

Bundesinstitut für Risikobewertung

FoodChain-Lab: Tracing software supporting foodborne disease outbreak investigations





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Outline

• Introduction

- FoodChain-Lab
 - Data Collection
 - $\circ~$ Analysis and Visualization
 - \circ Live

Outlook



FoodChain-Lab – ad hoc



Weiser et al., 2013: "Trace-Back and Trace-Forward Tools Developed Ad Hoc and Used During the STEC O104:H4 Outbreak 2011 in Germany and Generic Concepts for Future Outbreak Situations", **Foodborne Pathog Dis**.

Weiser et al., 2016: "FoodChain-Lab: a trace-back and trace-forward tool developed and applied during food-borne disease outbreak investigations in Germany and Europe", **PLoS ONE**.

Outbreak Scenario 1:

Restricted to one Location



- Often caused by mistake during food preparation
- Acute outbreak
- High dose
- High infection rate
- Local investigation



Outbreak Scenario 2:

Affecting Multiple Locations/Countries



- Contamination during production/processing
- Diffuse distribution of cases
- Low dose
- Low infection rate
- Complex investigation

The outbreak investigation team see: Cases





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What is FoodChain-Lab?



• Open source software

https://foodrisklabs.bfr.bund.de

- Database for managing food tracing data
- Tool for data cleaning, enrichment & processing
 - Validation (also online: <u>https://foodrisklabs.bfr.bund.de/templatevalidator/</u>)
 - Cleaning (e.g. Duplicate Detection)
 - Enrichment (e.g. Geocoding)
 - Analysis (Clustering, Tracing, Scoring, etc.)
- Tool for visualization and interactive reasoning



REGULATION (EC) No 178/2002, Article 18, Traceability

- (1) The **traceability** of food, feed, food-producing animals, and any other substance intended to be, or expected to be, incorporated into a food or feed shall be established **at all stages of production, processing and distribution**.
- (2) Food and feed business operators shall be able to identify any person from whom they have been supplied with a food, a feed, a foodproducing animal, or any substance intended to be, or expected to be, incorporated into a food or feed.

To this end, such operators shall have in place **systems and procedures** which allow for this information to be made available to the competent authorities **on demand**.

(3) Food and feed business operators shall have in place systems and procedures to identify the other businesses to which their products have been supplied. This information shall be made available to the competent authorities on demand.



Database – Structure for Food Chains







Principle of tracing back – Data gathering



Principle of tracing back – Data gathering



Data gathering – Development of a new "simple" template



"one step back-one step forward"principle of REGULATION (EC) No 178/2002, Article 18

->

Endless supply chains with arbitrary complexity realizable







FoodChain-Lab Data cleaning





Levenshtein distance



Μ	А	Y	0	Ν	Ν	А	I	S	Е	_				
=	=	=	=	=	-	=	=	=	=					
Μ	А	Y	0	Ν		А	Ι	S	Е					
										_		_	_	
										E	L	E	<u>P</u>	
										=	=	=	0	_

Works well for finding typos



ELEF

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Available Providers:

- (Google)
 - Web service
- MapQuest
 - Web service on open data
- Gisgraphy
 - Locally installable
 - Confidentiality of data ensured!
 - No request limit!





FoodChain-Lab Scoring



Definition:

Trace = path, a contamination can take via the food chain network

- Visualization of backward / forward "trace"
- Simulations based on
 - Cross Contamination
 - Regional Effects (e.g. environmental contamination)
 - Weights for Outbreak Stations
- Tracing score as simulation result
 - ~ likelihood a station is involved in the outbreak





FoodChain-Lab

Data visualization of Traces



Traces of the products of the blue station. All 3 outbreak stations (red) are reached by the forward trace (green).





FoodChain-Lab

(Geo-) cluster analysis



Synchronized network- and map-view.

Manually or automatically defined regions may be treated as one station. This allows analysis of regional causes of the outbreak.





Real world applications



Armin Weiser, 15.03.2016, Baltic Countries 2016 Workshop on Crisis preparedness, FoodChain-Lab



Live...



https://foodrisklabs.bfr.bund.de





Outlook Software



- Automation
 - Simulations for various parameters
- Integration
 - Further tools: FoodProcess-Lab, Pmm-Lab, ...
 - Further data: Sample analysis data from laboratories, ...
- Simplification
 - Data collection
 - Handling
- Other
 - Improved Layouts
 - New Retrospective features
 - Support, bug fixes, documentation
 - o ...







- Special enhancements on data gathering
 - Centralizing / Cloud service (but still usable for decentral units)
 - Direct on-site data gathering, e.g. via Tablet/Phone
 - Establish data exchange formats between authority -> authority and business -> authority
- Dissemination
 - Workshops with the motive "Train the trainer"
 - MS of EU
 - Other parties?
 - Every day usage? Further application areas?
- Realize (pilot) projects with potential stakeholders?
- Do we need a "Rapid Deployment Team"?





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Thank you for your attention

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