

# Using Social Media to Improve Foodborne Illness Reporting



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## Many people get sick, but few report it...

- The annual health and financial toll of foodborne illness...
  - 1 in 4 Americans get sick
  - 128,000 are hospitalized
  - 3,000 die of foodborne diseases
  - Costs approximately \$2-\$4 Billion annually in the US




**2.9% of people who get sick seek medical care and few report their illness**

# ...but they do complain about it on social media

 **DJ Hickey**  
@DJHickey\_  




Huge shoutout to [@Wendys](#) for the food poisoning. [#bothends](#)

LIKES  
9 


 **Houston**  
@GaymerNerd  

Applied for a place; battled food poisoning (!?);  
Forced servitude for the White Queen -  
Porcelina. DAY

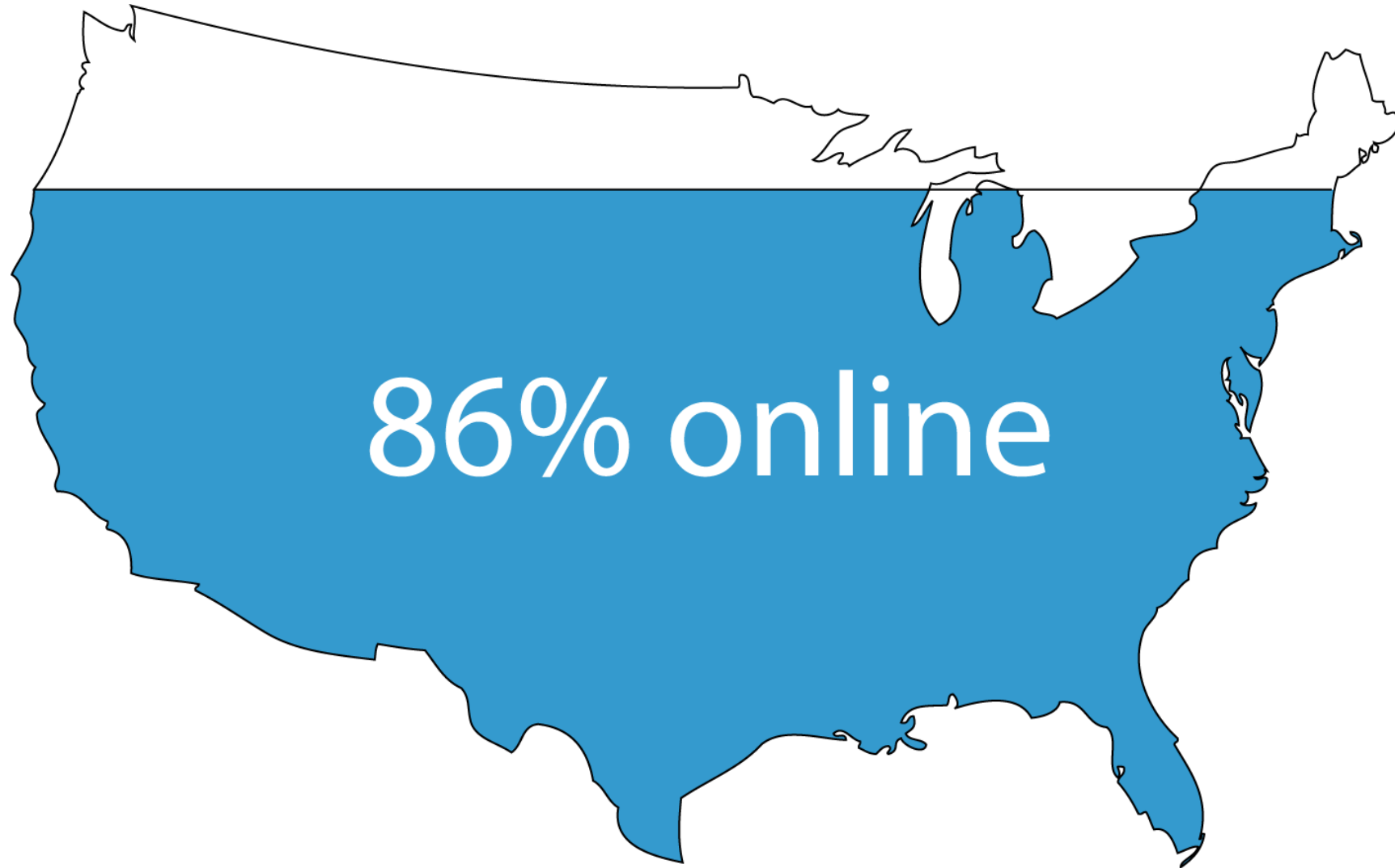
9:49 PM - 18 Feb 2016

 **Brendan Bognar**  
@bbognar12  

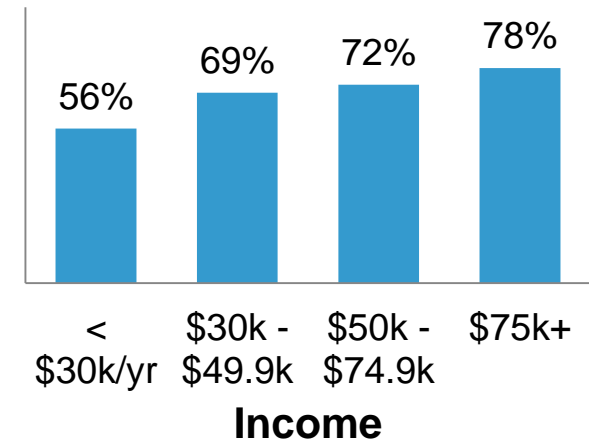
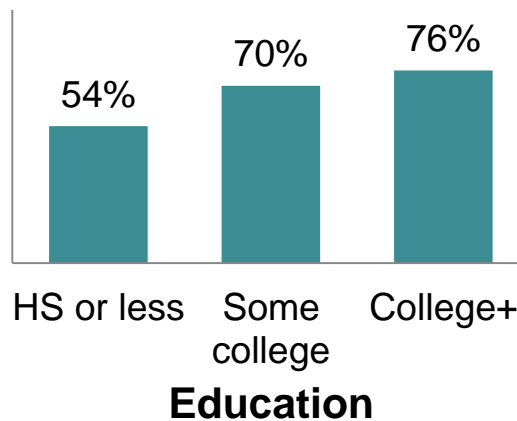
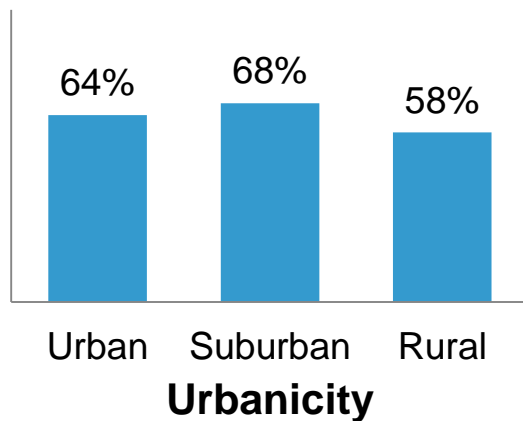
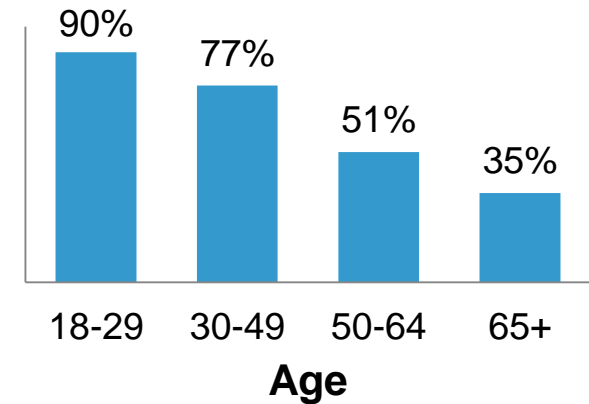
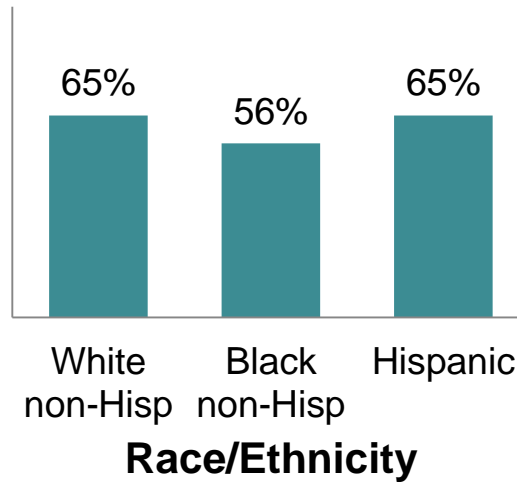
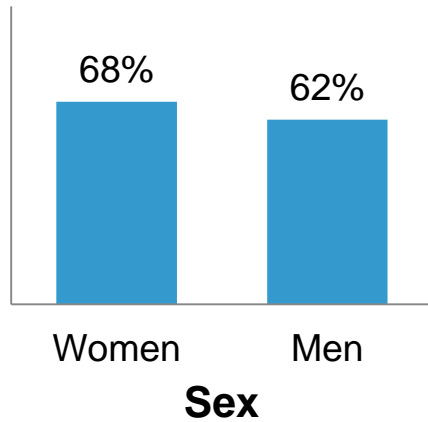
Well food poisoning sucks. Thanks  
[@olivegarden](#)

LIKE  
1 

## Social media use in the US



# US social media users by the numbers



# How can we tap into social media to improve surveillance and reporting?



The screenshot shows the website for 'FOODBORNE CHICAGO', a project of the Smart Chicago Collaborative. The navigation bar includes 'Home', 'About', 'Q&A', 'Press', and a 'Follow @foodbornechi' button. The main content area features a logo with a red cross and a smartphone icon, followed by the text 'Report food poisoning' and 'A project of the Smart Chicago COLLABORATIVE'. Below this, there is a paragraph explaining that users should complete a form if they suspect food poisoning in Chicago, and another paragraph stating that the organization uses code to search for tweets related to food poisoning in Chicago and replies to them with a link to the reporting form.

Home About Q&A Press Follow @foodbornechi

 **FOODBORNE CHICAGO**  
Report food poisoning  
A project of the **Smart Chicago**  
COLLABORATIVE

If you think you have food poisoning in Chicago, please complete this form. The info will be sent to the Chicago Department of Public Health so they can take any necessary action.

Did we @reply you on Twitter? Here's why.

We use computers & code to search Twitter for tweets related to food poisoning in Chicago. We do as much as we can to automatically zero-in on the tweets we think are really about a possible food poisoning case and really coming from Chicago. Then real humans review the tweets and @reply back to people with a link back to this page. [More detail here.](#)

Chicagoan tweets about possible foodborne illness




Twitter tool captures the tweet and sends to health department





Health department replies to the tweet with a message and form to report the foodborne illness

# Identify and reply to tweets

 **Tamara Ramirez**  
@\_MaraMilady  



Food poisoning is a bitch. Never eating Chinese again. And I hate this damn hospital 😞 😞

 Reply  Retweet  Favorite  More

3:45 AM - 2 Nov 2013

Reply to @\_MaraMilady

 **Foodborne Chicago** @foodbornechi · Nov 5  
@\_MaraMilady We're sorry to hear you're so sick. We can help you by clicking on this link to report it:  
[foodborne.smartchicagoapps.org/39655870105558...](http://foodborne.smartchicagoapps.org/39655870105558...)

 Details  Reply  Retweet  Favorite  More

 **LovelyStars**  
@jazhearts  

Yep doctor said I had food poisoning 😞 😞 😞

 from Chicago, IL

 Reply  Retweet  Favorite  More

5:51 PM - 13 Apr 2014

Reply to @jazhearts

 **Foodborne Chicago** @foodbornechi · Apr 17  
@jazhearts Sorry to hear you're ill. The Chicago health department can help.  
[foodborne.smartchicagoapps.org/45547842393093...](http://foodborne.smartchicagoapps.org/45547842393093...)

 Details  Reply  Retweet  Favorite  More

 **DaMediaGuy**  
@DaMediaGuy  

UPDATE: I'm back, after 5 days of having what my doctor says is a stomach virus/food poisoning from eating at @LouMalnatis Lincoln Park 😞 😞 😞 🤧

 Reply  Retweet  Favorite  More

2:16 PM - 24 Apr 2013

Reply to @DaMediaGuy @LouMalnatis

 **Foodborne Chicago** @foodbornechi · 24 Apr 2013  
@DaMediaGuy Sorry to hear you were sick. The city can help you here:  
[foodborne.smartchicagoapps.org/32713895154459...](http://foodborne.smartchicagoapps.org/32713895154459...)

 Details  Reply  Retweet  Favorite  More

 **DaMediaGuy** @DaMediaGuy · 25 Apr 2013  
@foodbornechi Thanks!

 Details  Reply  Retweet  Favorite  More

 **Foodborne Chicago** @foodbornechi · 26 Apr 2013  
@DaMediaGuy You're welcome!

 Details  Reply  Retweet  Favorite  More

# Foodborne Chicago first 10 months

Centers for Disease Control and Prevention  
**MMWR**  
Weekly / Vol. 63 / No. 32

Morbidity and Mortality Weekly Report  
August 15, 2014

**Health Department Use of Social Media to Identify Foodborne Illness — Chicago, Illinois, 2013–2014**

Jenine K. Harris, PhD<sup>1</sup>, Raed Mansour, MS<sup>2</sup>, Bechara Choucair, MD<sup>2</sup>, Joe Olson<sup>3</sup>, Cory Nissen, MS<sup>4</sup>, Jay Bhatt, DO<sup>2</sup>  
(Author affiliations at end of text)

An estimated 55 million to 105 million persons in the United States experience acute gastroenteritis caused by foodborne illness each year, resulting in costs of \$2–\$4 billion annually (1). Many persons do not seek treatment, resulting in under-reporting of the actual number of cases and cost of the illnesses (2). To prevent foodborne illness, local health departments nationwide license and inspect restaurants (3) and track and respond to foodborne illness complaints. New technology might allow health departments to engage with the public to improve foodborne illness surveillance (4). For example, the New York City Department of Health and Mental Hygiene examined restaurant reviews from an online review website to identify foodborne illness complaints (5). On March 23, 2013, the Chicago Department of Public Health (CDPH) and its civic partners launched FoodBorne Chicago (6), a website (<https://www.foodbornechicago.org>) aimed at improving food safety in Chicago by identifying and responding to complaints on Twitter about possible foodborne illnesses. In 10 months, project staff members responded to 270 Twitter messages (tweets) and provided links to the FoodBorne Chicago complaint form. A total of 193 complaints of possible foodborne illness were submitted through FoodBorne Chicago, and 133 restaurants in the city were inspected. Inspection reports indicated 21 (15.8%) restaurants failed inspection, and 33 (24.8%) passed with conditions indicating critical or serious violations. Eight tweets and 19 complaint forms to FoodBorne Chicago described seeking medical treatment. Collaboration between public health professionals and the public via social media might improve foodborne illness surveillance and response. CDPH is working to disseminate FoodBorne Chicago via freely available open source software. FoodBorne Chicago tracked Twitter messages using a supervised learning algorithm (7). The algorithm parsed tweets

originating from Chicago that included “food poisoning” to identify specific instances of persons with complaints of foodborne illness. The geographic boundaries used by the algorithm also included some neighboring Chicago suburbs. However, follow-up inspections were conducted only at restaurant locations within the city limits. Tweets identified by the algorithm were reviewed by project staff members for indications of foodborne illness (e.g., stomach cramps, diarrhea, or vomiting) from food prepared outside the home. Project staff members provided feedback on whether each tweet fit the criteria, enabling the tweet identification algorithm to learn and become more effective over time.

**INSIDE**  
686 Sugar-Sweetened Beverage Consumption Among Adults — 18 States, 2012  
691 Prevention and Control of Seasonal Influenza with Vaccines: Recommendations of the Advisory Committee on Immunization Practices (ACIP) — United States, 2014–15 Influenza Season  
698 Notes from the Field: Hospitalizations for Respiratory Disease Among Unaccompanied Children from Central America — Multiple States, June–July 2014  
700 Notes from the Field: Malnutrition and Elevated Mortality Among Refugees from South Sudan — Ethiopia, June–July 2014  
702 Notice to Readers: Final 2013 Reports of Nationally Notifiable Infectious Diseases  
716 QuickStats

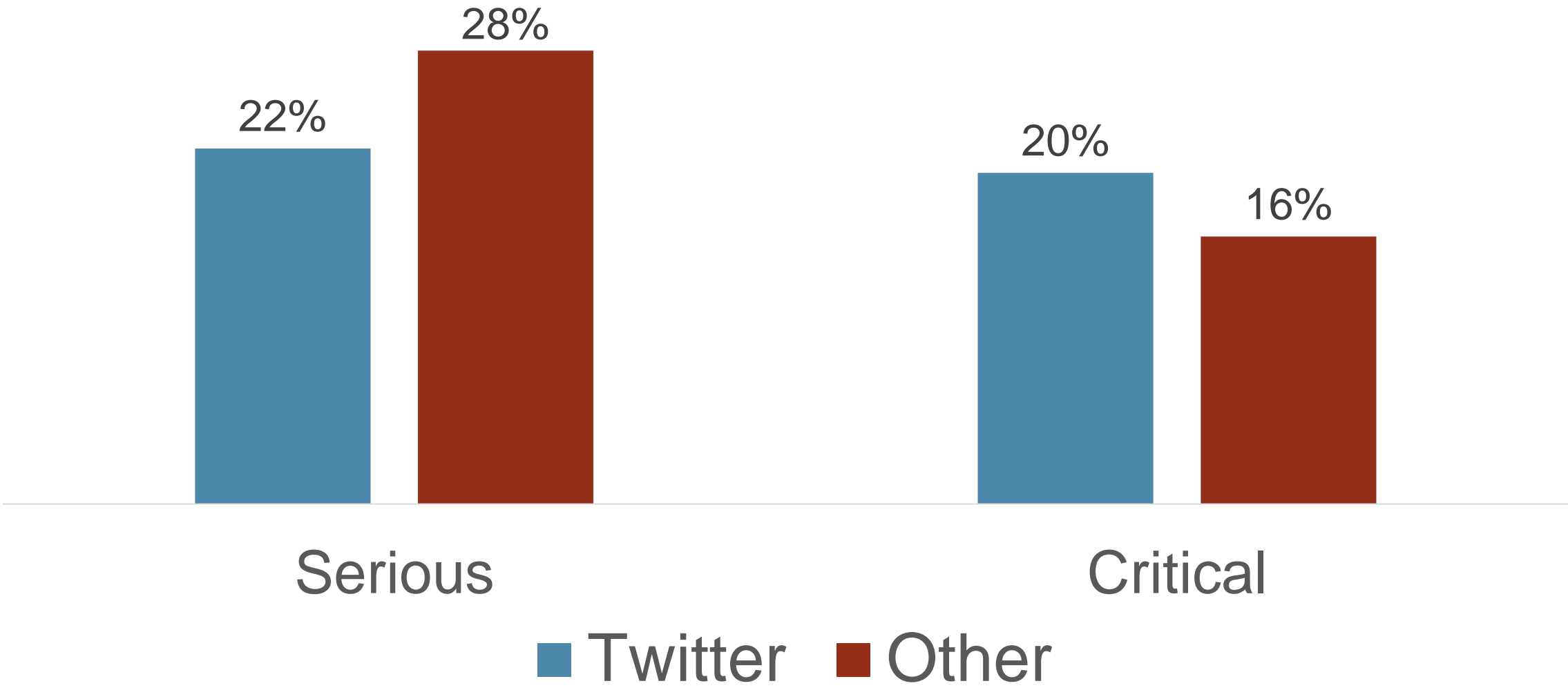
Continuing Education examination available at [http://www.cdc.gov/mmwr/cme/conted\\_info.html#weekly](http://www.cdc.gov/mmwr/cme/conted_info.html#weekly).

 U.S. Department of Health and Human Services  
Centers for Disease Control and Prevention

- 2,241 Tweets identified and classified
- 270 Response tweets
- 193 Reports submitted
- 179 Food establishments identified
- 133 Inspections
- 21 (15.8%) failed inspection



# Percent of inspections finding serious and critical violations after complaints from Twitter vs. other sources in Chicago



# Taking the show on the road

Home About Q&A Press [Follow @foodbornechi](#)



## FOODBORNE CHICAGO

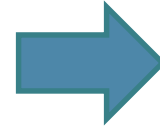
Report food poisoning

A project of the **Smart Chicago** COLLABORATIVE

If you think you have food poisoning in Chicago, please complete this form. The info will be sent to the Chicago Department of Public Health so they can take any necessary action.

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STLOUIS-MO GOV  
Mayor Francis G. Slay

Services Government News  Search

Government Departments and Agencies Health Environmental Health Food Control

## Food Safety STL

Helping City of St. Louis residents report cases of foodborne illness to the Department of Health through social media


### What is Food Safety STL?

Food Safety STL (@FoodSafetySTL) is a Twitter account set up for residents to report cases of suspected foodborne illness, and further interact with the Department of Health. Meanwhile, a corresponding internal social media application will capture tweets that mention or use keywords related to foodborne illness located within a 25-mile radius from the center of the City of St. Louis. These captured tweets will prompt a response from the Food Safety STL Twitter account to provide further information on reporting. After a report has been submitted, the individual will receive either a follow-up reply tweet and/or an email providing him/her with a case number.

Complaints that fall outside of this jurisdiction will be appropriately referred to the corresponding local health department and the state health department.

### Tweets by @FoodSafetySTL

- Food Safety STL (@FoodSafetySTL) Easy way to ensure your favorite greens are safe to eat!
- Food Safety STL, Retweeted HealthMap (@healthmap) CDC Investigating #Salmonella outbreak linked to shell eggs - @41ActionNews ow.ly/MDH2304P1hd

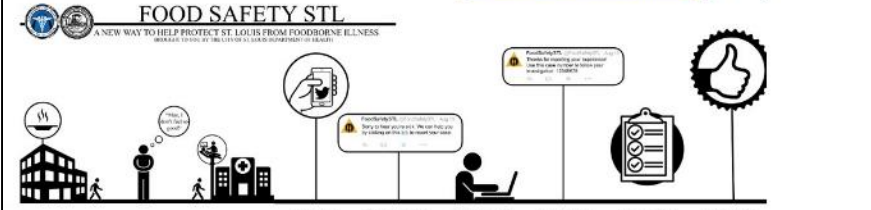


Embed View on Twitter

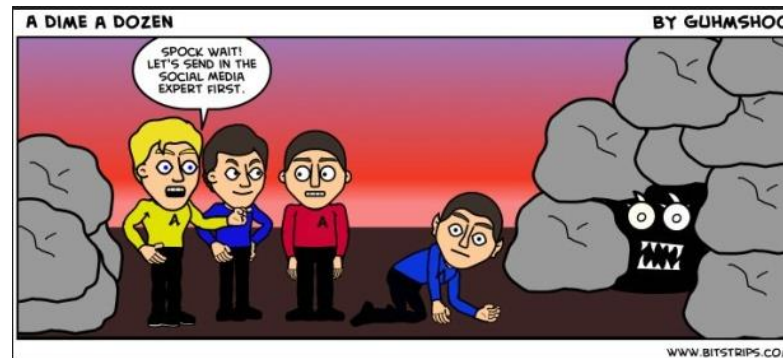
[twitter.com] [Report Foodborne Illnesses with Twitter](#) [twitter.com]

### FOOD SAFETY STL

A NEW WAY TO HELP PROTECT ST. LOUIS FROM FOODBORNE ILLNESS  
ORIGINATED BY THE OFFICE OF THE DEPARTMENT OF HEALTH



The infographic illustrates the workflow: 1. You tweet about it. 2. We scan our tweets. 3. You fill out a report. 4. We report it to you. 5. Other actions, etc. 6. You're back home.



# HealthMap Foodborne Dashboard

Kara Sewalk, MPH

Program Coordinator

HealthMap | Innovation and Digital Health Accelerator

Boston Children's Hospital



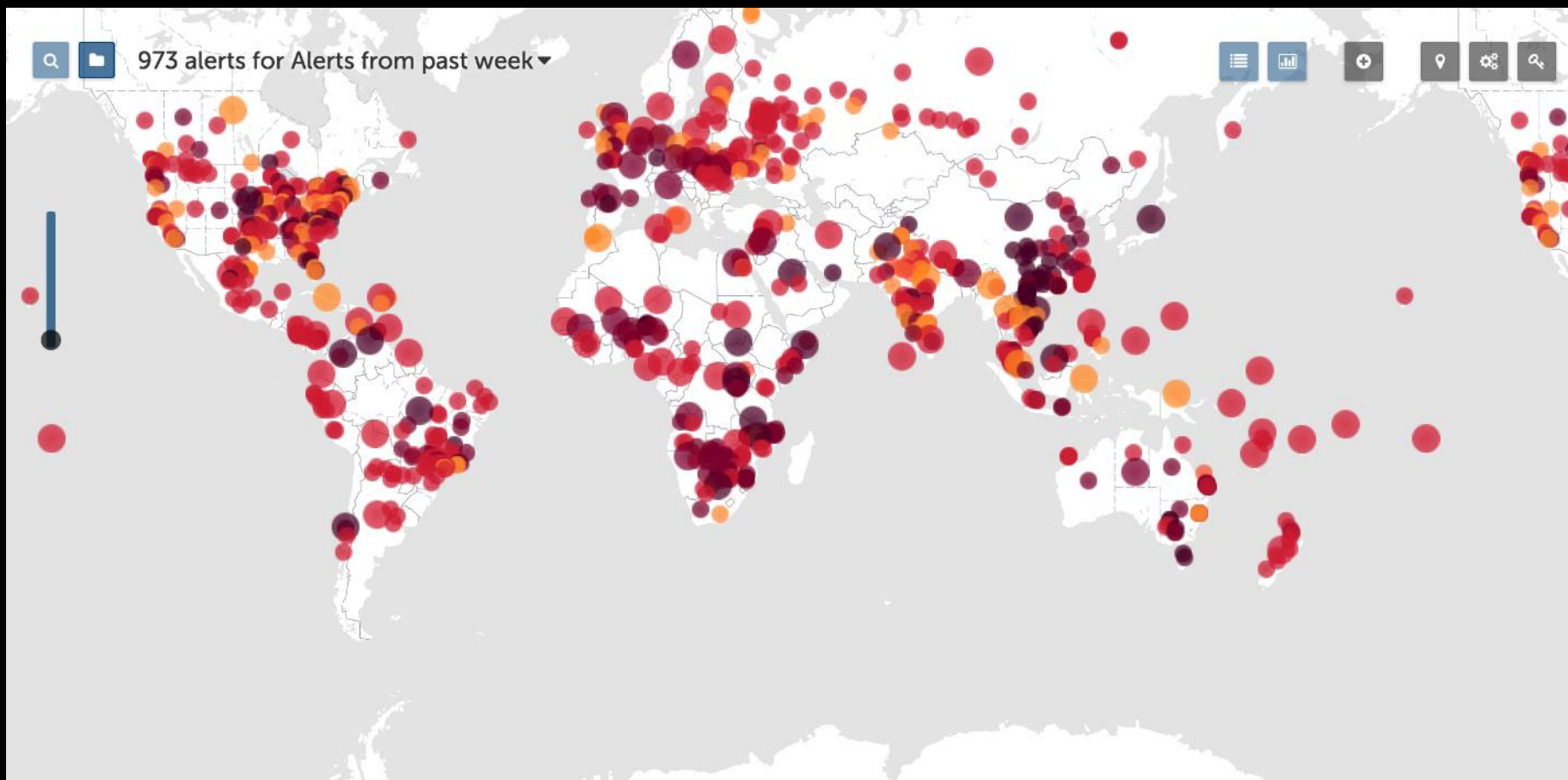
**Boston Children's Hospital**

Innovation & Digital  
Health Accelerator



# HealthMap

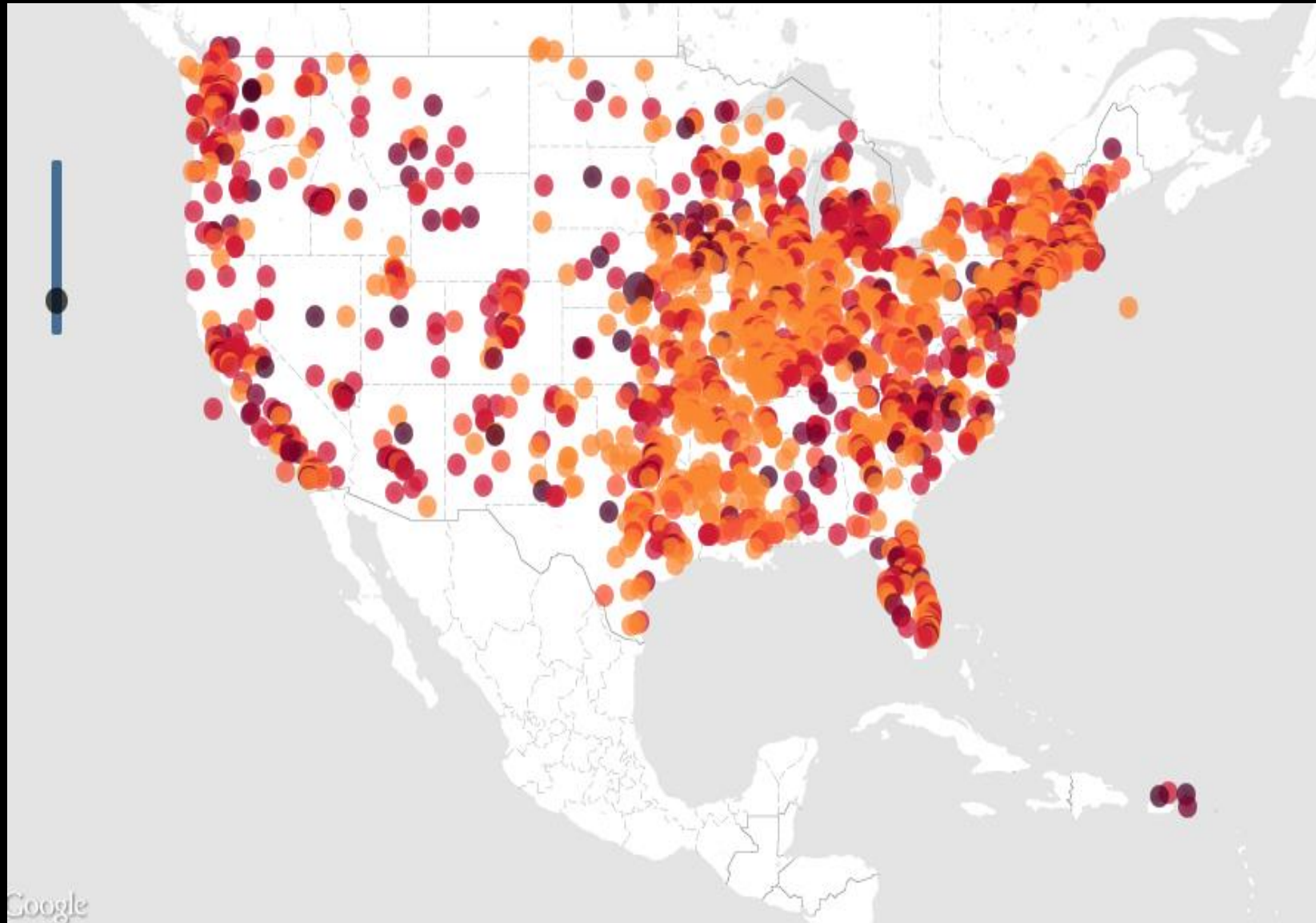
Global Health, Local Information



# The Digital Phenotype



# Foodborne Outbreaks Reported Online in past year



# 800M Foodborne tweets over 4 years

## Twitter #DataGrants selections

Thursday, April 17, 2014 | By Raffi Krikorian (@raffi), Vice President, Platform Engineering [18:34 UTC]

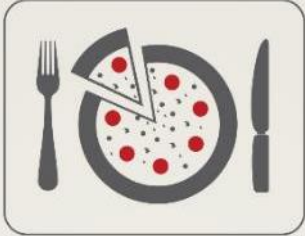
Tweet

In February, we [introduced](#) the Twitter [#DataGrants](#) pilot program, with the goal of giving a handful of research institutions access to Twitter's public and historical data. We are thrilled with the response from the research community — we received more than 1,300 proposals from more than 60 different countries, with more than half of the proposals coming from outside the U.S.

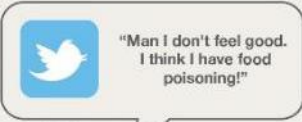
After reviewing all of the proposals, we've selected six institutions, spanning four continents, to receive free datasets in order to move forward with their research.

- [Harvard Medical School / Boston Children's Hospital](#) (US): Foodborne Gastrointestinal Illness Surveillance using Twitter Data
- [NICT](#) (Japan): Disaster Information Analysis System
- [University of Twente](#) (Netherlands): The Diffusion And Effectiveness of Cancer Early Detection Campaigns on Twitter
- [UCSD](#) (US): Do happy people take happy images? Measuring happiness of cities
- [University of Wollongong](#) (Australia): Using GeoSocial Intelligence to Model

# Real-time detection



Now go visit your doctor!



"Man I don't feel good. I think I have food poisoning!"



If you send out a public tweet, we'll hear you.





maddv



+ Follow



Val

@NYCOrganix



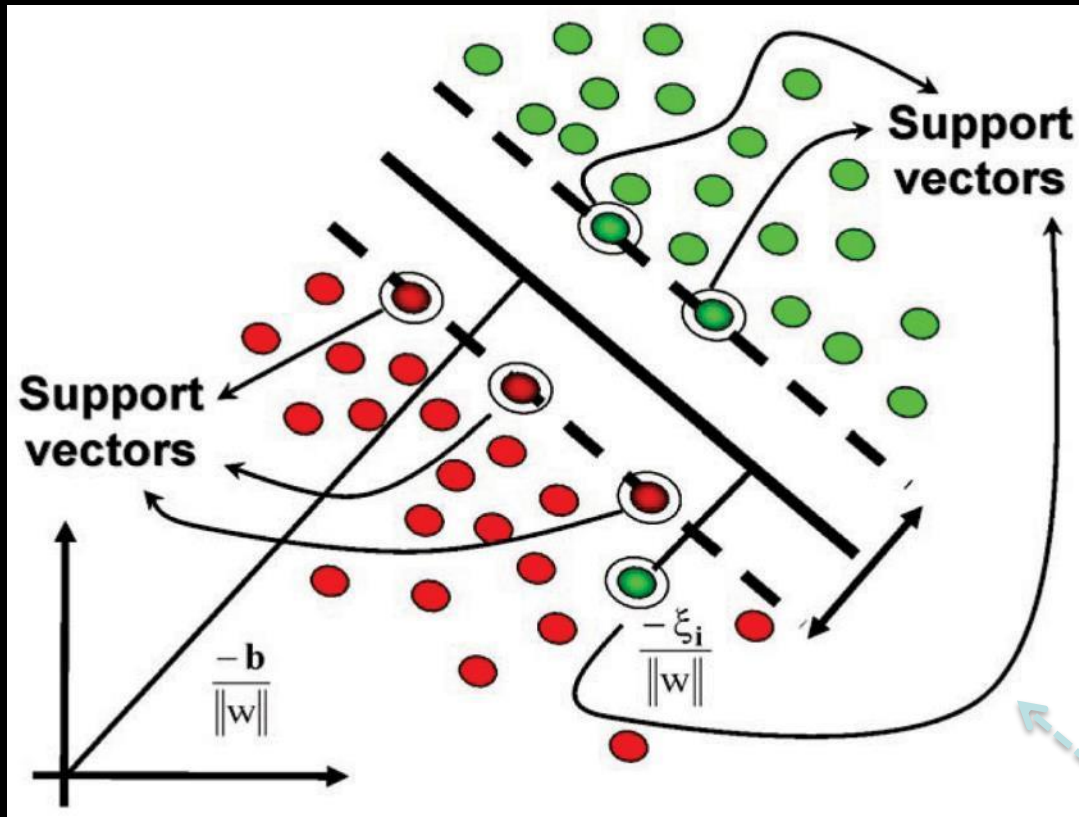
+ Follow

@WholeFoods I already have an APOLOGY letter from your GM for the first incident, my gf got sick from food poisoning, and my lawyer is on it

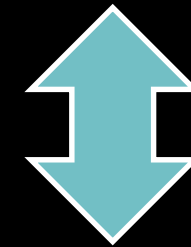


2:27 PM - 10 Nov 2014

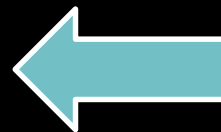
8:37 PM - 10 Nov 2014



Manual classification – relevant/irrelevant



Evaluate classifier performance



Build a machine-learning classifier

# Real-time detection



HealthMap Foodborne Illness: St. Louis

Cities ▾




Jared Hawkins (Logout)




validated		10.25.15	@toddyrockstar I rewatched ur shows on my birthday,I got sick(food poisoning from the restaurant)& it cheered me up. Music makes me happy.Ty	details	respond
validated		10.25.15	before I got food poisoning <a href="https://t.co/D646YUWkr8">https://t.co/D646YUWkr8</a>	details	respond
validated		10.24.15	Hey it might not even be my gallbladder I could have food poisoning this is so bad though LOL way to cheat day yesterday!	details	respond
validated		10.23.15	Via @NPR: Yelp Reviews Can Take Food Poisoning Viral <a href="https://t.co/yCWtJH6Zig">https://t.co/yCWtJH6Zig</a> Ok, so this may be the single redeeming aspect of Yelp.	details	respond
validated		10.22.15	@ky_iamme yeah food poisoning is a bitch.. I swear my body is so stiff I can barely move	details	respond
validated		10.22.15	#FoodSafety and the #Internet can be your best friend or worst enemy <a href="https://t.co/yWRHHH8Txo">https://t.co/yWRHHH8Txo</a>	details	respond
validated		10.22.15	I'll never eat fast food again.. Make my words!! Food poisoning is a MF	details	respond

# Classifying tweets in the Dashboard

HealthMap Foodborne Illness: St Louis Classified Tweets Jenine Harris (Logout)


Showing classified tweets for St Louis:  
[map](#) | [analytics](#)

validate    11.14.16 St Louis, MO [#restaurants ? Are your employees covered to help prevent food poisoning in the work place?](https://t.co/BSD9pDXzCe) details




Label	Definition	Example Tweets
Relevant 	Tweet about a possible current case of foodborne illness	<ul style="list-style-type: none"><li>• I'm straight hella sick with food poisoning</li><li>• Well, things didn't go my way this weekend in St. Louis. I got some bad food poisoning and couldn't... <a href="https://t.co/dmYeuyfG9R">https://t.co/dmYeuyfG9R</a></li></ul>
Unclear 	Unable to distinguish whether tweet is relevant or not relevant	<ul style="list-style-type: none"><li>• Woohoo possible food poisoning ☹️</li><li>• BREAKING: Food Poisoning SUCKS</li><li>• Chipotle will close restaurants briefly on Feb.8 to address food safety issues: Successive food poisonings... <a href="https://t.co/ZbbTgTh77Zm">https://t.co/ZbbTgTh77Zm</a></li></ul>
Not Relevant 	Not about a possible current case of foodborne illness	<ul style="list-style-type: none"><li>• Hope I don't get food poisoning from Ikea.</li><li>• Food poisoning makes you terrified to eat any food ever again</li><li>• 48 Million People Get Ill from Food Poisoning Says Chef Remi <a href="https://t.co/Sj7hepmmwF#pr">https://t.co/Sj7hepmmwF#pr</a></li></ul>

# Real-time detection

HealthMap Foodborne Illness Cities - HealthMap Demo (Logout)



Map data ©2014 Google [Terms of Use](#) [Report a map error](#)

**validated**    11.06.14 I think this school gave me food poisoning again 03:48:47 PM

**Twitter user details**  
[addy](#)  
your, dreams  
Tweets: 14276 | Friends: 128 | Followers: 318

# Citizen Engagement

## Respond to Tweet

EMPATHY	AUTHORITY	ACTION
Sorry to hear you're ill.	The City of STL Dept. of Health can help.	Click here:
Sorry to hear that.	The City of STL Dept. of Health can assist you.	Report here:
That sounds terrible!		

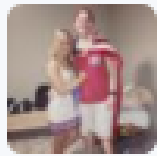
@adrienneleigh  [UNIQUE LINK](#)

104 characters remaining

[send tweet](#)

cats. She/her.  
website  
Tweets: 72831 | Friends: 1090 | Followers: 1466

# Citizen Engagement



**Matthew Kissel** @STLMANIAC · Oct 15

Hey @ChickfilA thank you. Thank you for the food poisoning. All I wanted was a nice chicken sandwich dinner and you do me like this. Wow.



3



5



**FoodSafetySTL** @FoodSafetySTL · Oct 16

@STLMANIAC Sorry to hear you're ill. The City of STL Dept. of Health can help. Report here: <http://foodborne.healthmap.org/requestInfo?tw...>

# Citizen Engagement



HealthMap Foodborne Illness

## Food Safety STL



### Additional Case Details

Was this food eaten at home or at a restaurant?

Home  Restaurant

\* Required Fields

What restaurant did you eat at?\*

e.g., Pete's Lobster Hut

What is the restaurant address?

e.g., 70 Lake St, St. Louis, MO

What type of food did you eat?\*

e.g., Lobster

When did you eat it?\*

10/4/15

What happened?

Please be as specific as possible, e.g. "I ate a lobster from Pete,s around 6pm, and had multiple bouts of diarrhea and vomiting starting at 2am. I was up all night and felt horrible until the next afternoon."

How many people got sick?\*

e.g., 1

The City of St. Louis Department of Health would like the following information in order to contact you directly if needed:

Name

e.g., Joe Citizen

Phone number\*

e.g., 314.555.4525

Email address

e.g., Joe.Citizen@example.com

By clicking here, you agree to the contents outlined in our [Privacy Policy](#).

submit



# Data Sharing





# THE FOOD SAFETY STL PROJECT

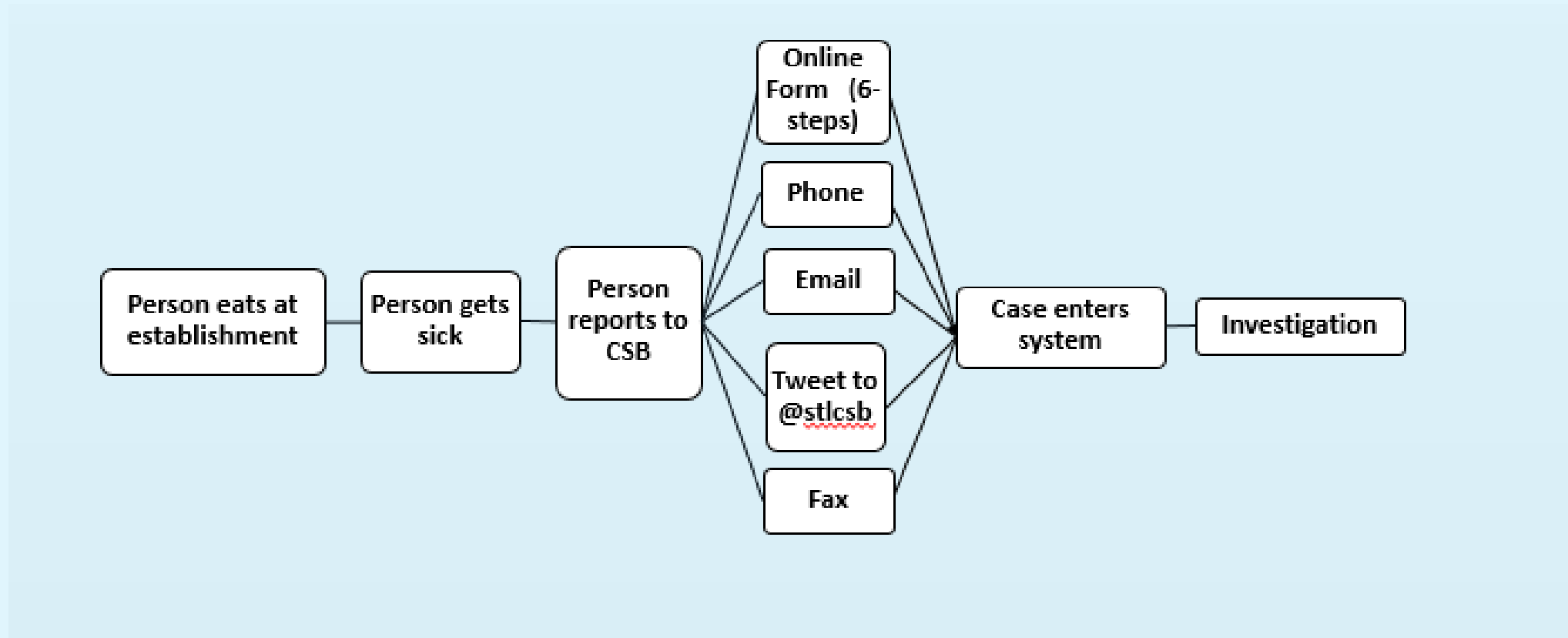
Using Social Media to Detect Potential Foodborne Outbreaks

Candace Da Silva, MPH  
City of St. Louis Department of Health

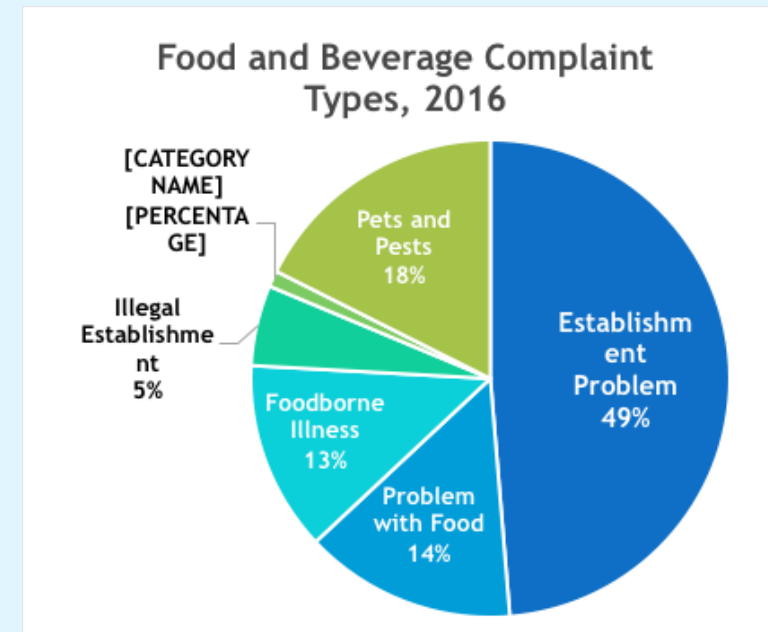
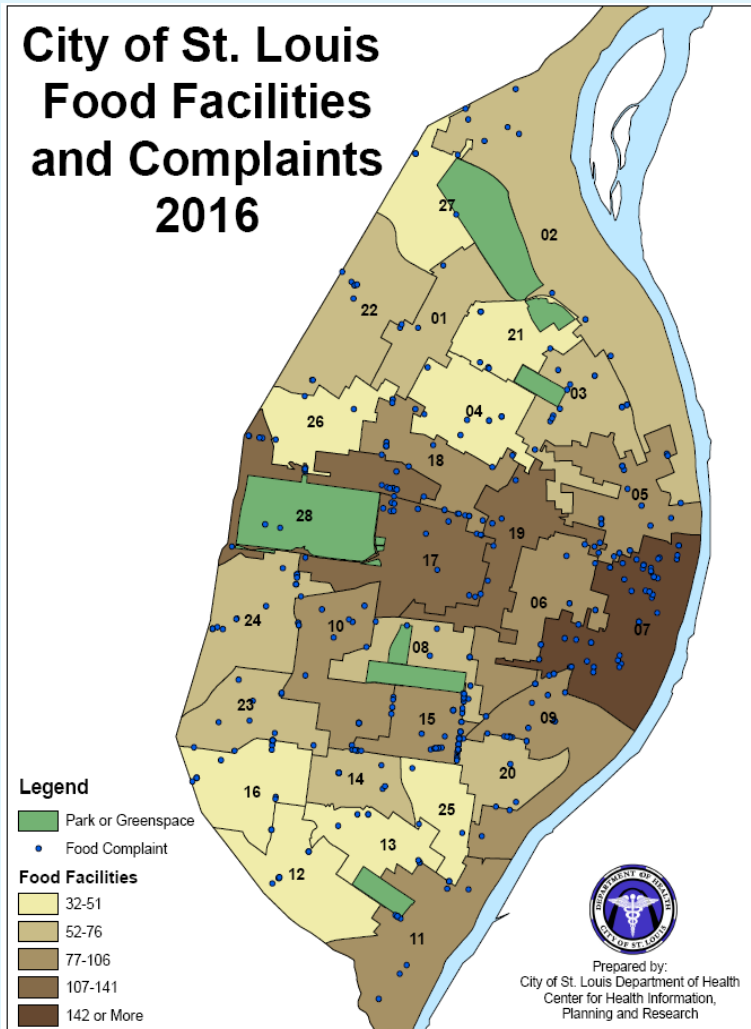
# City of St. Louis Department of Health (STL-DOH)



- Existing Surveillance



# Foodborne Illness in City of St. Louis



2016 Annual Environmental Health report,  
City of St. Louis Department of Health

# Foodborne Illness Complaints

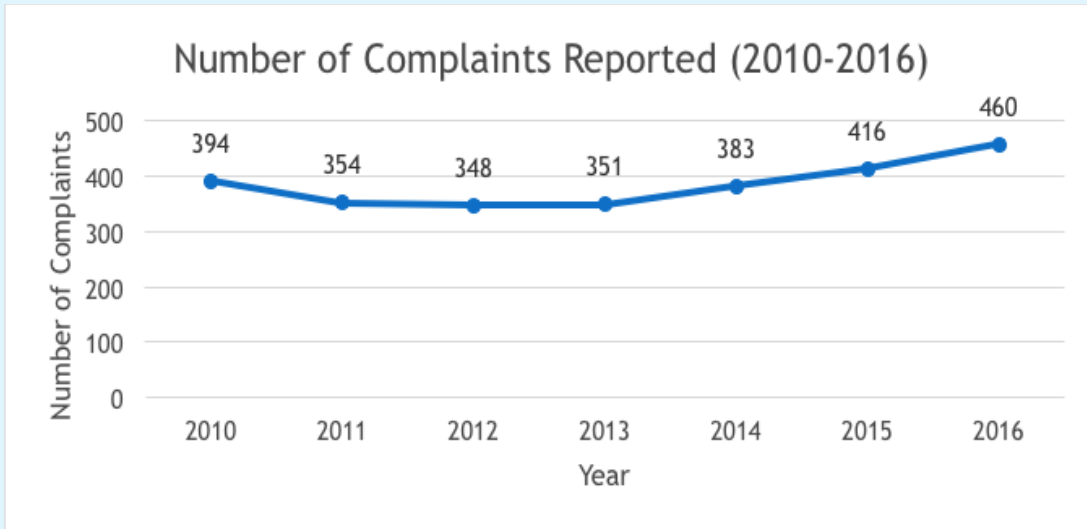


Table 1. Total food establishment complaints reported to City of St. Louis Department of Health from 2010-2016

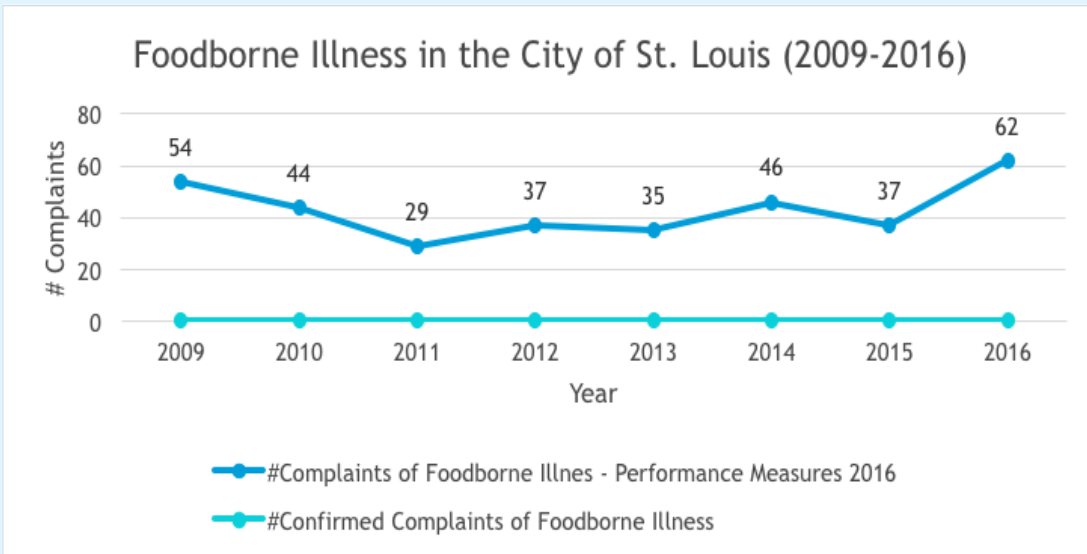


Table 2. Total foodborne illness complaints reported to City of St. Louis Department of Health from all sources (2009-2016)

# Implementation at STL-DOH



- Social Media surveillance prep
  - Website pages, live feed
  - Twitter handle posts
  - Knowledge, staff training, troubleshooting



The screenshot shows the website for Food Safety STL. The URL is <https://www.stlouis-mo.gov/government/departments/health/environmental-health/food-control/food-safety-stl.cfm>. The page header includes "STLOUIS-MO GOV" and "Mayor Francis G. Slay". The main heading is "Food Safety STL" with the subtext "Helping City of St. Louis residents report cases of foodborne illness to the Department of Health through social media". A section titled "What is Food Safety STL?" explains that the account is a Twitter account set up for reporting foodborne illness cases. A "Tweets" section shows three tweets: one from US Food Safety (@foodsafeguru) about a recalled pizza, one from CDC (@CDCgov) about a chicken salad outbreak, and one from USDA Food Safety (@USDAFoodSafety) about turkey pop-up timers.



The screenshot shows the Twitter profile page for Food Safety STL (@FoodSafetySTL). The header includes the Twitter logo, "Home", "Moments", a search bar, and a "Log in" link. The profile banner features the logos of the Department of Health and the City of St. Louis, along with the text "FOOD SAFETY STL" and "A NEW WAY TO HELP PROTECT ST. LOUIS FROM FOODBORNE ILLNESS BROUGHT TO YOU BY THE CITY OF ST. LOUIS DEPARTMENT OF HEALTH". Below the banner is a yellow triangular warning sign with a black circle containing a white knife and fork. The profile statistics are: 141 TWEETS, 43 FOLLOWING, 46 FOLLOWERS, 11 LIKES, and 6 LISTS. A "Follow" button is visible. The main content area shows a tweet from USDA Food Safety (@USDAFoodSafety) about food safety tips for a party, which was retweeted by FoodSafetySTL.



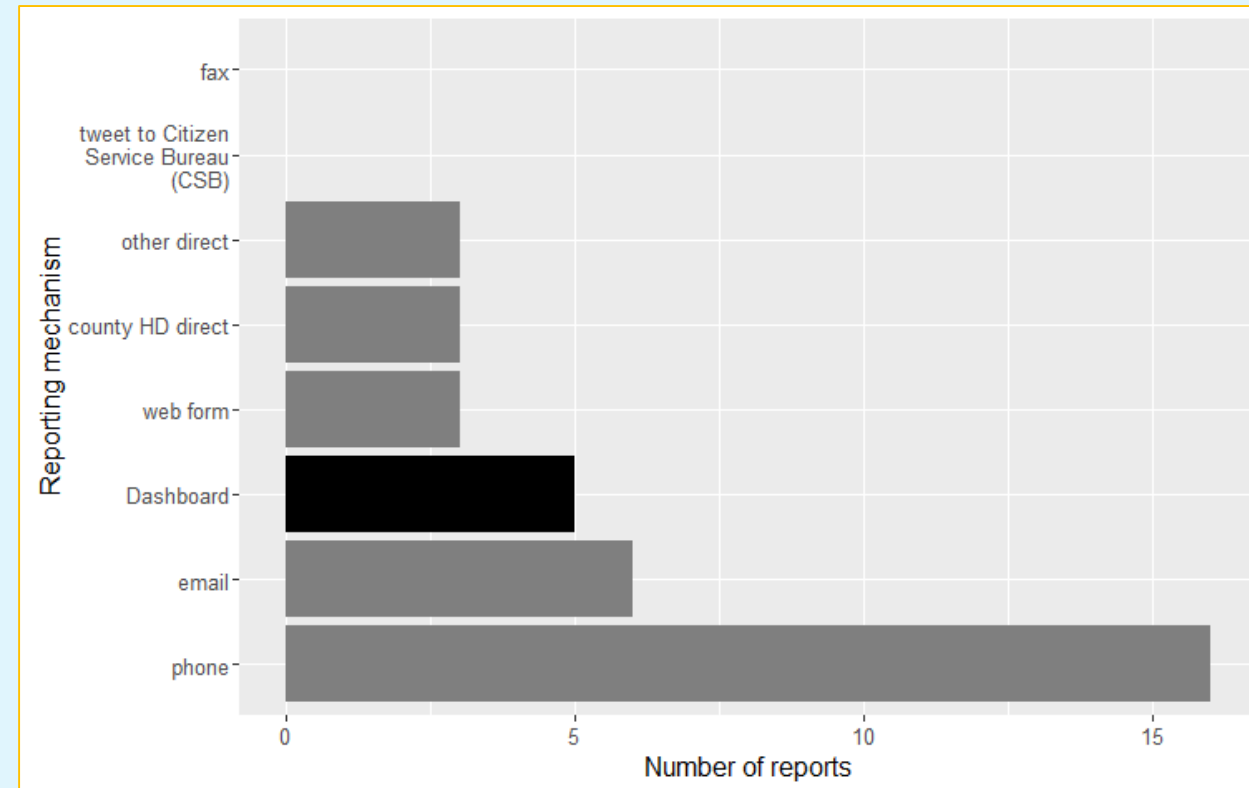
# FOOD SAFETY STL

A NEW WAY TO HELP PROTECT ST. LOUIS FROM FOODBORNE ILLNESS  
BROUGHT TO YOU BY THE CITY OF ST. LOUIS DEPARTMENT OF HEALTH

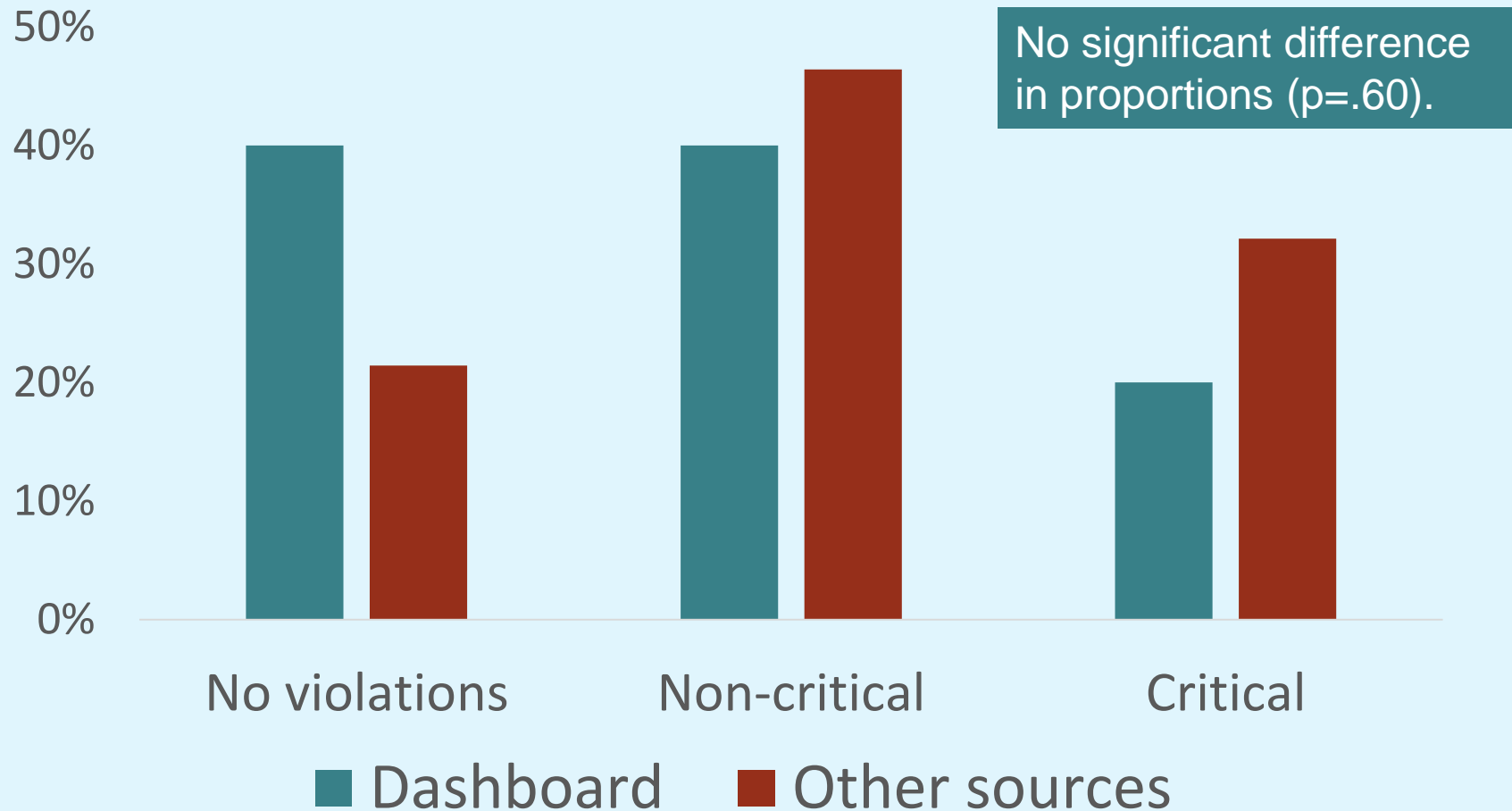


## In the first seven months of use...

- 442 tweets captured by Dashboard
- 193 relevant and received a reply
- 13 reports filed
- 5 in jurisdiction
- 31 reports filed via other mechanisms



# Inspection results for Food Safety STL Dashboard vs. other reporting mechanisms







# Dashboard Reports By Jurisdiction

January 2016 - December 2016

## In Jurisdiction

- City of St. Louis: 10 Reports
  - 9 Inspections Completed
  - No Violations: 4
  - Non-Critical Violations: 3
  - Critical Violations: 2
  - 1 Attempt to inspect;  
seasonal facility

## Out of Jurisdiction

- St. Louis County: 4 Reports
- St. Charles County: 2 Reports
- Out of State: 3 Reports
  - Clinton County, IL
  - Walton County, GA
  - Riverside County, CA



# For 2017, thus far...

## Reports received: 7

- St. Louis County: 4 Reports
  - 1 Inspection discovered 5 Critical Violations & 4 Non-Critical Violations
- Springfield-Green County: 1 Report
  - Inspection discovered 3 Critical Violations
- St. Charles County: 1 Report
  - Inspection discovered 1 Critical Violation
- City of St. Louis: 1 Report
  - Partially completed form

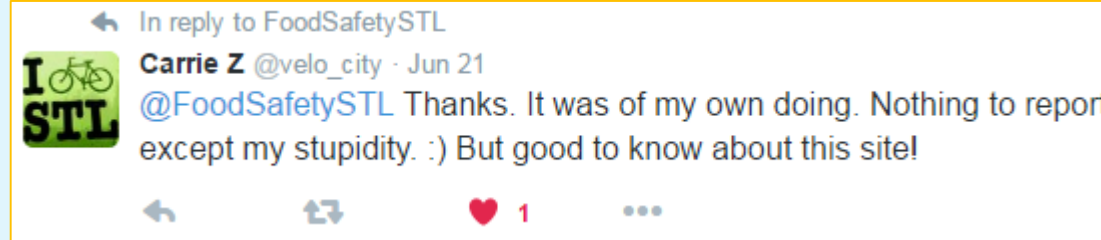


# Strengths of the Dashboard

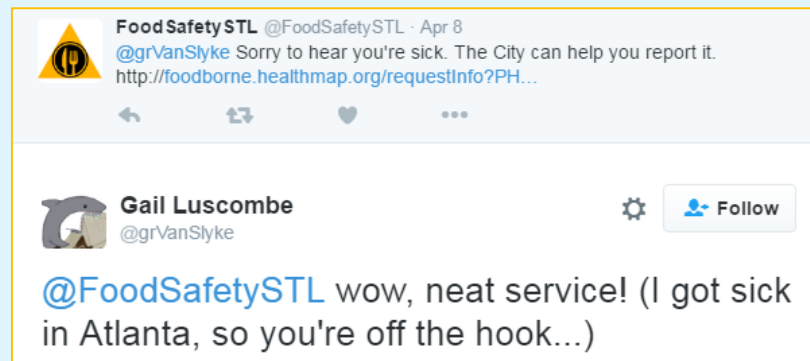
- Encourages interaction with residents on foodborne illness



- Increases transparency and trust of health department

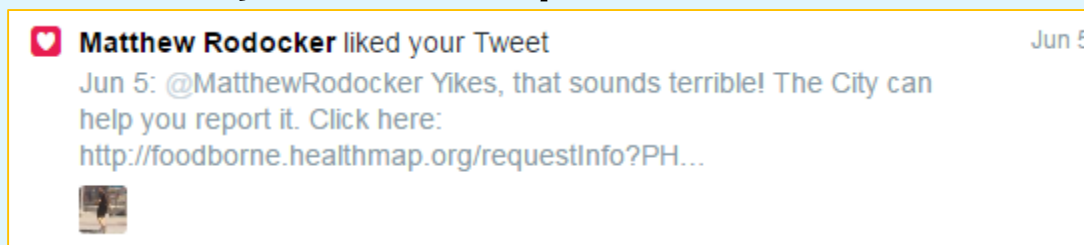


- Increases public knowledge of reporting processes

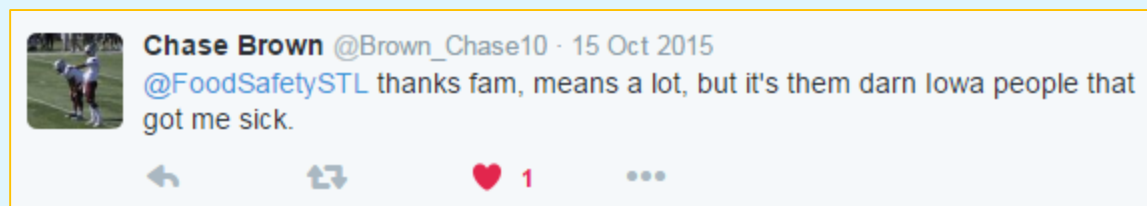


# Challenges of the Dashboard

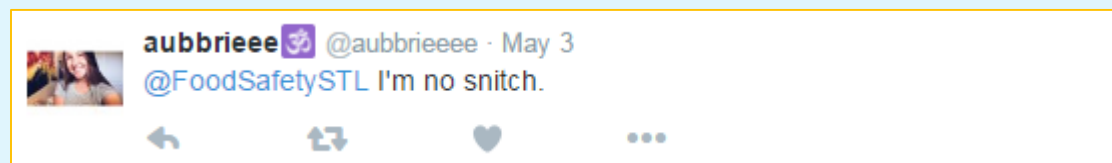
- People like us but they don't report!



- Reports from out of jurisdiction



- Big Brother is watching (trust issues)



# Looking Forward... next steps

- Increasing support from STL-DOH staff
  - Developing promotion strategy for staff & citizens
- Collaboration with Yelp
  - To post most recent inspection grades/ratings
- Application to other health topics



Hospital Quality  
(Current)



Suicidality  
(Current)



Alert LHDs to concerns like standing  
water and mosquitoes  
(potential)

# Project Team

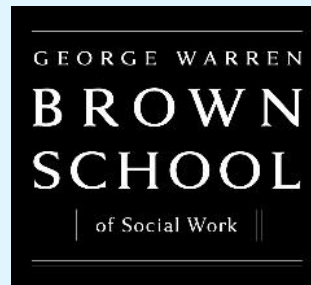


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