Evaluation of Tennessee Foodborne Illness and Outbreak Response Using the Council to Improve Foodborne Outbreak and Response (CIFOR) Metrics

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Tennessee Integrated Food Safety Center of Excellence
Tennessee Department of Public Health

Background

The Council to Improve Foodborne Outbreak Response (CIFOR) was established in 2006 to improve methods at the local, state, and national levels to detect, investigate, control, and prevent foodborne disease outbreaks. In 2014, CIFOR released a second edition of their "Guidelines for Foodborne Disease Outbreak Detection and Response" [1]. Chapter 8 of the Guidelines outlines a set of 16 performance indicators intended to assess the effectiveness of surveillance and outbreak response. The standardization of these performance criteria and metrics is intended, among other things, to allow for evaluation of state, regional or national level program effectiveness with the goal of identifying needs for improvement. The CIFOR Performance Indicators Work Group has also developed target ranges based on the relative importance and feasibility of calculating each measure. The target ranges are further categorized as "acceptable" or "preferable," indicating an easily recognized level of achievement for each measure. These performance indicators address a range of public health infrastructure elements including database use, outbreak response, and laboratory performance, which reflect both the short-term and long-term objectives of foodborne disease surveillance programs.

Utilizing the updated guidelines for assessing program performance, the Tennessee Integrated Food Safety Center of Excellence has evaluated Tennessee data to identify strengths and areas in need of improvement with regard to foodborne illness surveillance and outbreak surveillance.

Methods

To evaluate Tennessee performance on the 16 performance indicators, the following data sources were used:

- NEDSS—The National Electronic Disease Surveillance System (NEDSS) is a secure online framework that allows healthcare professionals and government agencies to communicate about disease patterns and coordinate national response to outbreaks.
- National Outbreak Reporting System (NORS)—managed by the Centers for Disease Control and Prevention (CDC); designated TDH employees report outbreaks to CDC using NORS.
- TDH Outbreak Database—a Microsoft Excel database used by TDH staff to track and manage outbreaks of enteric diseases. The TDH Outbreak Database contains some different data elements than NORS.

- Star Laboratory Information Management System (StarLIMS)—an Abbott company system used to track and archive all laboratory testing performed at the TDH Public Health Laboratory.
- CIFOR Cluster Detection Software— a freeware package developed by CIFOR, APHL, and private contractors, with input from a variety of public health jurisdictions (e.g., county, regional and state); used to detect clusters of PFGE-matched cases.
- TDH Cluster Database— An internal database used by TDH Epidemiologists to track clusters identified by the CIFOR Cluster Detection Tool, CDC PulseNET and surveillance interviews.

Data from 1/1/2013-12/31/2013 were analyzed unless otherwise noted. No additional data were collected for the purpose of evaluating the CIFOR performance indicators.

Results

Table 1 describes the 16 revised CIFOR performance indicators, the target ranges suggested by the CIFOR Metrics Working Group, Tennessee findings, and the target range(s) achieved by Tennessee.

Table 1: CIFOR Performance Indicators and Tennessee Performance, 2013

CIFOR Performance Indicators		Tennessee Performance	
Performance Indicator	**Target Range**	**Findings for Each Performance Indicator**	**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:** Electronic database **Acceptable:** System to log complaints	Electronic Database maintained in Microsoft Access	**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.	**Preferable:** > 20 outbreaks / 1,000 complaints **Acceptable:** 10-20 outbreaks/ 1,000 complaints	Unable to calculate with available data.	**Not available**
3. Foodborne illness outbreak rate: Number foodborne outbreaks	**Preferable:** >6 outbreaks / 1,000,000 population	3.85 per 1,000,000 population	**Acceptable**

CIFOR Performance Indicators		Tennessee Performance	
Performance Indicator	**Target Range**	**Findings for Each Performance Indicator**	**Target Range Achieved**
reported, all agents. Rate of outbreaks reported per 1,000,000 population.	**Acceptable:** 1-6 outbreaks / 1,000,000 population		
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	**FoodCORE Results:** A. *Salmonella* 69% (598/872) B. *E. Coli* (STEC) 93% (115/124) C. *Listeria* 85% (11/13)	**A. Acceptable** **B. Preferable** **C. Preferable**
5. Isolate/CIDT-positive clinical submissions to Public Health Laboratory: Number and % of isolates from confirmed *Salmonella,* Shiga toxin-producing *E.coli* (STEC), and *Listeria* cases and clinical specimens from patients diagnosed by culture independent diagnostic test (CIDT), submitted to PHL.	**Preferable:** > 75% of cases **Acceptable:** 50-75% of cases	A. *Salmonella* 83% 762/917 B. *E. Coli* (STEC) 83% (155/187) C. *Listeria* 87% (13/15)	**A. Preferable** **B. Preferable** **C. Preferable**
6. Pulsed Field Gel Electrophoresis (PFGE) subtyping of isolates: Number and percentage of *Salmonella,* Shiga toxin-producing *E. coli* (STEC), and *Listeria* isolates with PFGE information.	**Preferable:** > 90% of cases **Acceptable:** 60-90% of cases	A. *Salmonella* 100% (862/862) B. *E. Coli* (STEC) 100% (78/78) C. *Listeria* 100% (14/14)	**A. Preferable** **B. Preferable** **C. Preferable**
7. Isolate/CIDT-positive clinical specimen submission interval: Median number of days from collection of clinical specimen to receipt of isolate or clinical specimen from a patient	**Preferable:** <7 days **Acceptable:** 7-8 days	A. *Salmonella* 8 days B. *E. Coli* (STEC) 5 days C. *Listeria* 6 days	**A. Acceptable** **B. Preferable** **C. Preferable**

CIFOR Performance Indicators		Tennessee Performance	
Performance Indicator	**Target Range**	**Findings for Each Performance Indicator**	**Target Range Achieved**
diagnosed by CIDT at PHL.			

8. **Isolate subtyping interval:**
 	
Median number of days from receipt of *Salmonella,* Shiga toxin-producing *E. coli* (STEC), and *Listeria* isolate to PFGE subtyping results.
	Preferable:
	≤4 days
	Acceptable:
	5-6 days
		A. *Salmonella*
		   5 days
		
		B. *E. Coli* **(STEC)**
		   4 days
		
		C. *Listeria*
		   4 days
			A. Acceptable
			
			B. Preferable
			
			C. Preferable

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.
		A. *E. Coli* **(STEC)**
		   92%
		
		B. *Listeria*
		   100%
			A. **Acceptable**
			
			B. **Acceptable**

10. Outbreak clinical specimen collections: Number and percentage of outbreak investigations with clinical specimens collected and submitted to PHL from 2 or more people.	**Preferable:** > 75% of outbreaks **Acceptable**: 50-75% of outbreaks	76% (19/25)	**Preferable**
11. **Cluster investigation interval:** Median number of days from initiation of investigation to identification of source.	**Preferable:** <7 days **Acceptable:** 7-21 days	7 days	**Acceptable**
12. **Complaint investigation interval:** Median numbers of days from initiation of investigation to implementation of intervention.	**Preferable:** <7 days **Acceptable:** 7-21 days	Unable to calculate with available data.	**Not available**

CIFOR Performance Indicators		Tennessee Performance	
Performance Indicator	Target Range	Findings for Each Performance Indicator	Target Range Achieved
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	100% (8/8)	**Preferable**
14. Outbreak etiology reported to NORS: Number and percentage of outbreaks for which etiology was identified and reported to the National Outbreak Reporting System (NORS).	**Preferable:** > 68% of outbreaks **Acceptable**: 44-68% of outbreaks	76% (19/25)	**Preferable**
15. Outbreak vehicle reported to NORS: Number and percentage of outbreaks for which a vehicle was identified and reported to NORS.	**Preferable:** > 68% of outbreaks **Acceptable**: 44-68% of outbreaks	56% (14/25)	**Acceptable**
16. Outbreak contributing factor reported to NORS: Number and percentage of outbreaks for which contributing factors were identified and reported to NORS.	**Preferable:** > 68% of outbreaks **Acceptable**: 44-68% of outbreaks	44% (11/25)	**Acceptable**

Discussion

Of the 16 CIFOR performance indicators, 14 could be evaluated using available Tennessee data. Tennessee achieved either preferable or acceptable on those indicators where data were available. Number of outbreaks detected as a result of foodborne illness complaints and number of days from initiation of investigation to intervention implementation are not captured in Tennessee's foodborne illness complaint database, so performance indicators #2 and # 12 could not be calculated.

Tennessee's FoodCORE Interview Team (FIT) conducts interviews for *Salmonella*, STEC and *Listeria* cases who reside in 93 of 95 Tennessee counties. Hamilton County and Davidson County interview cases from their jurisdiction locally. All case clinical and exposure data are entered into NEDSS. The FIT and local

health department staff perform many of the functions evaluated with the CIFOR performance indicators.

Laboratory metrics are calculated from data in the StarLIMS system as well as BioNumerics. All data is available, however external calculations are used as neither information system directly reports answers to any of the metrics.

The Tennessee Department of Health continues to educate local health department staff about the importance of collecting stool specimens during an outbreak investigation. Stool collection and shipping training has been developed to educate health department staff, as well as staff in long-term care facilities that often collect stool during outbreaks in these types of facilities.

Continued training on identifying food vehicles and contributing factors during an outbreak investigation is needed to improve performance indicators # 15 and #16. Calculating performance indicators #15, #16, as well as # 14 and #10 by Tennessee health region will be important to do in the future so training needs can be targeted to the appropriate regional health department.

Recommendations
- Add variable to Tennessee foodborne illness complaint database that will capture whether or not the complaint resulted in an outbreak investigation.
- Continue to interview all cases of *Salmonella,* Shiga toxin-producing *E.coli,* and *Listeria* and capture demographic, clinical and exposure data into NEDSS.
- Continue to educate clinical and reference lab partners about isolate/specimen submission and monitor completeness of isolate/specimen submission, testing, and reporting.
- Provide stool collection and shipping training to local health department staff, as well as to partners who may assist in stool collection during an outbreak investigation.
- Provide training to epidemiology, environmental health and laboratory staff on various methods to identify food vehicles.
- Provide training to epidemiology and environmental health on identifying, responding to and reporting contributing factors.
- Review NORS reports quarterly and provide NORS training when appropriate.

References
[1]Council to Improve Foodborne Outbreak Response (CIFOR). Guidelines for Foodborne Disease Outbreak Response. 2nd Edition. Atlanta: Council of State and Territorial Epidemiologists, 2014.

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