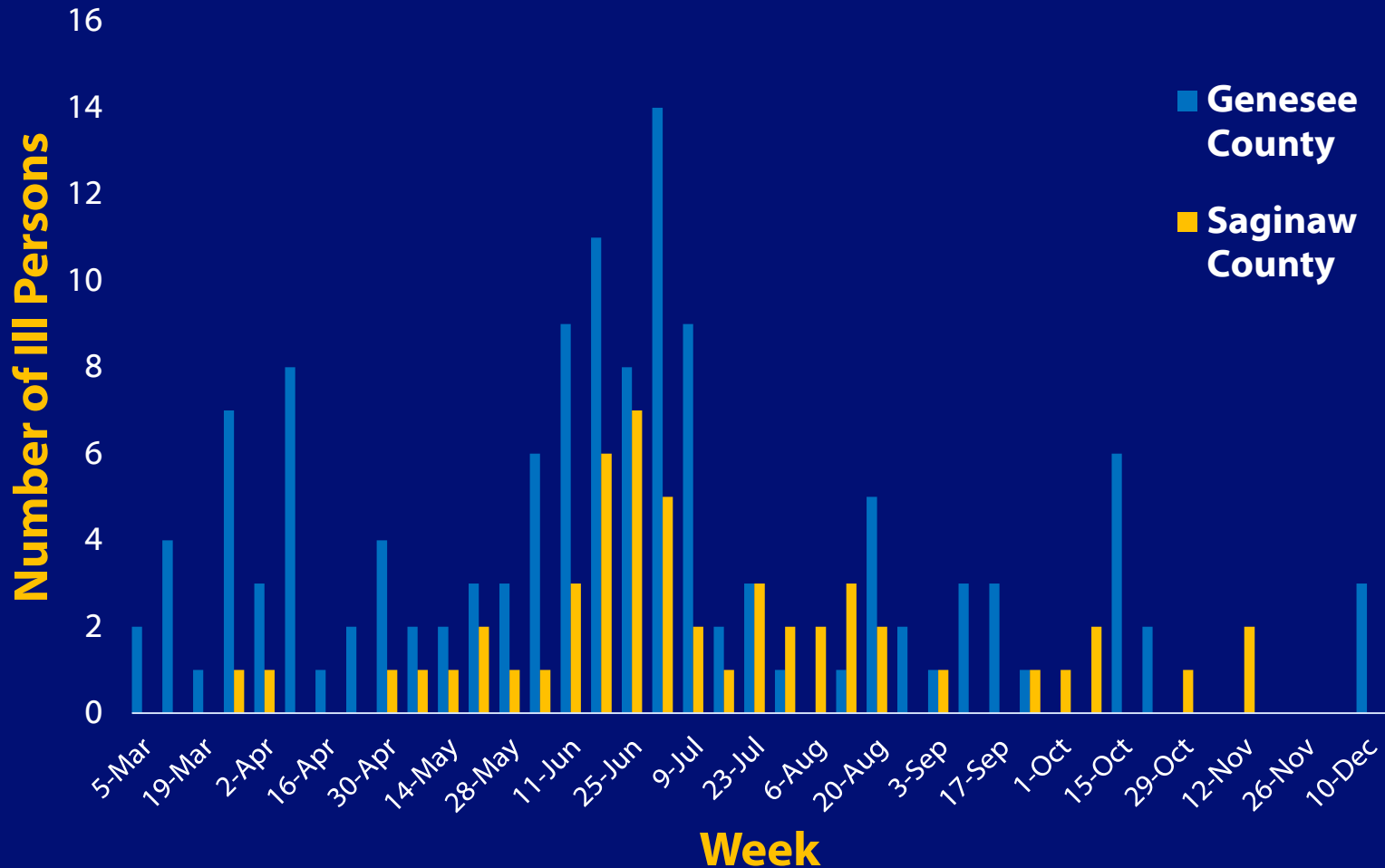
## **Methods: Laboratory and Water Data Analyses**

- **Molecular typing**
  - **Pulsed-field gel electrophoresis (PFGE)**
  - **Whole genome sequencing (WGS)**
- **Geospatial Research, Analysis, and Services Program (GRASP), ATSDR/CDC**
  - **Mapping, Spatial-temporal analysis**
    - **Cases**
    - **Water quality data from sampling**
    - **Water main breaks**
    - **Household size**
    - **Water supplies**
    - **Private wells**
    - **Flint HH water use**

# **REVIEW OF MAIN FINDINGS**



# Shigellosis cases reported to MDHHS, by week — Genesee and Saginaw Co., Michigan, Mar 1–Dec 10, 2016 (N=185)



## REVIEW OF MAIN FINDINGS

1. *Shigella* bacteria appear to have spread from person to person.

## Mean size and case count of case-households, stratified by county — Michigan, Mar-Oct 2016

	Saginaw & Genesee Co. (N=83)	Saginaw Co. (n=29)	Genesee Co. (n=54)
Mean household size			
Case-households	<b>4.3*</b>	<b>4.1*</b>	<b>4.3*</b>
General population† (ref)	2.5	2.5	2.4
Mean cases per case-household	1.9	2.0	1.8

*Households in the outbreak were larger than the average household*

\*  $P < 0.001$

† 2015 American Community Survey, 1-year estimates

## Median age of cases versus that of the general population, by county — Michigan, Mar-Oct 2016

<u>Median age (years)</u>	<u>Saginaw Co.</u>	<u>Genesee Co.</u>
Cases*	<b>12‡</b>	<b>10‡</b>
General pop. (ref)	40	39.1

*In each county, people who got sick were significantly younger than the general population.*

\* Saginaw County, n=59; Genesee County, n=99; ‡  $P < 0.0001$ ; † 2015 American Community Survey, 1-year estimates

## Median age of cases and non-ill household members — Genesee & Saginaw Co., Michigan, Mar-Oct 2016

	Median age (years)
Cases (n=158)	10*
Non-ill HH members (n=183) {ref}	23

*Cases were significantly younger than household members who didn't get sick*

\*  $P < 0.01$

## Contact with diapers, people wearing diapers, or people with diarrhea outside the home among index cases, by location — Michigan, Mar-Oct 2016

	Saginaw & Genesee Co. (N=83)	Saginaw Co. (n=29)	Genesee Co. (n=54)	Flint (n=24)
Contact with diapers* or with a person with diarrhea	68%	79%	62%	74%

*The majority of sick people either wore diapers, had contact with people who wore diapers, or had contact with a person with diarrhea outside the home.*

\* Includes diaper contact inside or outside the home

## REVIEW OF MAIN FINDINGS

2. *Shigella* bacteria did NOT appear to spread through drinking water.

## Tap water consumption among case-households, stratified by location — Michigan, Mar-Oct 2016

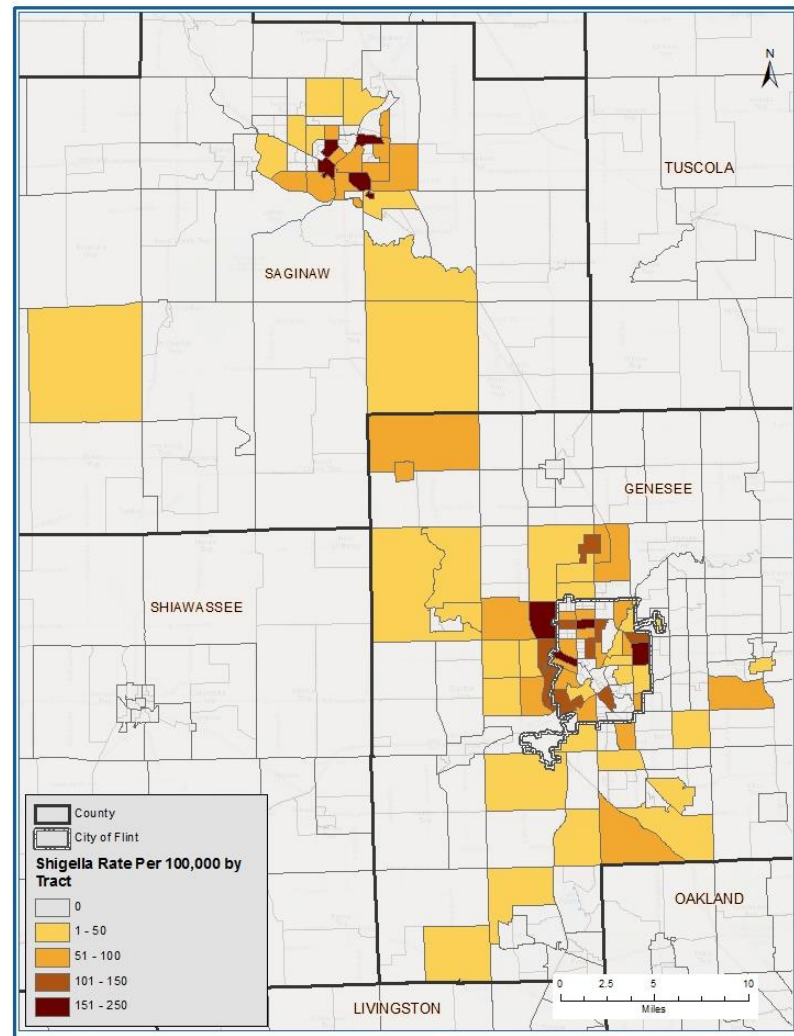
Tap water consumption*	Saginaw Co.	Genesee Co.	Flint (ref)	Greater Genesee Co.
Either filtered or unfiltered water	100%‡	50%	33%	63%‡
Unfiltered water	93%‡	20%	8%	30%‡

*Case-households from greater Genesee County and Saginaw County were significantly more likely to consume tap water than those from Flint*

\* Tap water consumption included using tap water for drinking, mixing cold drinks, or using ice made with tap water; ‡  $P < 0.05$

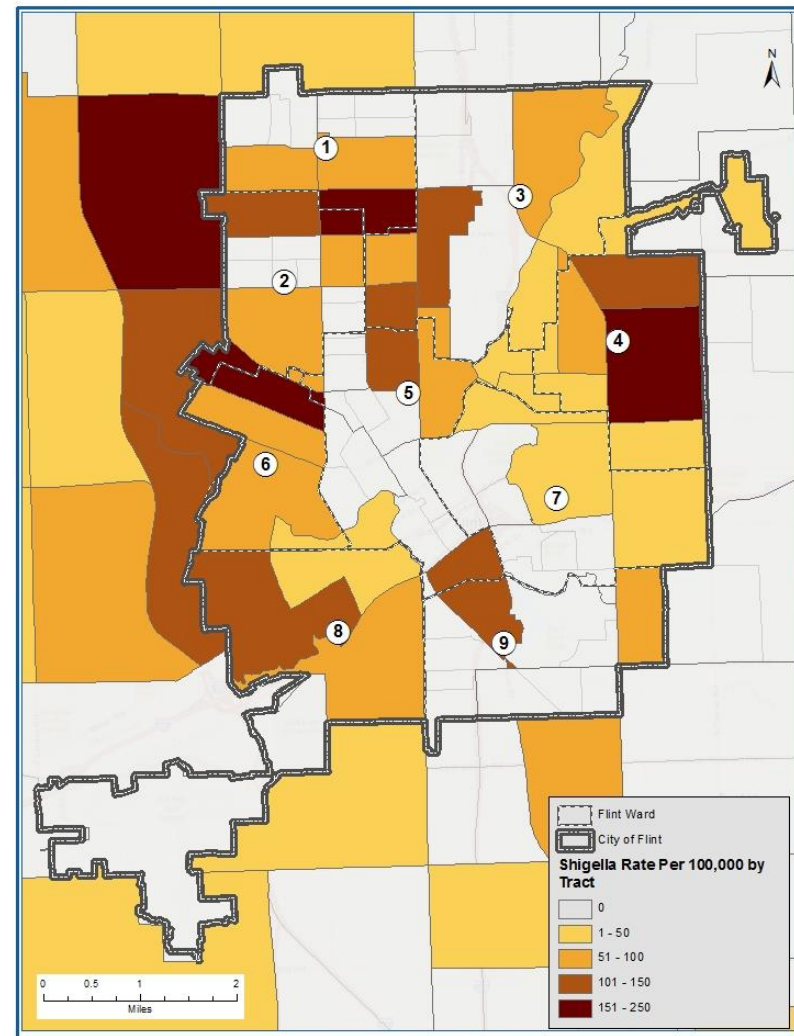


# Rate of shigellosis per Census tract as reported to MDSS — Saginaw and Genesee Counties, Michigan, Mar 1–Dec 10, 2016



\* U.S. Census Bureau; American Community Survey, 2015  
American Community Survey 5-Year Estimates by Block Group.  
Table B01001e1. Accessed 9 December 2016.

# Rate of shigellosis per City of Flint ward as reported to MDSS — Flint and surrounding Genesee County, Michigan, Mar 1–Dec 10, 2016

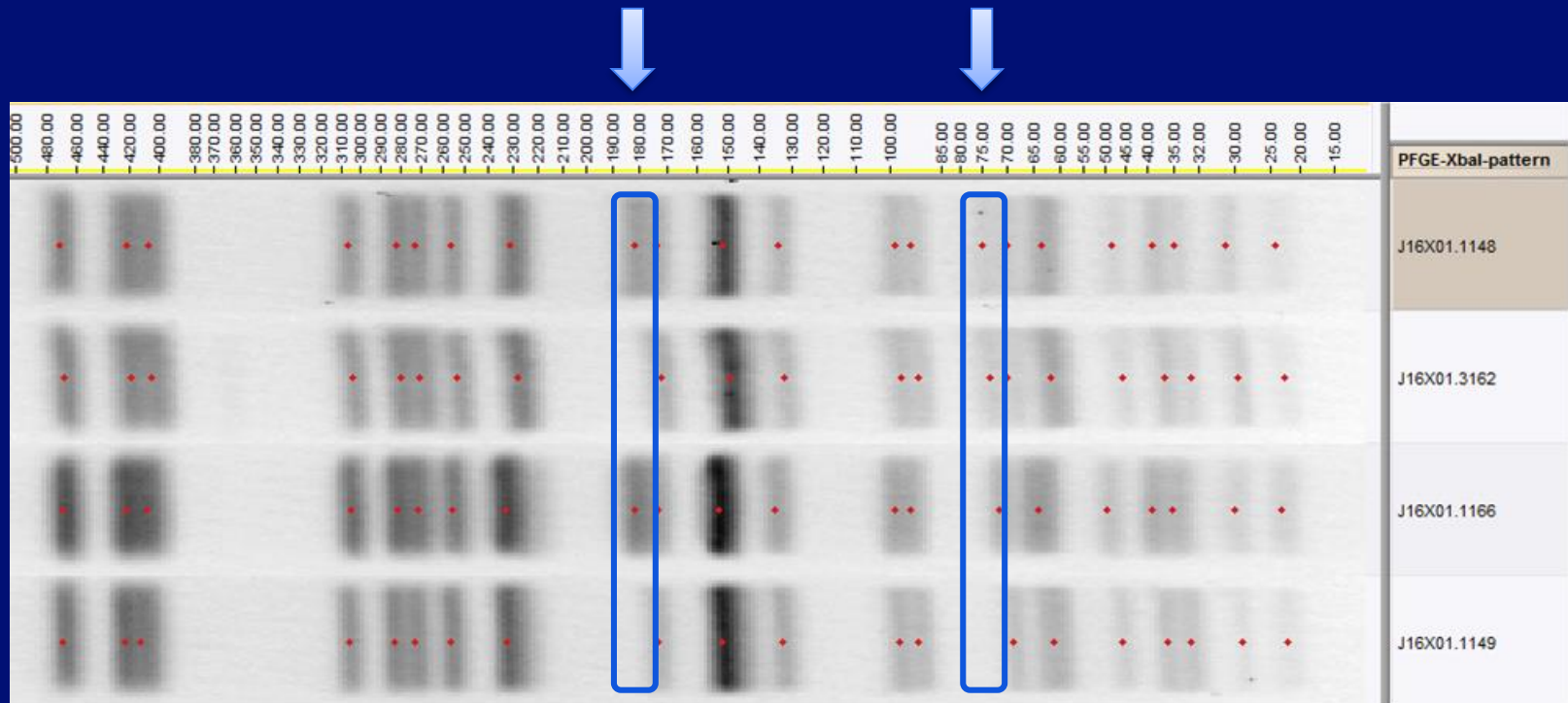


\* U.S. Census Bureau; American Community Survey, 2015  
American Community Survey 5-Year Estimates by Block Group,  
Table B01001e1. Accessed 8 December 2016.

## REVIEW OF MAIN FINDINGS

3. *Shigella* bacteria from Saginaw and Genesee counties are related to each other, suggesting they are part of the same outbreak.

# Four Closely Related PFGE Patterns Among Case-isolates from the Outbreak



Whole genome sequencing of isolates from across MI. Genesee and Saginaw are two most closely related clades (11-34 SNPs). Ingham County isolates in both these clades---suggests longer term evolution vs. point source

## Summary of Main Findings

1. *Shigella* bacteria appear to have spread from person to person.
2. *Shigella* bacteria did NOT appear to spread through drinking water.
3. *Shigella* bacteria from Saginaw and Genesee counties are related to each other, suggesting they are part of the same outbreak.

## Summary of Additional Findings

- Overall, information was collected on 158 ill people from 83 households
- Characteristics that did not differ by location:
  - Age, gender, the proportion of people who got sick in each household
- Factors that were similar across counties:
  - Travel, dining outside the home, recreational water exposure
- No single event or establishment was identified as the source of the outbreak

## What's Next?

- **Laboratory testing**
  - **Processing additional *Shigella* samples from greater Michigan**
  - **Analyzing the samples to better understand how *Shigella* bacteria in different parts of the state relate to each other**
- **Mapping analysis**
  - **Collecting and mapping the final pieces of data**
  - **Determining whether there are any links between shigellosis cases and indicators of poor water quality, such as water main breaks or low chlorine levels.**
- **Results will be released in a final report**

**Thank You**

National Center for Emerging and Zoonotic Infectious Diseases  
Division of Foodborne, Waterborne, and Environmental Diseases

