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

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Background:

The Council to Improve Foodborne Outbreak Response (CIFOR) was established in 2006 to improve methods at the local, state, and federal levels to detect, investigate, control, and prevent foodborne disease outbreaks. In 2009, CIFOR released "Guidelines for Foodborne Disease Outbreak Detection and Response" (Guidelines)[1]. Chapter 8 of the Guidelines lists over 100 performance measures for foodborne disease programs. These measures are divided into foodborne disease program objectives and indicators (short-term, intermediate, and long-term) and major performance measures and metrics for program evaluation (for local and state communicable disease, environmental health, and laboratory programs).

In 2013, the CIFOR Metric Working Group consulted with state epidemiologists to assess the metrics that could be calculated with available state data, the difficulty of obtaining and calculating data, and value of the performance measures in evaluating foodborne disease programs' performance. As a result, the group revised the existing measures to include 16 performance measures and target ranges. The 16 performance measures were evaluated in the following report.

Methods:

To evaluate Nebraska performance on the 16 CIFOR performance measures, the following data were used:

- Extracted laboratory data from the Nebraska Public Health Laboratory – confirmed cases (*E.coli, Listeria, Salmonella*), specimen collection dates, serotyping/DNA fingerprinting dates, and PulseNet upload dates from 2015
- Outbreak tracking – Microsoft Excel spreadsheet of all foodborne and enteric illness outbreaks reported in Nebraska from 2011-2015
- Cluster tracking – Microsoft Excel spreadsheet of foodborne and enteric illness clusters reported in Nebraska from 2011-2015
- National Outbreak Reporting System (NORS) – managed by the Centers for Disease Control and Prevention (CDC). The 2011-2015 NORS data extract contains some different data elements than the state outbreak tracking data.
- 2011 United States census data

All performance measures were calculated with 2011-2015 data, unless otherwise specified. Multistate outbreaks, unless detected in Nebraska, were excluded from analysis.

Additionally, only clusters and outbreaks from point source foodborne exposures were included in the analysis.

Results:

Below, Table 1 describes the 16 CIFOR performance measures, which includes the target ranges suggested by the CIFOR Metrics Working Group, Nebraska findings, and the target range(s) achieved by Nebraska.

Table 1. CIFOR Performance Measures and Nebraska Performance

CIFOR Performance Measures		Nebraska Performance	
Performance Measure	**Target Range**	**Findings for Each Performance Measures**	**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	Used of mixed complaint reporting systems. *Nebraska foodborne illness complaint reporting systems vary by the local public health agency. The state does not utilize a unified reporting system to track complaints across jurisdictional boundaries.	Acceptable
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 at the state level because there is no unified complaint system. Individual local public health agencies (LPHAs) are encouraged to calculate this using their data.	N/A
3. Foodborne illness outbreak rate: Number of 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	2011= 0.55 (1 outbreak) 2012 = 1.1 (2 outbreaks) 2013 = 0 2014 = 1.1 (2 outbreaks) 2015 = 1.64 (3 outbreaks)	Acceptable (2012, 2014, 2015) Out of Range (2011, 2013)
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	2015 data *Salmonella*: 84.5% (239/283) STEC: 89.0% (113/127) *Listeria*: 100% (1/1)	Preferable

5. Isolate submissions to Public Health Laboratory: Number and percentage of isolates from confirmed *Salmonella*, STEC, and *Listeria* cases submitted to Public Health Laboratory	**Preferable:** > 90% of isolates **Acceptable**: 60-90% of isolates	2015 data *Salmonella*: 95.3% (285/299) STEC: 84.6% (110/130) *Listeria*: 100% (1/1)	Preferable (*Salmonella* and *Listeria*) Acceptable (STEC)
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	2015 data *Salmonella*: 97.9% (279/285) STEC: 70.8% (92/130) *Listeria*: 100% (1/1)	Preferable (*Salmonella* and *Listeria*) Acceptable (STEC)
7. Isolate submission interval: Median number of days from specimen collection to receipt of *Salmonella*, STEC, and *Listeria* isolate at PHL	**Preferable:** <7 days **Acceptable**: 7-8 days	Unable to link cases from the lab data containing the specimen receipt dates, to the case data containing the specimen collection data.	N/A
8. Isolate subtyping interval: Median number days from receipt of *Salmonella*, STEC, and *Listeria* isolates to serotyping or subtyping results	**Preferable**: ≤4 days **Acceptable:** 5-6 days	2015 data *Salmonella*: 2 days STEC: 2 days *Listeria*: 5 days	Preferable (*Salmonella* and STEC) Acceptable (*Listeria*)
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.	2015 data *E. coli* O157: 97% (29/30) *Listeria*: not tested at the Nebraska Public Health Lab, isolates are sent to CDC	Acceptable (STEC)
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	2012-2015 data 2012 = 0% (0/2) 2013 = no outbreaks identified 2014 = 50.0% (1/2) 2015 = 66.7% (2/3)	Out of Range
11. Cluster investigation interval: Median no. days from initiation of investigation to identification of a source.	**Preferable:** < 7 days **Acceptable:** 7-21 days	Clusters with initiation of investigation and source identification are moved to outbreaks and not maintained as clusters.	N/A

12. Complaint investigation interval: Median no. days from initiation of investigation to implementation of intervention.	**Preferable:** < 7 days **Acceptable:** 7-21 days	Unable to calculate. *Nebraska does not have a centralized foodborne illness complaint system hence unable to capture an intervention implementation date.	N/A
13. Cluster source identification: Number and percentage of clusters with 5 or more cases in which a source was identified.	**Preferable:** >20% of clusters with ≥5 cases **Acceptable**: 10-20% of clusters with ≥5 cases	2013-2015 data 2013 = 75.0% (3/4) 2014 = no clusters identified 2015 = 0% (0/1) *Limited number of clusters that had not been moved to the outbreak line list, as most solved clusters are deemed outbreaks. Also, most clusters did not have 5 or more cases.	Preferable (2013) Out of range (2014, 2015)
14. Outbreak etiology reported to NORS: Number and percentage of outbreaks for which etiology was identified and reported to NORS.	**Preferable:** > 68% of outbreaks **Acceptable:** 44-68% of outbreaks	2011-2015 NORS data 50% (3/6 outbreaks)	Acceptable
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	2011-2015 NORS data 66.7% (4/6 outbreaks)	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	2011-2015 NORS data 33.3% (2/6 outbreaks)	Out of Range

Discussion:

Out of 16 performance measures, 12 could be evaluated using the available data. Of these 12, 2 achieved a preferable range, 3 were in the acceptable range, 2 were out of range, and 5 had mixed ranges. The performance measures that individually evaluated *Salmonella, Listeria,* and *E.coli* often resulted in mixed ranges. Three of the four performance measures (#2, #11, #12) were unable to be evaluated because they required a unified complaint system and/or uncollected cluster data. Performance measures evaluating cluster data have proven to be difficult in multiple states, as many do not maintain cluster data in the same manner as outbreak data or classify solved clusters as outbreaks.

Additionally, the median number of days between specimen collection and isolate receipt at the laboratory (#7) was unable to be evaluated because there was no way to link the case data and the lab data.

Several of the performance measures with mixed results were on the border of preferable and acceptable ranges. Performance measures that evaluated public health laboratory response including isolate submission, serotyping or DNA fingerprinting, and PulseNet upload, achieved overall high target ranges.

As noted in the methods, only clusters and outbreaks with suspected point source foodborne exposure were included in the analysis. This criteria greatly impacted measure #3, where the majority of outbreaks were excluded due to suspected person-to-person or unknown transmission, resulting in very low foodborne illness outbreak rates. Due to the low rates of foodborne outbreaks per million population, some outbreaks are likely being missed.

We identified a notable inconsistency between the NORS extract and the outbreak data. For several records, the NORS data listed the outbreak etiology as unknown or left blank. However, the same outbreak would have an etiology listed after cross-referencing with the outbreak line list data. It is possible that the NORS data only includes lab confirmed etiology, whereas the outbreak data includes confirmed or suspected etiology. For measure #14, (percentage of outbreaks for which an etiology was determined and reported to NORS), outbreaks were only counted if the etiology was defined in the NORS extract, regardless if an etiology was included in the outbreak line list data.

As a final consideration, any target range specifically evaluating *Listeria* is representative of single case from 2015. Due to the small sample size, it may be difficult to interpret the state's true performance and response to *Listeria*.

Recommendations:

- Increase detection of foodborne illness clusters and outbreaks
- Increase the frequency and completeness of NORS reporting; ensure that the outbreak data matches the NORS data
- Attempt to collect stool specimens from 2 or more people for each outbreak
- Develop method to link cases from the outbreak data to the laboratory data, to improve tracking of collection, submission to the public health lab, and testing of specimens
- Consider developing a standard convention to assign ID numbers or unique identifiers to cases, that is used by both the local agencies and state
- Consider developing a unified complaint system
- Merge outbreak line list and cluster line list into a single Excel file, with one page for outbreaks and the other for clusters
- Improve identification and reporting of contributing factors
- Track cluster/outbreak investigation start and closure date