

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

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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)<sup>1</sup>. Chapter 8 of the Guidelines lists over 100 performance indicators for foodborne disease programs. These indicators are divided into foodborne disease program objectives and indicators (short-term, intermediate, and long-term) and major performance indicators and metrics for program evaluation (for local and state communicable disease, environmental health, and laboratory programs).

In preparation for a revision of the Guidelines, the CIFOR Metrics Working Group identified 20 key performance indicators from Chapter 8 and suggested target ranges for the indicators. These were sent to state epidemiologists in April 2013. States were asked to assess which metrics could be calculated with available state data, the difficulty of obtaining and calculating data, and value of the performance indicators in evaluating foodborne disease programs performance. Concurrently, the Colorado Integrated Food Safety Center of Excellence proposed evaluating Colorado data using the CIFOR performance indicators as a way to assess strengths and areas for improvement in outbreak detection and response.

## Methods

To evaluate Colorado performance on the 20 performance indicators, the following data was used:

- Colorado Electronic Disease Reporting System (CEDRS)—a web-based surveillance system used by Colorado Department of Public Health and Environment (CDPHE) staff, local public health staff, and hospital infection preventionists to report, investigate, and manage cases of reportable conditions in Colorado.
- CDPHE Outbreak Database—a Microsoft Access database used by CDPHE staff to track and manage outbreaks of enteric diseases, health-care acquired infections, and influenza.
- National Outbreak Reporting System (NORS)—managed by the Centers for Disease Control and Prevention (CDC), designated CDPHE employees report outbreaks to CDC using NORS. NORS contains some different data elements than the CDPHE Outbreak Database.

- Laboratory Information Tracking System Plus (LITS+)—a CDC-developed system used to track and archive all laboratory testing performed at the CDPHE Public Health Laboratory.
- 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.

Data from 2008-2012 were analyzed unless otherwise noted. No additional data were collected for the purpose of evaluating the CIFOR performance indicators.

## Results

Below, Table 1 describes the 20 revised CIFOR performance indicators, the target ranges suggested by the CIFOR Metrics Working Group, Colorado findings, and the target range(s) achieved by Colorado.

**Table 1:** CIFOR Performance Indicators and Colorado Performance

CIFOR Performance Indicators		Colorado Performance	
Performance Indicator	Target Range	Findings for Each Performance Indicator	Target Range Achieved
<p><b>1. Foodborne illness complaint reporting system:</b> 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.</p>	<p><b>Optimal:</b> database <b>Acceptable:</b> system to log complaints</p>	<p>Paper registry of complaints* * Most foodborne illness complaints received by local public health agencies</p> <p>Foodborne illness complaint reporting systems vary by agency. The CDPHE Division of Environmental Health and Sustainability has a paper system. However, the various systems used throughout the state do not “communicate” to each other across jurisdictional boundaries.</p>	Acceptable
<p><b>2. Foodborne illness complaint rate:</b> Number complaints received. Rate of complaints received per 100,000 population in jurisdiction.</p>	<p><b>High:</b> &gt; 20 complaints/ 100,000 population <b>Middle:</b> 10-20 complaints/ 100,000 population</p>	<p>Unable to calculate at the state level because there is no unified complaint system.</p> <p>Individual local public health agencies (LPHAs) are encouraged to calculate this using their data.</p>	Not Available
<p><b>3. Outbreaks detected from complaints:</b> Number of outbreaks detected as a result of foodborne illness complaints. Rate of outbreaks detected per 1,000 complaints received.</p>	<p><b>High:</b> &gt; 20 outbreaks / 1,000 complaints <b>Middle:</b> 10-20 outbreaks/ 1,000 complaints</p>	<p>Unable to calculate because no unified complaint system in Colorado.</p> <p>Individual LPHAs are encouraged to calculate this using their data.</p>	Not Available
<p><b>4. Foodborne illness outbreak rate:</b></p>	<p><b>High:</b> &gt;6 outbreaks /</p>	<p>2008= 13.26 outbreaks per million population</p>	High

CIFOR Performance Indicators		Colorado Performance	
Performance Indicator	Target Range	Findings for Each Performance Indicator	Target Range Achieved
Number foodborne outbreaks reported, all agents. Rate of outbreaks reported / 1,000,000 population.	1,000,000 population <b>Middle:</b> 1-6 outbreaks / 1,000,000 population	2009= 7.03 2010= 7.33 2011= 5.67 2012*= 7.62 *2012 rate uses 2011 population data because 2012 population data not available	
<b>5. Confirmed cases with exposure history obtained:</b> Number and percentage of confirmed cases with exposure history obtained	<b>High:</b> > 75% of cases <b>Middle:</b> 50-75% of cases	Salmonella=(2424/2915)=83% E. coli=(844/909)=93%	High
<b>6. Isolate submissions to Public Health Laboratory:</b> Number and percentage of isolates from confirmed cases submitted to Public Health Laboratory	<b>High:</b> > 90% of isolates <b>Middle:</b> 66-90% of isolates	Salmonella=(2807/2915)=96% E. coli=(907/909)=99.8%	High
<b>7. Pulsed Field Gel Electrophoresis (PFGE) subtyping of isolates:</b> Number and percentage of isolates with PFGE information.	<b>High:</b> > 90% of isolates <b>Middle:</b> 66-90% of isolates	Salmonella=(2619/2807)=93% E. coli=(586/907)=94%	High
<b>8. Isolate submission interval:</b> Median number of days from report of clinical findings to receipt of isolate at PHL	<b>Low:</b> <4 days <b>Middle:</b> 4-5 days	Was not calculated. This calculation requires merging epi data (report to public health date) and lab data (isolate receipt date) by unique lab ID (HUM #). Currently, CDPHE does not merge that data.	Not Available
<b>9. Isolate subtyping interval:</b> Median number days from receipt of isolate to serotyping or subtyping results	<b>Acceptable:</b> ≤4 days	2012 Data Median interval* for isolates: Salmonella= 3 days (n=576) E. coli= 4 days (n=453) *Median intervals are conservative estimates because they do not account for weekends or holidays. Note: isolates with missing information: Salmonella =0 E. coli= 1.5%	Acceptable
<b>10. PFGE E. coli O157 and Listeria subtyping interval:</b> Percent of pulsed-field gel electrophoresis (PFGE)	<b>Acceptable:</b> ≥90% of PFGE subtyping results submitted to	2012 Data  E. coli O157= 100% (median of 2 days, n=69)	Acceptable

CIFOR Performance Indicators		Colorado Performance	
Performance Indicator	Target Range	Findings for Each Performance Indicator	Target Range Achieved
subtyping data results for <i>E. coli</i> O157:H7 and <i>Listeria</i> submitted to the PulseNet national database within four working days of receiving isolate at the PFGE laboratory	PulseNet within 4 working days.	Listeria= 100% (median of 2 days, n=9)	
<b>11. Outbreak case exposure assessments:</b> Number and percentage of outbreak investigations with exposure assessments conducted.	<b>High:</b> 100% of outbreaks <b>Middle:</b> 90-99% of outbreaks	2009*-2012 outbreak data = 93% *2009 was the first year these data were collected using NORS	Middle
<b>12. Outbreak clinical specimen collections:</b> Number and percentage of outbreak investigations with clinical specimens collected and submitted to PHL from 2 or more people	<b>High:</b> > 75% of outbreaks <b>Middle:</b> 50-75% of outbreaks	= 113* (55%) outbreaks *Likely an underestimate due to incomplete data collection in CDPHE Outbreak Database	Middle
<b>13. Outbreak clinical specimen testing:</b> Number and percentage of outbreak investigations where specimens were tested for potential agents at Public Health Laboratory.	<b>High:</b> > 75% of outbreaks <b>Middle:</b> 50-75% of outbreaks	=110 (54%) outbreaks	Middle
<b>14. Cluster or complaint investigation interval:</b> Median no. days from initiation of investigation to implementation of intervention or close out of investigation.	<b>Low:</b> < 7 days <b>Middle:</b> 7-21 days	Unable to calculate because Colorado no longer maintains a cluster database.	Not Available
<b>15. Multistate outbreak investigation interviews:</b> Once a multistate foodborne outbreak has been declared by CDC, state health departments in conjunction with their local public health agencies closeout 80% of interviews within 48 hours using the 'outbreak designated' questionnaire.	<b>Acceptable:</b> >80% standard is met for all multistate outbreak investigations involving cases within jurisdiction.	Unable to calculate because Colorado does not collect this data directly. CDC will be collecting these data for future outbreaks.	Not Available
<b>16. Cluster source identification:</b>	<b>High:</b> >20% of clusters with >5	Unable to calculate because Colorado does not collect	Not Available

CIFOR Performance Indicators		Colorado Performance	
Performance Indicator	Target Range	Findings for Each Performance Indicator	Target Range Achieved
Number and percentage of clusters in which a source was identified	cases <b>Middle:</b> 10-20% of clusters with >5 cases	data on clusters that are not determined to be outbreaks.	
<b>17. NORS form completion:</b> Number and percentage of outbreaks where NORS form completed	<b>Acceptable:</b> 100% of confirmed foodborne outbreaks <b>Not Acceptable:</b> <100% of confirmed foodborne outbreaks.	=202 (99%*) * May represent failure to update Colorado Outbreak Database after one NORS form completed.	Not Acceptable
<b>18. Outbreak etiology reported to NORS:</b> Number and percentage of outbreaks for which etiology was identified and reported to NORS	<b>Top:</b> > 68% of outbreaks <b>Middle:</b> 44-68% of outbreaks	2009*-2012 =78 (55%) *First year NORS data were available	Middle
<b>19. Outbreak vehicle reported to NORS:</b> Number and percentage of outbreaks for which a vehicle was identified and reported to NORS	<b>Top:</b> > 60% of outbreaks <b>Middle:</b> 48-60% of outbreaks <b>Not Acceptable:</b> <48% of outbreaks	2009*-2012 =58 (42%) *First year NORS data were available	Not Acceptable
<b>20. Outbreak contributing factor reported to NORS:</b> Number and percentage of outbreaks for which contributing factors were identified and reported to NORS	<b>Top:</b> >55% of outbreaks <b>Middle:</b> 33-55% of outbreaks	2009*-2012 = 81 (57%) *First year NORS data were available	Top

## Discussion

Of the 20 performance indicators, 14 could be evaluated using available Colorado data. Of those, high or top target ranges were achieved for 5, middle ranges were achieved for 4, acceptable ranges were achieved for 3, and not acceptable ranges were achieved for 2.

Enteric disease investigation and control are decentralized in Colorado; local public health agencies (LPHAs) perform many of the functions being evaluated with CIFOR Chapter 8 performance indicators.

While laboratory testing and multi-jurisdictional outbreaks are managed by CDPHE, the majority of foodborne illness complaints, reported cases, and outbreak investigations are managed by LPHAs. CDPHE is available for consultation and direct assistance when needed.

Currently, it is not possible to calculate and evaluate the rate of Foodborne Illness Complaints or the number of outbreaks detected from complaints (performance indicators #2 and #3) due to this decentralized model. Depending on the nature of their complaint systems, some LPHA may be able to calculate these data locally. A unified foodborne illness complaint system would enable evaluating these performance indicators with statewide data. The CDPHE Communicable Disease and Epidemiology Section and Division of Environmental Health and Sustainability are in the early phases of developing a unified foodborne illness complaint system.

Though Colorado maintained a database of all clusters investigated for the 3-year period from 2009 to 2011 as part of a Foodborne Diseases Active Surveillance Network (FoodNet) project, the database was discontinued because it was labor-intensive and was rarely used after acute investigation was completed (e.g. for data analysis). Currently, limited data about clusters are logged in a spreadsheet. Performance indicators on time spent investigating a cluster and percentage of clusters where the source is identified (performance indicators #14 and #16) could be calculated with the addition of two fields to this spreadsheet; addition of fields will be considered by CDPHE staff.

Evaluating outbreak data with these performance indicators reinforced the importance of thorough and accurate data entry into NORS and the Outbreak Database. Training of LPHA on how to correctly complete the NORS form could improve the quality of data CDPHE enters into NORS. Discordant data on specimen collection and outbreak etiology confirmation between NORS and the Outbreak Database indicate that the Outbreak Database is not always being updated at the end of an outbreak and when the NORS form is submitted by LPHA. Ideally, data would not need to be entered in duplicate into both systems, but currently data from other databases cannot be uploaded to NORS. Also, the number of specimens collected during an outbreak is not routinely captured on the NORS form, even when the form is completed properly.

Not all performance indicators are relevant to LPHA work. The following five indicators were selected to best evaluate foodborne illness case investigation and outbreak management by LPHA:

**Table 2:** Selected CIFOR Performance Indicators for Local Public Health Agency Evaluation

CIFOR performance indicator	Target Ranges	Rationale for including in Local Public Health Agency Evaluation
<b>4. Foodborne illness outbreak rate:</b> Rate foodborne outbreaks reported, all agents. Number of outbreaks reported / 1,000,000 population.	High: >6 outbreaks / 1,000,000 population  Middle: 1-6 outbreaks / 1,000,000 population	Represents ability to detect and report foodborne illness outbreaks.
<b>5. Confirmed cases with exposure history obtained:</b> Number and percentage of confirmed cases with exposure history obtained	High: > 75 of cases  Middle: 50-75% of cases	Represents case investigations of reported confirmed cases of enteric illness.

CIFOR performance indicator	Target Ranges	Rationale for including in Local Public Health Agency Evaluation
<b>11. Outbreak case exposure assessments:</b> Number and percentage of outbreak investigations with exposure assessments conducted.	High: 100% of outbreaks  Middle: 90-99% of outbreaks	Represents thorough outbreak investigations.
<b>12. Outbreak clinical specimen collections:</b> Number and percentage of outbreak investigations with clinical specimens collected and submitted to PHL from 2 or more people	High: > 75% of outbreaks  Middle: 50-75% of outbreaks	Represents effort to collect stool specimens, identify the etiology of outbreaks, and report etiology correctly to CDPHE.
<b>18. Outbreak etiology reported to NORs:</b> Number and percentage of outbreaks for which etiology was identified and reported to NORs	Top: > 68% of outbreaks  Middle: 44-68% of outbreaks	

**Recommendations**

- The CDPHE Communicable Disease and Epidemiology Section should continue to work on developing an integrated complaint system with the Division of Environmental Health and Sustainability.
- Use the selected five performance indicators to analyze county and regional data; provide regional or county-specific data to LPHA that express interest.
- Use the selected five performance indicators to analyze Colorado data annually.
- Continue to aggressively investigate or provide consultation to LPHA during outbreaks.
- Continue to monitor completeness of case interviews and isolate submission.
- Explore ways to facilitate specimen collection during outbreaks to increase percentage of outbreaks with known etiology.
- Hold trainings on NORs form completion for LPHAs and CDPHE staff.

*If you are interested in having your LPHA’s data analyzed using these five performance indicators, please contact Rachel Jervis at 303-692-2459 or [Rachel.jervis@state.co.us](mailto:Rachel.jervis@state.co.us).*

**References**

<sup>1</sup>Council to Improve Foodborne Outbreak Response (CIFOR). Guidelines for Foodborne Disease Outbreak Response. Atlanta: Council of State and Territorial Epidemiologists, 2009