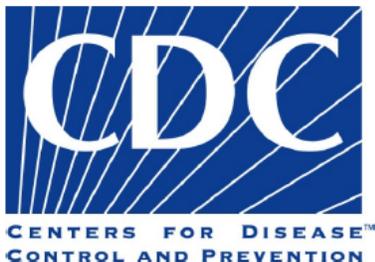


INTERAGENCY FOOD SAFETY -
ANALYTICS COLLABORATION -
(IFSAC) -

STRATEGIC PLAN -
CALENDAR YEAR 2017-2021 -



INTRODUCTION -

In 2011, three federal agencies—the Centers for Disease Control and Prevention (CDC), the U.S. Food and Drug Administration (FDA), and the Food Safety and Inspection Service of the United States Department of Agriculture (USDA-FSIS)—joined together to create the Interagency Food Safety Analytics Collaboration (IFSAC). The purpose of this collaboration is to improve coordination of federal food safety analytic efforts and address cross-cutting priorities for food safety data collection, analysis, and use. IFSAC's focus during its first five years was foodborne illness source attribution: identifying which foods are the most important sources of selected major foodborne illnesses.

Federal agencies and food safety experts rely on attribution analyses to inform strategic planning and risk-based decision-making, estimate benefits of interventions, and evaluate the impact of interventions, such as new or revised regulations, policies, and performance standards. By bringing together data from a variety of sources, broadly exploring an array of methods and disciplines, and developing sound analytical methods, IFSAC scientists can improve estimates of the sources of foodborne illness.

IFSAC identified four priority pathogens—*Salmonella spp.*, *Escherichia coli (E. coli) O157:H7*, *Listeria monocytogenes (Lm)*, and *Campylobacter*—for its initial work because estimates published by CDC in 2011 indicate these pathogens were responsible for about 21% of foodborne illnesses, 56% of related hospitalizations, and 54% of related deaths annually caused by known pathogens acquired in the United States (U.S.).¹ The three IFSAC agencies regularly investigate multistate outbreaks caused by the first three pathogens, and *Campylobacter* is estimated to be the second most common bacterial cause of foodborne illness. Interventions by industry and regulatory agencies directed at control of these pathogens could result in marked decreases in the number of illnesses, hospitalizations, and deaths due to these infections.

IFSAC Accomplishments: First 5 Years

During the period covered by IFSAC's first Strategic Plan (2012-2016), IFSAC aimed to improve methods to categorize foods implicated in outbreaks; generate estimates of the percentage of certain foodborne illnesses due to each food source attribution; identify data needs; take steps to determine how to better acquire, improve, and organize data available for source attribution; validate current methods and modeling approaches; develop improved methods; and create a plan for communicating results to the public. To achieve these aims, the three federal agencies developed individual statement of needs that informed IFSAC's first strategic plan, which focused on improving foodborne illness source attribution estimates. Scientists from the three agencies then designed and completed foundational analyses and projects. Projects were designed to complement each other to ensure maximum use and efficiency and to incrementally build on each other to allow for the pursuit of increasingly challenging objectives and projects.

Among these foundational projects was a new food categorization scheme that CDC now uses to classify foods implicated in outbreaks; this scheme is more relevant to food regulatory agencies for risk-informed resource allocation than earlier schemes. Other projects included a comparison of the

1 Scallan E, Hoekstra RM, Angulo FJ, Tauxe RV, Widdowson M-A, Roy SL, et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis* [serial on the Internet]. 2011 Jan. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3375761/>

characteristics of outbreak and sporadic (i.e., illnesses not linked to a known outbreak) cases to help assess the usefulness of outbreak data in estimating which food categories are most often sources of illness; and a project that resulted in an improved method for estimating the food sources of illnesses, accounting for the uncertainties and variability inherent in outbreak data.

Findings from these efforts resulted in improved methods for attributing illnesses to specific foods, and, even more importantly, served as the foundation for a key project that resulted in tri-agency consensus on a method for estimating the sources of foodborne illnesses, with uncertainty bounds around the proportion attributed to various food sources, for *Salmonella spp.*, *E. coli* O157:H7, *Lm*, and *Campylobacter* using outbreak data.

IFSAC also established a Communications Workgroup and implemented a formal communications plan, including the launch of an IFSAC website (<http://www.cdc.gov/foodsafety/ifsac/index.html>) to share information with the public about its strategic direction, as well as projects, activities, and other information. IFSAC's analytic work was also shared at public meetings and through scientific meetings, webinars, and publications in peer-reviewed journals.

IFSAC Plans: Next 5 Years

Building on previous accomplishments, this new Strategic Plan outlines goals and objectives for the next five years (2017-2021) that will guide IFSAC activities. IFSAC's primary focus is to continue to improve estimates of foodborne illness source attribution, and to develop methods to estimate how sources change over time. The three goals that underpin the overarching focus are: improving the use and quality of new and existing data sources; improving analytic methods and models; and enhancing the use of and communication about IFSAC analytic products. This document provides information about how IFSAC intends to meet these goals. IFSAC's focus, goals, and objectives are displayed in Table 1; strategies to achieve these goals and objectives are included in the text below. More details on the organizational processes IFSAC uses can be found in the [IFSAC Charter](#), which was updated in 2016. Ongoing and potential future projects supporting implementation of this Strategic Plan will be described in an Action Plan, which will be posted on the IFSAC website.

Table 1

IFSAC's Focus: Improve foodborne illness source attribution and the understanding of how it changes over time		
Goal 1: Improve the use and quality of new and existing data sources to conduct analyses and develop estimates	Goal 2: Improve analytic methods and models	Goal 3: Enhance the use of and communication about IFSAC products
<p>Objective 1.1: Enhance the collection and quality of relevant source data</p> <p>Objective 1.2: Enhance the use of existing foodborne illness surveillance data sources</p> <p>Objective 1.3: Incorporate genomic data and other novel data sources</p>	<p>Objective 2.1: Explore ways to address key gaps in data quality, quantity, methods, and models</p> <p>Objective 2.2: Develop new analytic approaches and models to maximize use of already available data</p> <p>Objective 2.3: Expand the availability of technical and scientific expertise through collaboration with internal and external partners</p>	<p>Objective 3.1: Enhance relationships and engagement with both internal and external groups</p> <p>Objective 3.2: Improve the synthesis, interpretation, and dissemination of analytic products for multiple audiences</p>

Goal 1: Improve the use and quality of new and existing data sources to conduct analyses and develop source attribution estimates

IFSAC uses a variety of data sources to estimate source attribution, and plans to continue to seek ways to improve the use and quality of new and existing data sources to develop the most accurate and updated foodborne illness source attribution estimates possible. Existing data sources, such as foodborne illness outbreak data, are highly valuable given the breadth and depth of the data. However, challenges with and limitations of these data include incompleteness and inconsistency in how certain aspects of outbreaks are reported (e.g., contributing factors [e.g., ingredient cross-contamination, improper temperature controls, etc.], specific implicated ingredients) and that additional relevant information collected during state and local investigations may not be captured in national databases. To help improve existing data sources, IFSAC intends to work with federal, state, and local partners to enhance data collection, completeness and quality. Furthermore, IFSAC intends to incorporate additional sources of data into analyses, such as regulatory sampling data and whole genome sequencing (WGS) information, to improve estimates.

Objective 1.1: Enhance the collection and quality of relevant source data

A fundamental component of developing robust attribution estimates is robust data from a variety of sources with which to perform detailed analyses. However, not only is there a limited variety of data sources available, but the data themselves also have important limitations. IFSAC intends to work with key partners (e.g., federal and state public health and regulatory agencies, industry, academia, and other external stakeholders) to identify gaps in data and sources of data, describe these gaps, and promote the collection of needed data. Because state and local government agencies collect the vast majority of foodborne illness data, IFSAC plans to encourage the collection of data that can benefit federal, state, and local partners without adding substantial resource burdens.

Strategy 1.1.1: Identify major gaps in relevant data and data sources

IFSAC intends to work with federal, state, and local partners, as well as external stakeholders, to assess gaps in data elements and sources of data that, if closed, would markedly improve IFSAC's ability to produce high-quality estimates of foodborne illness source attribution necessary to measure progress on agency goals and objectives.

Strategy 1.1.2: Actively advocate for ways to close identified data gaps through acquisition of new and existing data and sources of data

IFSAC intends to communicate the findings of the gaps assessment, and advocate for activities to address identified data needs, such as increasing access to and incorporation of existing data sources, improving the quality or utility of existing data sources for the purposes of attribution, and developing new data collection or research activities.

Strategy 1.1.3: Support states and local public health agencies in the collection of data relevant to IFSAC

Data collected at the state and local levels is essential for IFSAC to conduct analyses and improve understanding of foodborne illness sources and trends, but inconsistencies in how these data are reported present a challenge for subsequent analyses. IFSAC intends to work with state and local public health and regulatory agencies, and with the CDC group that manages the Foodborne Disease Outbreak Surveillance System (FDOSS), to develop ways to obtain more consistent and complete

outbreak investigation reporting. Through their agencies, IFSAC plans to encourage the provision of resources to state and local health departments to improve outbreak reporting.

Objective 1.2: Enhance the use of existing regulatory and foodborne illness surveillance data sources

IFSAC recognizes that regulatory and foodborne illness surveillance data can be useful in making foodborne illness estimates; to varying degrees, IFSAC has used both types of data. However, there exists a wider breadth and scope of data that IFSAC would like to use to improve current attribution estimates. Overall, regulatory sampling and inspectional data have been infrequently used in U.S. foodborne illness attribution estimates. IFSAC plans to work internally with regulatory partners to identify and evaluate inspectional data and product and environmental sampling data to assess ways it could better inform attribution estimates.

Similarly, there has been limited exploration of the uses of multiple sources and types of microbial testing results. IFSAC plans to explore the possibility of incorporating existing sources of laboratory-based, non-human surveillance data into models to generate attribution estimates.

Strategy 1.2.1: Work with regulatory agencies to incorporate regulatory sampling, inspection, and enforcement data into attribution studies

Regulatory agencies routinely conduct microbiological sampling in the food establishments they regulate. These data are often collected at multiple points in the food supply chain, allowing for a unique look into contamination at different points in the farm to fork continuum. Although limited in many ways, data generated from this type of sampling, such as product and environmental sampling results, may enable IFSAC to attribute illnesses along the supply chain. Routine inspection and enforcement data may also enhance attribution estimates through a better understanding of changes in contamination rates in response to inspection/enforcement activities. IFSAC therefore plans to explore the use of regulatory data with federal and industry partners. IFSAC also intends to engage with federal and state agencies on future sampling efforts based on IFSAC's assessment of data gaps in Strategy 1.1.1.

Strategy 1.2.2: Evaluate the use of existing laboratory-based surveillance data

Microbial subtyping that provides (sub-) speciation of pathogens has been used to generate source attribution estimates. IFSAC intends to evaluate existing microbial subtyping data of pathogens isolated from human, food, animal, and environmental samples relevant to foodborne illness. Specifically, IFSAC scientists may evaluate the use of pulsed-field gel electrophoresis (PFGE), antimicrobial resistance, serotyping, and WGS data in improving attribution estimates.

Objective 1.3: Incorporate genomic data and other novel data sources

Multiple federal, state, and local public health agencies are using new genomic technologies to perform pathogen identification during foodborne illness outbreaks. WGS reveals the complete DNA make-up of an organism, allowing researchers to subtype organisms with a precision that other technologies do not allow and which has the promise to replace several existing methods of microbial subtyping (serotyping, known antibiotic resistance, PFGE) for public health purposes. Genomic data offers the possibility of improving attribution estimates in several ways (e.g., by providing data on likely sources for a pathogen with particular traits). To leverage this new technology, IFSAC intends

to explore ways to incorporate genomic data and other novel data sources into models that generate attribution estimates.

Strategy 1.3.1: Develop mechanisms to obtain and incorporate WGS data

IFSAC plans to work with federal partners to develop standard mechanisms to obtain WGS data and collaboratively work with federal and state partners to incorporate these data into analyses.

Strategy 1.3.2: Explore the application of other novel public and private data sources

Public and private data sources, such as the National Health and Nutrition Examination Survey (NHANES) and purchasing volume data have the potential to inform analyses of foodborne illness sources and help in developing better and more precise estimates. In concert with the assessment of gaps described above, IFSAC intends to explore the benefits and limitations of these and other novel data sources to improve estimates.

Goal 2: Improve analytic methods and models

Progress has been made in developing new and innovative analytical methods and models to better attribute foodborne illnesses, yet additional efforts are needed, such as incorporating multiple methodological approaches to produce a single estimate. This is because no single data source or set of data sources was specifically designed to allow investigators to generate estimates of the number or proportion of illnesses attributable to each food source at the different points in the food production and distribution chain. Improved analytic methods and models will allow for more precise estimates, better address data sparseness, and better incorporate uncertainty. IFSAC intends, therefore, to continue to seek ways to improve analytic methods and models, through the expansion of collaborative scientific exchanges among internal and external subject matter experts (SMEs), to achieve the most accurate and timely foodborne illness source attribution estimates possible.

Objective 2.1: Explore ways to address key gaps in data quality, methods, and models.

As IFSAC seeks to develop better foodborne illness source attribution estimates, gaps in data quality, methods, and models should be addressed. IFSAC intends, therefore, to explore methods to address data sparseness and missingness, methods to better incorporate uncertainty, and adapt analytical techniques from other disciplines to allow for more precise estimates.

Strategy 2.1.1: Explore methods that address data sparseness and missingness

The data sources that IFSAC uses to estimate foodborne illness source attribution can pose challenges for analysis due to sparseness (e.g., an excess of zeroes in count data, necessitating the use of zero inflation models) and be limited by missing and incomplete data fields that result in a high level of uncertainty and potential errors in estimates. IFSAC plans to continue to explore methods such as hybrid models and multiple imputation to address data sparseness and missingness in attribution analyses.

Strategy 2.1.2: Explore the use of methods to better incorporate uncertainty

Uncertainty from measurement error, biases, and modeling choices can affect the applicability and generalizability of model results. IFSAC intends to explore, and when appropriate, apply methods that better incorporate all sources of error to better represent the uncertainty in estimates.

Strategy 2.1.3: Assess and adapt, where applicable, methods from other disciplines

Analytic methods from other disciplines can provide new techniques, insights, and approaches to explore and manipulate data, which can lead to improved estimates. For example, econometrics applies statistical methods to economic and time series data and may have similar applications for foodborne illness data. IFSAC could use these methods to better model time series or incorporate economic costs related to illness in attribution estimates. IFSAC intends to explore the use of these methods as appropriate in its model development.

Objective 2.2: Develop new analytic approaches and models to maximize use of already available data

New approaches and models can allow analysts to mine existing data sources, increasing the usefulness of currently available data and improving analyses. Better use of existing data sources provides IFSAC with the ability to make improvements to methods and models without having to wait for new data sources.

Strategy 2.2.1: Improve attribution methods based on outbreak data

Currently, IFSAC attribution estimates based on outbreak data are limited to four pathogens, and based only on outbreaks where a single contaminated ingredient could be identified or reasonably inferred. IFSAC intends to expand methods to incorporate data into its estimates from outbreaks associated with multi-ingredient foods, such as a chicken salad sandwich, and from outbreaks and clusters where the source was not determined. IFSAC plans to also consider developing attribution fractions for additional pathogens, and will consider other advances to its statistical modeling.

Strategy 2.2.2: Develop methods to incorporate sporadic illness surveillance data

IFSAC intends to expand its use of illness surveillance data to incorporate sporadic case data by using data from the CDC-led Foodborne Disease Active Surveillance Network's (FoodNet) case-exposure ascertainment questions. IFSAC may use case-case analyses or compare case with population data. This approach could be particularly helpful for pathogens not often associated with outbreaks, such as *Campylobacter*.

Strategy 2.2.3: Develop methods to assess changes in sources of illness over time

IFSAC intends to develop methods to assess changes in the sources of illness caused by specific pathogens over time. These analyses can help in assessing the impact of specific policies, performance standards, regulations, and changes in industry practices. These analyses could also help identify the emergence of historically uncommon food-pathogen pairs.

Strategy 2.2.4: Explore methods to integrate multiple sources of data into attribution estimates and other analyses

Attribution studies based on different data sources and methods often produce different results. IFSAC has produced some analyses to "blend" attribution estimates based on outbreak data with those based on sporadic epidemiological studies, but additional work is needed. In addition, IFSAC may work to integrate population-level data into its estimates (i.e., to better estimate disease burden and economic costs). IFSAC plans to continue to explore approaches to combine information from multiple attribution studies.

Objective 2.3: Expand the availability of technical and scientific expertise through collaboration with internal and external partners

IFSAC recognizes that much can be learned from a diverse group of technical and scientific experts. IFSAC therefore seeks to expand its collaboration among internal agencies and with experts outside the participating agencies to develop and incorporate data, methods, and models for estimating foodborne illness source attribution. With respect to building upon external collaborations, IFSAC plans to explore mechanisms to better leverage a more diverse set of expertise.

Strategy 2.3.1: Increase the inclusion of tri-agency participants with programmatic expertise

On a day-to-day basis, agency epidemiologists and statisticians are involved in IFSAC technical projects. To build on the collaborative efforts achieved over the last five years, IFSAC aims to increase participation from SMEs in other federal programs (e.g., experts on regulatory compliance) to be involved in IFSAC technical projects.

Strategy 2.3.2: Identify and incorporate external technical and scientific expertise

At certain targeted points in project development and implementation, IFSAC may wish to engage expertise from outside the three agencies (e.g., through federal agencies' Centers of Excellence

(COEs)) or through discussions with external stakeholders. This could help address specific analytic questions or provide input into analytic projects. IFSAC intends to identify the needed technical and scientific expertise to achieve this strategy, and the appropriate mechanisms to make that expertise available.

Goal 3: Enhance the use of and communication about IFSAC products

Communication is a key component of IFSAC's efforts. Foodborne illness source attribution is a complex issue, and ensuring that IFSAC's work and findings are properly communicated to federal leadership, state and local public health practitioners, academics, advocacy groups, industry, and the general public is an important element of IFSAC's work. In particular, a major challenge is how to communicate changing attribution estimates over time that may result not only from changes in food safety and food consumption patterns, but also changes in methods for calculating estimates (e.g., because of new data sources or improved methods). Different data sources and models vary in their strengths and weaknesses, and so a single approach may not be useful for all scenarios.

IFSAC intends to build and expand relationships, to better understand the needs of users of IFSAC products, to enhance their usage, and to enrich how IFSAC communicates findings.

Objective 3.1: Enhance relationships and engagement with both internal and external groups

Over the past five years, IFSAC has increased the involvement of experts within the participating federal agencies and established relationships with a variety of stakeholders, including the Interagency Risk Assessment Consortium (IRAC), the CDC's Board of Scientific Counselors (BSC), agency COEs, and other groups. IFSAC intends to further grow these relationships and establish new partnerships, both within the federal government and outside of it, to gain insights into the needs of the stakeholders, increase awareness of IFSAC products, and share findings from IFSAC projects.

Strategy 3.1.1: Enhance engagement with scientific groups and external stakeholders

Awareness and engagement of the scientific community is essential to advancing the use of IFSAC's analytical products, particularly new methods and analytic approaches to improve foodborne illness source attribution. This engagement may result in new collaborations contributing to IFSAC's other goals and objectives. Another important component of communicating the findings of IFSAC's analyses is sharing them with a wide variety of stakeholders, including the food industry, public interest groups, academia, and others, in a variety of venues and formats. IFSAC intends to continue to engage the broader food safety community, including participating and presenting at scientific conferences, hosting meetings and webinars, and publishing in peer-reviewed journals.

Strategy 3.1.2: Engage agency stakeholders on ways to assess impact of agency policies and regulations and inform new policies

IFSAC has worked with federal partners to assess the public health impact of policies and regulations and to inform new policies by helping identify which foods cause specific foodborne illness. For example, IFSAC estimated the proportion of illnesses that could be attributed to shell eggs and other common sources before the implementation of the 2010 FDA Egg Rule in order to provide baseline estimates of *Salmonella* Enteritidis. IFSAC intends to continue these types of activities and work collaboratively with the federal agencies to evaluate the impact of regulations and policies and provide data and estimates to inform new policies.

Objective 3.2: Improve the synthesis, interpretation, and dissemination of analytic products for multiple audiences

Ensuring that IFSAC's analytic products are meaningful, easily understood, and useful is an essential component of IFSAC's overarching goal to improve attribution. IFSAC plans to continue working with analysts, communication specialists, and others to provide meaningful explanations for results that differ across a variety of analytic products, ensure those products are easy to use and interpret, and ensure they reach the intended users.

Strategy 3.2.1: Identify audience for and assess gaps in IFSAC products

IFSAC intends to work with public health and regulatory agencies, consumer advocacy groups, and relevant industry sectors, as well as communication experts to better identify users of IFSAC products and identify gaps in current products.

Strategy 3.2.2: Identify and implement improved approaches to communicate differences in attribution estimates

Foodborne illness attribution estimates rely on sophisticated statistical models and methods and a wide variety of data sources and inputs, from various time periods. IFSAC plans to explore techniques to communicate uncertainty and differences in estimates from various analytic approaches and how they fit together to improve our overall understanding of the foods causing specific illnesses.

Strategy 3.2.3: Work with federal partners to increase use of IFSAC methods and estimates

Attribution estimates are most valuable when they are integrated into broader analyses that regulatory agencies use to prioritize resources aimed at food safety interventions. Tangible ways to incorporate IFSAC methods and estimates into regulatory operations is complex. Further, using consistent approaches and estimates across all federal food safety partners increases transparency and allows for improved understanding of the sources of illness across the farm-to-fork continuum. IFSAC intends to work closely with federal partners to better understand their needs and to present attribution estimates in ways that are useful to them, so they may use the estimates, with other data, to inform policy-making, priority setting, and resource allocation.