Evaluation of Florida Foodborne Illness and Outbreak Response Using the Council to Improve Foodborne Outbreak and Response (CIFOR) Performance Measures

Final Report

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INTRODUCTION

The Council to Improve Foodborne Outbreak Response (CIFOR) was nationally established in 2006 to improve methods at the local, state, and federal levels to detect, investigate, control, and prevent foodborne disease outbreaks. In 2014, the second edition of the CIFOR Guidelines was released and included measurable indicators of effective surveillance for enteric diseases and for response to outbreaks by state and local public health agencies.[1] The performance indicators are intended to be used by agencies to evaluate performance of their foodborne disease surveillance programs, environmental health programs, laboratory programs, and control programs. They also provide a framework for communicating best practices for surveillance activities and create clear performance expectations that will increase the likelihood of compliance across jurisdictions. Along with the indicators, an abridged version of the performance measures was published that identified specific target ranges for 16 selected performance indicators. The target ranges allow a common criterion for all agencies involved in foodborne outbreak investigations to evaluate their program effectiveness and identify areas that need improvement.

The Integrated Food Safety Centers of Excellence (CoE) proposed evaluating data using the CIFOR performance measures as a way to assess strengths and areas for improvement in outbreak detection and response. This evaluation assesses Florida's performance for the year 2013 at the state level and uses the most recent performance measures which are included in the second edition of the CIFOR Guidelines.[1]

METHODS

To evaluate Florida's performance on the 16 performance measures for 2013, data were obtained and calculated from the following sources:

- Merlin, an electronic surveillance database specific to Florida and used by Department of Health (DOH) staff at the state and local level to report, investigate, and manage cases of reportable diseases.
- National Outbreak Reporting System (NORS), a national web-based platform for reporting of enteric disease outbreaks transmitted by food and managed by the Centers for Disease Control and Prevention (CDC).
- BioNumerics, developed by Applied Maths. BioNumerics is used by CDC PulseNet as an unbiased and reproducible way of describing pulsed-field gel electrophoresis (PFGE) patterns.
- LabWare, a laboratory information management system utilized by the Bureau of Public Health Laboratories (BPHL) at the Florida Department of Health.

RESULTS

The results of the analysis for the 16 CIFOR performance measures, suggested target ranges for each measure, and Florida's performance and achieved target range for each measure are found below (Table 1).

Table 1. CIFOR Performance Measures and Florida's Performance

CIFOR Performance Measures		Florida Performance	
Performance Measure	**Target Range**	**Findings for Each Performance Measure**	**Target Range Achieved**
1. Foodborne illness complaint reporting system: Agency maintains logs or databases for all complaints or referral reports from other sources alleging food-related illness, food-related injury or intentional food contamination, and routinely reviews data to identify clusters of illnesses requiring investigation.	**Preferable:** database **Acceptable:** system to log complaints	Florida Environmental Health Surveillance System (FLEHS)	Preferable
2. Outbreaks detected from complaints: Number of outbreaks detected as a result of foodborne illness complaints. Rate of outbreaks detected per 1,000 complaints received.	**Preferable:** >20 outbreaks/1,000 complaints **Acceptable:** 10-20 outbreaks/1,000 complaints	Unable to calculate.	Not Available
3. Foodborne illness outbreak rate: Number foodborne outbreaks reported, all agents. Rate of outbreaks reported/1,000,000 population.	**Preferable:** >6 outbreaks/1,000,000 population **Acceptable:** 1-6 outbreaks/1,000,000 population	48 outbreaks/19.5 million people = 2.5 per 1,000,000	Acceptable
4. Confirmed cases with exposure history obtained: Number and percentage of confirmed *Salmonella*, Shiga toxin-producing *E. coli* (STEC), and *Listeria* cases with exposure history obtained.	**Preferable:** >75% of cases **Acceptable:** 50-75% of cases	***Salmonella:*** Unable to calculate **STEC:** (60/109) = 55.1% ***Listeria:*** (31/41) = 75.6%	***Salmonella:*** Not Available **STEC:** Acceptable ***Listeria:*** Preferable

CIFOR Performance Measures		Florida Performance	
Performance Measure	**Target Range**	**Findings for Each Performance Measure**	**Target Range Achieved**
5. Isolate submissions to public health laboratory: Number and percentage of isolates from confirmed *Salmonella*, STEC, and *Listeria* cases and clinical specimens from patients diagnosed by culture-independent diagnostic test (CIDT), submitted to public health laboratory (PHL).	**Preferable:** >90% of isolates **Acceptable:** 60-90% of isolates	***Salmonella:*** 1,809/5,955 = 30.4% **STEC:** 109/109 = 100% ***Listeria:*** 34/41 = 88.2%	***Salmonella:*** Not Acceptable **STEC:** Preferable ***Listeria:*** Acceptable
6. Pulsed-field gel electrophoresis (PFGE) subtyping of isolates: Number and percentage of *Salmonella*, STEC, and *Listeria* isolates with PFGE information.	**Preferable:** >90% of isolates **Acceptable:** 60-90% of isolates	***Salmonella:*** 1,707/1,809 = 94.4% **STEC:** 26/109 = 23.9% ***Listeria:*** 30/34 = 88.2%	***Salmonella:*** Preferable **STEC:** Not Acceptable ***Listeria:*** Acceptable
7. Isolate submission interval: Median number of days from collection of *Salmonella*, STEC, and *Listeria* clinical specimens to receipt of isolate or clinical specimens from a patient diagnosed by CIDT, at PHL.	**Preferable:** <7 days **Acceptable:** 7-8 days	***Salmonella:*** 7 Days **STEC:** 7 Days ***Listeria:*** 7 Days	***Salmonella:*** Acceptable **STEC:** Acceptable ***Listeria:*** Acceptable
8. Isolate subtyping interval: Median number days from receipt of *Salmonella*, STEC, and *Listeria* isolates to PFGE subtyping results.	**Preferable:** ≤4 days **Acceptable:** 5-6 days	***Salmonella:*** 2 days **STEC:** 2 Days ***Listeria:*** 1.5 Days	***Salmonella:*** Preferable **STEC:** Preferable ***Listeria:*** Preferable

CIFOR Performance Measures		Florida Performance	
Performance Measure	**Target Range**	**Findings for Each Performance Measure**	**Target Range Achieved**
9. PFGE E. coli O157 and Listeria subtyping interval: Percent of pulsed-field gel electrophoresis (PFGE) subtyping data results for *E. coli* O157:H7 and *Listeria* submitted to the PulseNet national database within four working days of receiving isolate at the PFGE laboratory.	**Acceptable: ≥**90% of PFGE subtyping results submitted to PulseNet within 4 working days.	49/50 for *E. coli* O157:H7 and *Listeria* = 97.5%	Acceptable
10. Outbreak clinical specimen collections: Number and percentage of outbreak investigations with clinical specimens collected and submitted to PHL from two or more people.	**Preferable:** >75% of outbreaks **Acceptable:** 50-75% of outbreaks	Foodborne outbreaks excluding ciguatera, scombroid, and chemical poisoning: (7/33) = 21%	Not Acceptable
11. Cluster investigation interval: Median number of days from initiation of investigation to identification of source.	**Preferable:** <7 days **Acceptable:** 7-21 days	1/1 cluster investigation with source identified. Median number of days = 7 days	Acceptable
12. Complaint investigation interval: Median number of days from initiation of investigation to implementation of intervention.	**Preferable:** <7 days **Acceptable:** 7-21 days	Unable to calculate: system to track complaints that became outbreaks was not available in 2013.	Not Available
13. Cluster source identification: Number and percentage of clusters with more than five cases in which a source was identified.	**Preferable:** >20% of clusters with >5 cases **Acceptable:** 10-20% of clusters with >5 cases	1/1 cluster investigation with more than 5 cases in which a source was identified = 100% of clusters	Preferable

CIFOR Performance Measures		Florida Performance	
Performance Measure	**Target Range**	**Findings for Each Performance Measure**	**Target Range Achieved**
14. Outbreak etiology reported to NORS: Number and percentage of outbreaks for which etiology was identified and reported to National Outbreak Reporting System (NORS).	**Preferable:** >68% of outbreaks **Acceptable:** 44-68% of outbreaks	2013 NORS Data (33/45) = 73%	Preferable
15. Outbreak vehicle reported to NORS: Number and percentage of outbreaks for which a vehicle was identified and reported to NORS.	**Preferable:** >60% of outbreaks **Acceptable:** 48-60% of outbreaks	2013 NORS Data (33/45) = 73%	Preferable
16. Outbreak contributing factor reported to NORS: Number and percentage of outbreaks for which contributing factors were identified and reported to NORS.	**Preferable:** >55% of outbreaks **Acceptable:** 33-55% of outbreaks	2013 NORS Data (29/45) = 64%	Preferable

CONCLUSIONS

In 2013, 14 of the 16 CIFOR performance measures were available for evaluation for state-level data; measures 2 and 12 were unavailable for evaluation.

Performance Measure 1: The preferable achievement for measure 1 refers to the Florida Environmental Health Surveillance System (FLEHS), a web-based database for environmental health data management. All foodborne illness complaints received by DOH from a number of reporting entities are entered into FLEHS and complaints are monitored for ongoing surveillance purposes.

Performance Measure 2: This measure could not be accurately calculated because the capacity to track complaints that are part of an outbreak was established in September 2013.

Performance Measure 3: The rate of outbreaks reported per 1 million people was acceptable (2.5/1,000,000).

Performance Measure 4: There were 109 cases of Shiga toxin-producing *E. coli* (STEC) reported; 55.1% with a complete exposure history available therefore meeting the acceptable performance level. A total of 41 cases of listeriosis were reported; 75.6% with completed exposure history collected therefore meeting the preferable status for the measure. Florida does not require county health departments (CHD) to report exposure history for *Salmonella* cases in Merlin, therefore case exposure history available is limited and the measure could not be accurately calculated for statewide analysis.

Performance Measure 5: Isolate submissions to BPHL for *E. coli* was 100%, achieving a measure of preferable and isolate submissions for *Listeria* was 82.9%, achieving a measure of acceptable. *Salmonella* isolates are not required to be submitted to BPHL, thus yielding a low percentage of submissions.

Performance Measure 6: The number of isolates that had PFGE analysis completed for *Salmonella* was in the preferable range (94.4%). Isolates with PFGE information for *Listeria* was acceptable (88.2%). BPHL conducts PFGE on *E. coli* O157:H7 strains only, resulting in a limited number of isolates with completed PFGE information for STEC cases (23.9%).

Performance Measure 7: Acceptable for all pathogens.

Performance Measure 8: Preferable for all pathogens.

Performance Measure 9: PFGE information for *Listeria* (30/30) and *E. coli* O157:H7 (19/20) isolates were submitted to PulseNet 97.5% of the time within four working days of receiving the isolates.

Performance Measure 10: Florida's percentage of outbreak clinical specimen collection (21%) from two or more people can be partially attributed to the patients' willingness to submit stool samples in combination with the timing of disease reporting. DOH routinely requests three to five specimens per outbreak but not every person is comfortable submitting a stool sample. Case confirmation requires epidemiological evidence implicating an agent and confirmatory laboratory data. DOH only requires one case and one confirmed clinical specimen for an outbreak to be counted. This measure only includes outbreak with two or more lab-confirmed cases for reporting in NORS. In addition, foodborne outbreaks of botulism, marine toxins, and other chemicals are often reported in Florida and have distinct clinical symptoms where a physician's diagnosis is sufficient and laboratory confirmation is not always necessary for case confirmation.

Performance Measure 11: Only one cluster was investigated and it took seven days to identify the source; a target measure of acceptable was achieved.

Performance Measure 12: This measure could not be accurately calculated because the capacity to track complaints that were associated with clusters was established in September 2013.

Performance Measure 13: There was only one cluster with more than five cases in which a source was identified; a target measure of preferable was achieved.

Performance Measure 14: Outbreaks for which etiology was reported to NORS was preferable (73%).

Performance Measure 15: Outbreaks for which a vehicle was identified and reported to NORS was preferable (73%).

Performance Measure 16: Outbreaks for which contributing factors were identified and reported to NORS was preferable (64%).

Strengths

The Food and Waterborne Disease Program provides support to the CHDs via eight Regional Environmental Epidemiologists (REEs), each assigned to a different region of the state. REEs assist the 67 counties in the surveillance, investigation, reporting, and prevention of food and waterborne disease. CHDs compile food and waterborne complaint logs and submit them to their respective REE. REEs are responsible for entering these complaints into FLEHS and entering the outbreak data into NORS. Duties required for measures 1 and 14-16 are concentrated among REEs to ensure efficient data cleaning and timely data entry. Employee performance evaluations for the REEs include timely data submission for FLEHS and NORS data. The regional system, which includes subject matter experts who only handle food and waterborne disease investigations, has provided Florida with the ability to achieve a target range of preferable for each of these performance measures listed above.

Prior to the existence on FLEHS, DOH utilized an external database to track food and waterborne complaints. It was in Florida's best interest to build an internal complaint management system to more efficiently manage complaints and tailor the system to best fit the needs of the DOH. Midway through the 2013 reporting year, FLEHS was configured to detect the number of outbreaks as a result of foodborne illness complaints midway through the reporting year. This configuration did not allow for an accurate calculation of performance measure 2 for 2013, but will for future reporting years.

To maximize the amount of specimens received at BPHL and to reduce shipping costs, laboratorians often physically pick up specimens from private laboratory facilities located in close proximity to the Tampa BPHL locations. Due to the large number of *Salmonella* cases, the number of isolates received at BPHL still remained below 60%, the criteria for achieving an acceptable performance measure status.

Challenges

Florida leads the nation in the incidence of *salmonellosis.* To maximize the likelihood of implementation of timely and effective outbreak control measures, DOH's recommended priority for enteric disease case interviews is to intervene when individuals are still symptomatic with diarrhea.[2] If a person with *salmonellosis* is free of diarrhea by the time they are contacted by DOH, and is not in a sensitive situation, it is less likely they will contribute to the spread of disease so there is lesser value in conducting an interview.[2] This recommendation may result in the case interviewers not collecting necessary exposure information on individuals who have recovered to properly determine the food vehicle responsible for the outbreak.

Florida requires CHDs to report exposure history information (performance measure 4) for STEC and *Listeria*. In 2013, there was not a policy in place that required CHDs to enter exposure history information in Merlin for *Salmonella* cases. The number of confirmed cases with exposure history obtained for statewide analysis could not be performed for this evaluation due to the extensive number of *Salmonella* cases in Florida each year, generally over 6,000. Although 84% of cases of *Salmonella* were interviewed in 2013, only 16% had exposure history information completed in Merlin. Presently, there is an absence of a state mandate that requires clinical samples of *Salmonella* to be submitted to BPHL for additional analysis, with the exception of *Salmonella typhi* (performance measure 5).

Diagnosis of marine toxin poisoning, such as ciguatera fish poisoning, scombroid poisoning, and histamine poisoning are generally based on symptoms and a recent history of consuming high risk seafood, such as large, recreationally caught reef fish. Laboratory testing for the specific toxin in patient samples is generally not possible due to limited availability of special techniques and laboratory equipment. If leftover fish or shellfish are available they readily can be tested for the presence of the toxin. Identification of the specific toxin is not usually necessary for treating patients since there is not a known cure for these types of marine toxin exposures. Florida's geographic location and rate of seafood consumption, in combination with the naturally occurring marine toxins, create a confounding effect for performance measure 10, yielding a low rate of clinical samples sent to BPHL during outbreaks.

RECOMMENDATIONS

- Develop a mechanism to detect complaints that have turned into an outbreak or cluster.
- Review requirements for entering *Salmonella* exposure history into Merlin and ensure clinical specimens are forwarded to BPHL for analysis.
- Continue timely data entry into NORS.
- Continue active outbreak surveillance and detection.
- Explore ways to increase clinical sample collection among affected foodborne illness cases.

REFERENCES

[1] Council to Improve Foodborne Outbreak Response (CIFOR). Guidelines for Foodborne Disease Outbreak Response. Second edition. Atlanta: Council of State and Territorial Epidemiologists; 2014.

[2] Recommendations From the Bureau of Epidemiology for Interview and Investigation of Reported Cases of Enteric Infections. Guidance Document. Florida Department of Health. 2012.

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