The Risk and Best Practices in the Digital Transformation of the Foodservice industry

Hal King, Ph.D., Managing Partner

A focus on how to prevent infectious diseases and save lives

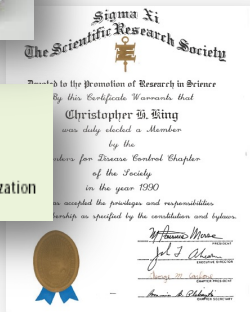US PUBLIC HEALTH SERVICE COMMISSIONED CORPS

Infectious Disease Research

Outbreak Investigations

US Army

International Disease Prevention

Emerging Diseases Investigations

Interventions for Prevention

Biological Threats - Force Health

Food Safety Industry Leadership
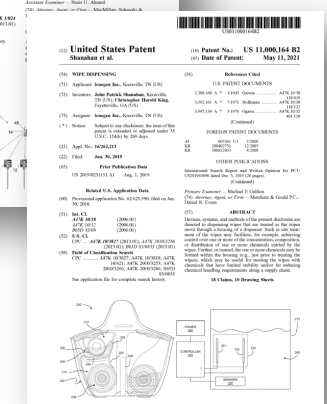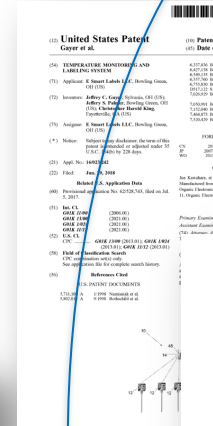
Intervention/Product Innovations

Advisory Services

What is the state of the public health in the foodservice industry?

60% of all foodborne disease outbreaks in the US
Nothing is changing year to year

2020 Foodborne disease outbreaks associated with retail foodservice

All Foodservice

Outbreaks per State — Display: U.S. Map

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

National Outbreak Reporting System (NORS)
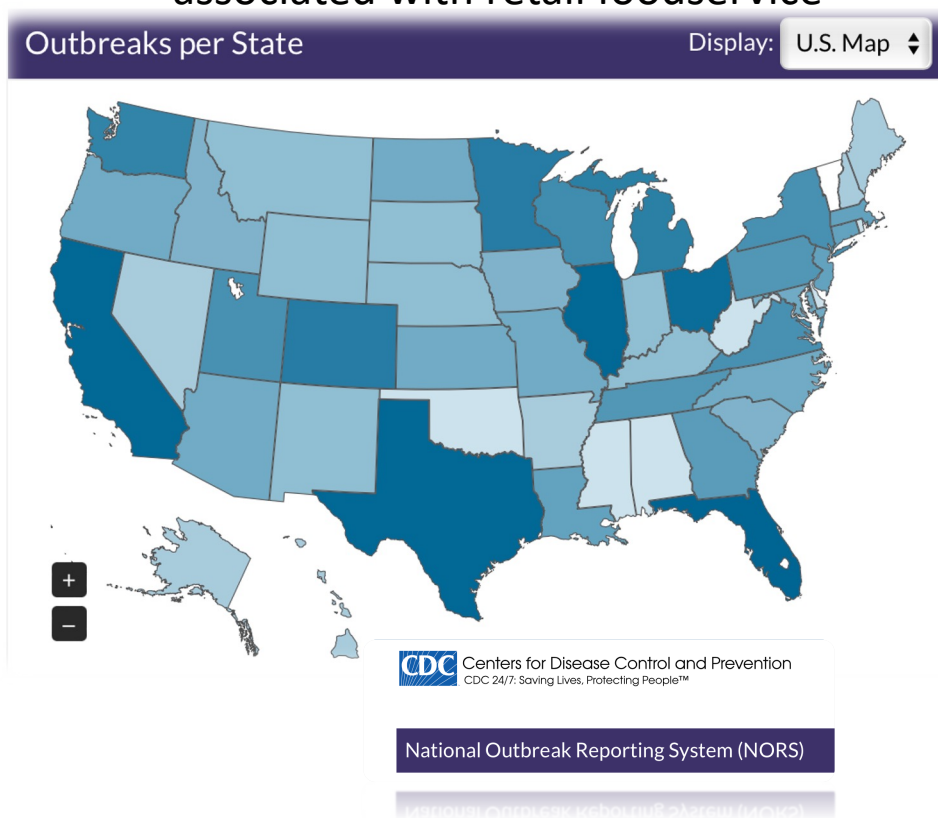
Quick Stats - Current Filters

180	Outbreaks
3,047	Illnesses
337	Hospitalizations
3	Deaths

Quick Stats - Overall

57,649	Outbreaks
2,031,782	Illnesses
41,246	Hospitalizations
2,205	Deaths

Data from reports of foodborne and waterborne disease outbreaks and enteric (intestinal) disease outbreaks spread by contact with environmental sources, infected people or animals, and other means

What is the state of the public health in the foodservice industry?

Just because a restaurant hasn't caused a foodborne disease outbreak-
doesn't mean it isn't causing sporadic cases of illness

Reported in 2021 in the United States

- An outbreak from the same strain of *Salmonella* from only one restaurant over the course of 10 years

- Different employees also had illness from the same strain

- The same strain was isolated from several environmental surfaces in this restaurant

Sporadic cases of illness over time from the same strain of pathogen from the same source of all cases

What is the state of the public health in the foodservice industry?

Just because a restaurant hasn't caused a foodborne disease outbreak, doesn't mean it isn't causing sporadic cases of illness
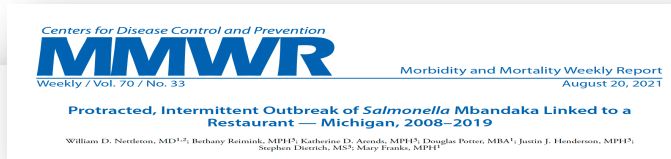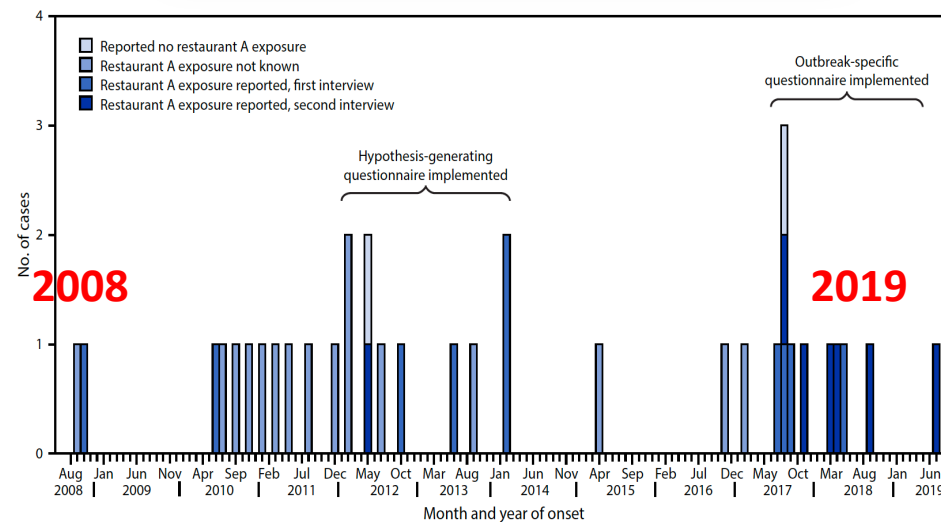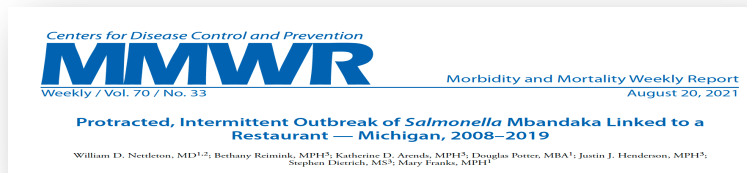
The same strain was isolated from several environmental (drains, floors, equipment, etc.) surfaces in this restaurant

TABLE. Characteristics of *Salmonella* Mbandaka outbreak subtype isolates from symptomatic patients, asymptomatic restaurant A employees, and restaurant A environmental surfaces — Michigan, August 2008–June 2018

Source of isolate	No. of samples collected	No. (%) of isolates identified by PFGE	No. (%) of isolates identified by WGS	Isolation date or date range	Clade by cgMLST
Symptomatic patient	36	36 (100)	30 (83)	2008–2012	B
				2012–2014	C
				2015–2018	A
Asymptomatic employee*	100	5 (5)	5 (5)	Jun 2018	A
Environment (restaurant)	80	39 (49)	26 (33)	Jun 2018	A
Environment (restaurant)	81	11 (14)	10 (12)	Nov 2018	A

Abbreviations: cgMLST = core genome multilocus sequence typing; PFGE = pulsed-field gel electrophoresis; WGS = whole genome sequencing.
* Five isolates were analyzed from four asymptomatic employees.

active food SAFETY

What is the state of the public health in the foodservice industry?

THERE CAN BE MORE SPORADIC CASES OF FOODBORNE DISEASE OUTBREAKS IN THE UNITED STATES THEN THE NUMBER OF CASES IN ALL OUTBREAKS

Pathogen	Outbreak Illnesses	Sporadic Illnesses	Outbreak Fraction*
Campylobacter	195	42,744	0.5%
E. coli 0157	730	3,117	19.0%
Listeria monocytogenes	56	1,024	5.2%
Salmonella (all)	3,161	50,690	5.9%

Table 4. Differences between number of illnesses in all outbreaks vs. number of illnesses in all sporadic foodborne disease incidents in the United States between 2004-2011 (Data reproduced from CDC 2016). * Outbreak Fraction equals percent of all illnesses in the United States only associated with an outbreak

King, 2020 Springer

Just because a restaurant hasn't caused a foodborne disease outbreak, doesn't mean it isn't causing sporadic cases of illness

How do the majority of foodborne disease outbreaks/illnesses happen in restaurants?

TRADITIONAL RETAIL FOODSERVICE SUPPLY CHAIN AND RESTAURANT OPERATIONS

- **Biological hazards** (e.g., *Listeria monocytogenes*)
- **Chemical hazards** (e.g., undeclared allergens)
- **Physical hazards** (e.g., plastics, bones)

Cocoa Beans

Salmonella

During manufacturing, distribution, and transportation

Salmonella

Sugar & Flour

Cocoa Powder

Salmonella

Liquid Eggs

Butter

During food preparation and service

Raw Cookie Dough

Salmonella

2020

180	Outbreaks
3,047	Illnesses
337	Hospitalizations
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The digital transformation of foodservice and delivery

During manufacturing, distribution, and transportation

During food preparation and service

During food storage and delivery

Cocoa Beans

Salmonella

Salmonella

Sugar & Flour

Cocoa Powder

Liquid Eggs

Salmonella

Butter

Salmonella

Raw Cookie Dough

~$800 Billon in sales/year

~$100 Billon in sales/year by 2030
(off premise, ghost kitchens, mail order sales)

MAIL

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Skipping the line

Transaction rates
~100-250 customers per hour (or more)

Transaction rates
~30-50 customers per hour

Number of Smartphone Subscriptions 2016-2022
smartphone users in billions

2016	2017	2018	2019	2020	2021	2022*projection
3.66	4.43	5.09	5.62	5.92	6.25	6.56

CellP
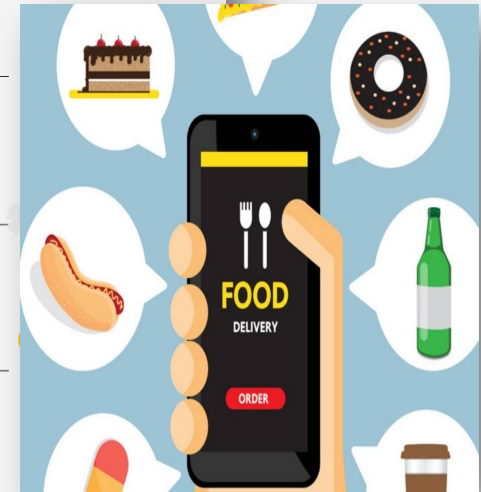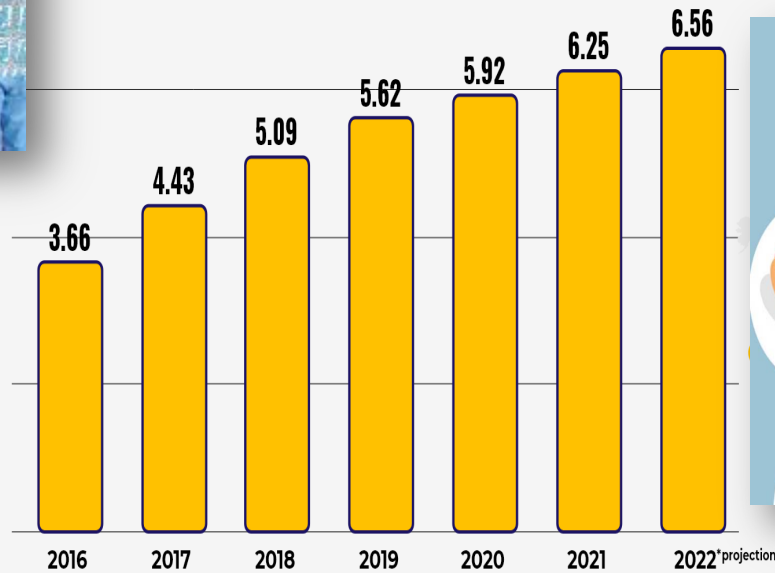
Is every foodservice kitchen designed and equipped to do these numbers?

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Off Premise Sales

Improved reach through increased adoption of delivery services

- Digital ordering and deliveries have **grown 300% faster** than dine-in traffic since 2014
- Further the pandemic helped speed up the growth and development of ghost kitchens as more people are ordering online, thereby **accelerating the segment by five years in three months**

According to a recent Deloitte survey:

61% people are ordering a takeout or delivery at least once a week

57% customers are using a digital app to order food for off-premise dining

Deloitte.

active food SAFETY®

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Ghost Kitchens

Brief about Ghost Kitchens

Ghost kitchens are a new business model in which virtual or existing restaurants **use equipped kitchen spaces with no dine-in facilities** and directly connect with delivery platforms to enhance their online food delivery capabilities.

Deloitte.

US market

- Currently, US is home to approximately **1,500 ghost kitchens. Increasing interest in the space** from small operators and startups like **DoorDash** is expected to boost growth
- By 2025, share of ghost kitchens **in US restaurant market is expected to climb to 21%** from the current 9-10% market share

UK	USA	India	China
750	1500	3500+	7500+

Ghost kitchen share of US restaurant market (%)

Approximately 133% increase

9% — 2020
21% — 2025

Source: Statista; CBRE Research, 2021
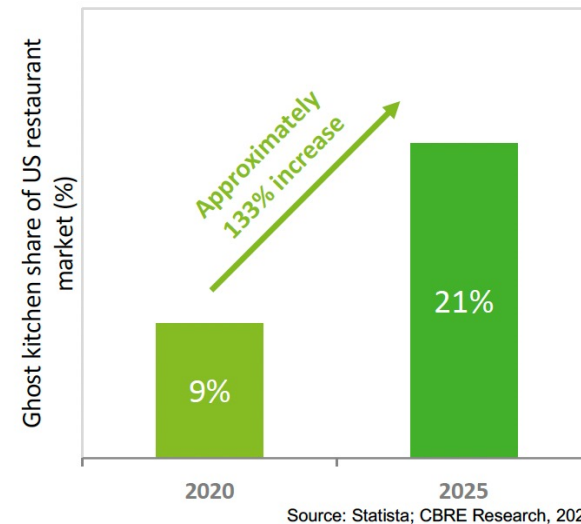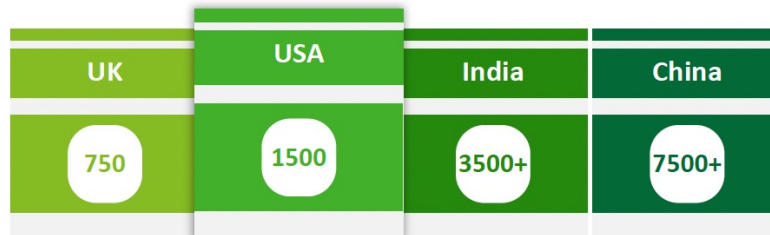
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Mail Order Food Delivery

Volume?

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Off Premise Sales

Due to loss of On-Premise (dining inside) sales, restaurants have increased Off-Premise sales

What are Off-Premise foodservice sales

- One business model to address the economic loss that has impacted the restaurant and foodservice industry is the more rapid expansion of off-premise sales

- This business model includes the preparation of food for immediate consumption and home meal kits for pick-up, delivery, drive-thru, curbside, and even packaged food sales

- Before the pandemic, off-premise sales were primarily pursued for the convenience of the customer (e.g., delivery) and as a means for a foodservice business to grow sales beyond restaurant visits, with cost being an ever-present limiting factor

- However, now, during this pandemic, off-premise sales are driven primarily by public health, as well as a need to recapture lost sales due to in-restaurant (on-premise) dining restrictions
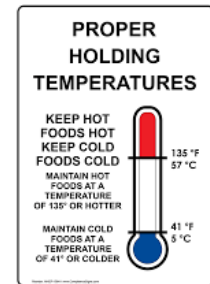
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Off Premise Sales

What are the Off-Premise sales food safety risks?

With off-premise sales, there are risks during the times and places associated with:

- **Ordering** — When ordering from a mobile app or website, allergen avoidance messaging can be difficult to find, or missing altogether, putting customers at potential risk

- **Holding** — Keeping food hot or cold to prevent growth of pathogens and spoilage organisms before the food is delivered

- **Handling** — Handling food properly to prevent cross-contact with allergens and transmission of viruses from packaging

- **Transporting** — Preventing contamination, physical or temperature abuse, or tampering of the packaged food during transport

- **Delivering** — Ensuring delivery personnel are trained in best practices and are not an exposure risk to the consumer

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Off Premise Sales

What are the Off-Premise sales food safety risks?

Additionally, contaminated environmental surfaces can play a critical role in the indirect (secondary) transmission of pathogens

- For example, the virus that causes stomach flu, norovirus, can survive on surfaces for many days, with even greater persistence at cold temperatures. The transmission of norovirus may not only be by a food handler during food preparation

- This virus can also be transmitted simply by contamination of items reused to carry foods including reusable food storage and delivery equipment and bags

Repp, K. K., and W. E. Keene. 2012. A point-source norovirus outbreak caused by exposure to fomites. J. Infect. Dis. 205:1639– 1641. https://europepmc.org/article/med/22573873

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Off Premise Sales

What are the Off-Premise sales food safety risks?

Neither the FDA nor most states regulate which delivery service can pick up food from a restaurant or foodservice business and deliver that food to a customer

- Unregulated third-party delivery services are not required to work with the restaurant or foodservice business to ensure menu accuracy and safety

- Third parties can increase risk by providing incorrect menus and ingredients (allergen avoidance risk), failing to ensure the quality of the food upon delivery, or not following personal hygiene and safe transport of food guidelines — all of which could also hurt a restaurant's reputation

- Some states are moving forward with regulations before the Food Code is updated. California's Fair Food Delivery Act, passed in September 2020, requires food delivery platforms to obtain an agreement from restaurants "expressly authorizing" them to take orders and deliver meals[1]

- We can likely expect future updates to the FDA Food Code to address off-premise sales as a recent set of guidelines were published by the Conference for Food Protection[2] and reviewed against best practices that retail foodservice business can use for application.[3]

[1] https://restaurant.org/articles/news/find-the-ghost-kitchen-model-thats-right-for-you
[2] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB2149
[3] http://www.foodprotect.org/issues/packets/2020Packet/attachments/III_004_content_c.pdf

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Off Premise Sales

Best practices

- **Ordering** — Provide allergen avoidance messaging on all menu choices on apps (e.g., contains or may contain statements). Ensure all delivery services are approved by your business for pick up and delivery

- **Holding** — Track time and temperature of foods held for pick up or delivery (e.g., "stamped" time prepped and time to consumption under 4 hours)

- **Handling** — Facilitate handling of food packaging (e.g., reduce cross contact of inner food packaging)

- **Transporting** — Prevent physical and temperature abuse (e.g., ensure tamper evident seals of packaging and temperature of carry)

- **Delivering** — Ensuring delivery personnel are trained in best practices and are not an exposure risk to the consumer (e.g., ensure delivery is made within designated time (track via delivery app)

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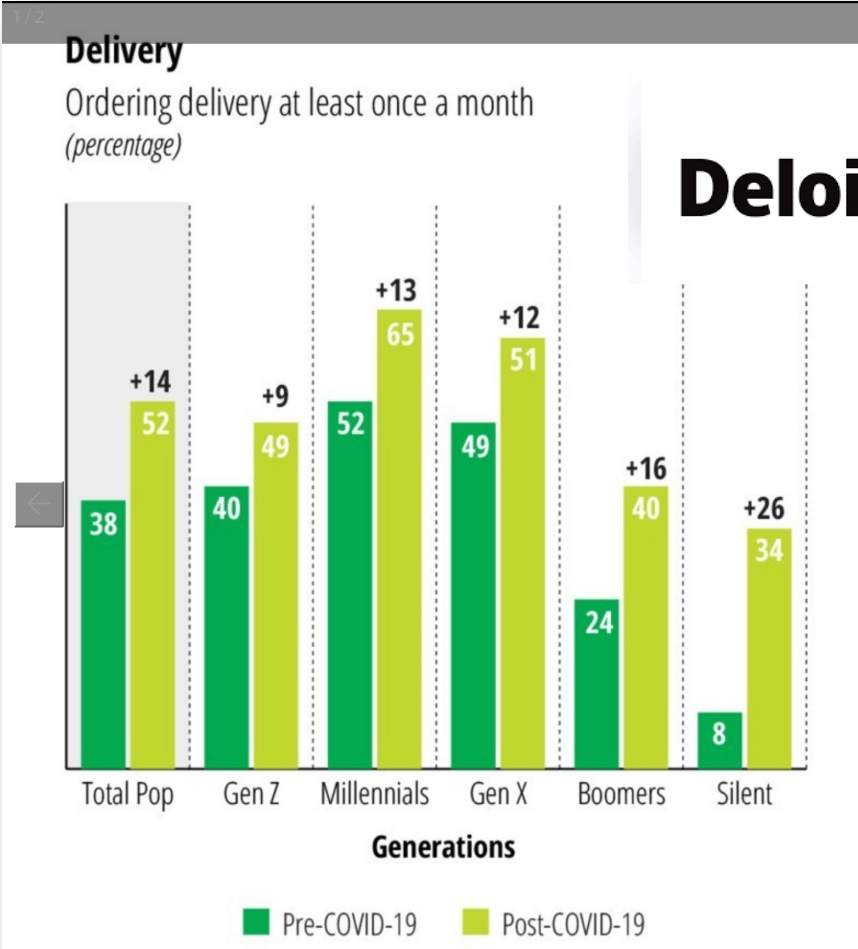
Off Premise Sales

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Ghost Kitchens

What are the Ghost Kitchen food safety risks?

- Some ghost kitchens are placed inside existing warehouses or in trailers or shipping containers
  - Most ghost kitchen mobile establishments (food trucks and fixed vessels) have no restroom facilities for employees, or the mobile restrooms do not have reliable/consistent hot water to support hand washing requirements

- Some ghost kitchen businesses lease kitchen space to multiple restaurant brand's during separate shifts (leasing the space as time slots)
  - Ghost kitchen facilities are also leased to other businesses (e.g., catering businesses) when not in use for the ghost kitchen brands

- Some ghost kitchen businesses do not have the proper portable water systems and grey water handling (wastewater) in their mobile foodservice establishments

- In many ghost kitchens, even when inspected by a local health inspector, the grade/scores of the inspection are not available to the public
  - A recent CDC study showed that locations where regulatory authorities nor foodservice establishments disclose inspection results to the public via health inspection grades/scores had a higher number of outbreaks per one thousand establishments per year than their alternatives.

Kitchen design and location

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Ghost Kitchens

Best practices

- Choose locations that support foodservice kitchen design with proper potable hot water and proper kitchen design for cleaning and sanitation

- Design kitchens according to the menu items being prepared including separation of raw proteins and allergens from Ready-to-Eat (RTE) food preparation

- Ensure a plan review of the kitchen design and menus being prepared by the local regulatory authorities that include the proper number of hand wash sinks (including assurance of hot water capacity needed if in mobile establishments) and equipment use that will reduce the risk of cross contamination and cross contact of allergens

- Ensure customers have access to local health inspection scores/grades to build confidence in the food safety of the location
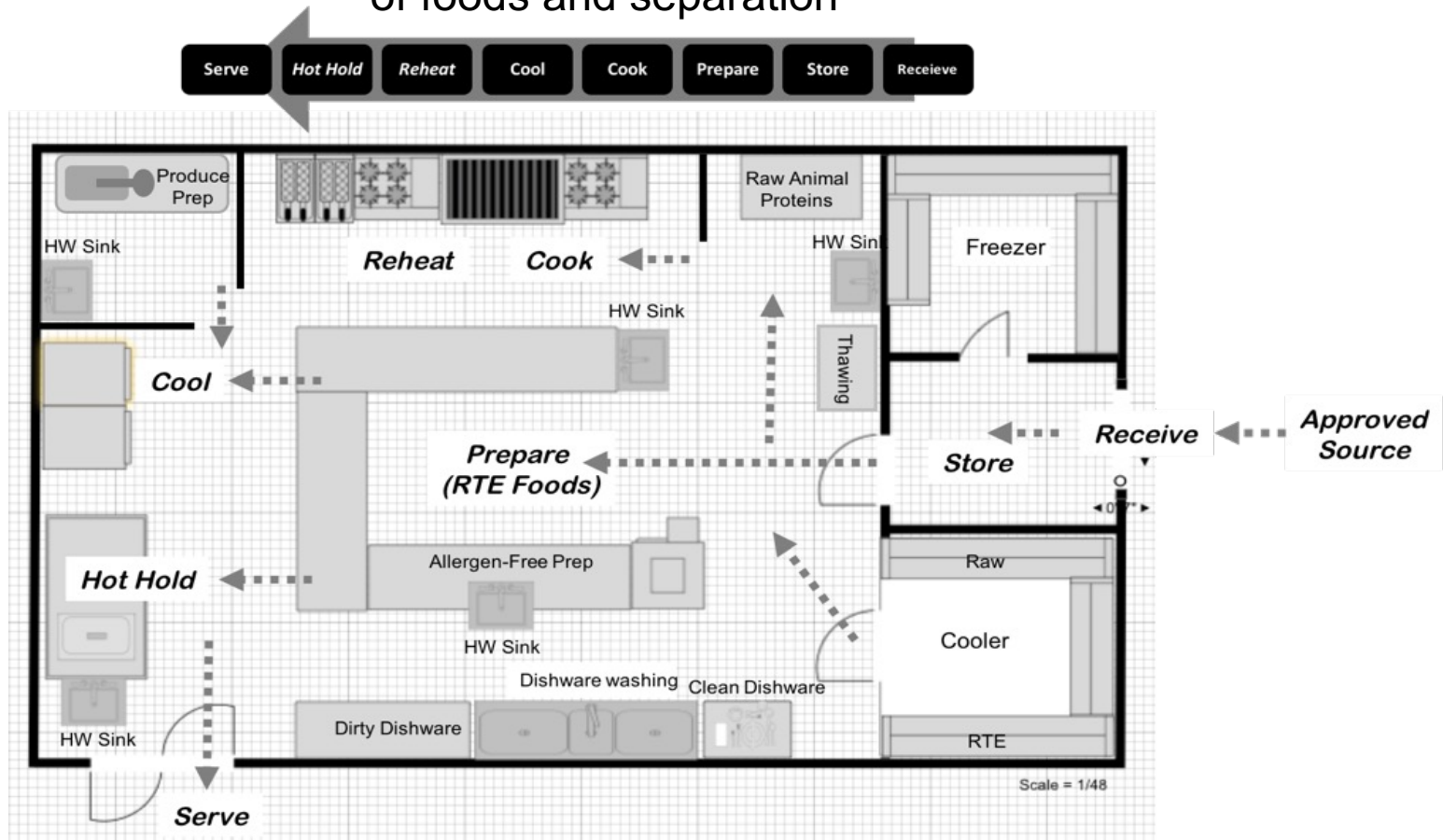
Kitchen design and location

The digital transformation of foodservice and delivery
Ghost Kitchens

Ensure each facility is designed/organized to establish proper flow of foods and separation

Kitchen design and location

The digital transformation of foodservice and delivery
Ghost Kitchens

What are the Ghost Kitchen food safety risks?

- Many ghost kitchen businesses source multiple ingredients (some of which are used to make different menu items for multiple branded products) sometimes without the same requirement for food safety specifications that the enterprise brand requires of its suppliers
  - There is a probable food safety risk increase during the food preparation and service phases of the ghost kitchen business

- Kitchens are not designed to ensure separation of raw proteins or an allergen containing product, there could be an increase in the risk of cross contamination and foodborne illness or an allergic illness by customers.
  - Because some customers have intolerances to certain ingredients like gluten that can lead to illness, the same risk of exposure to these ingredients may occur without a robust supply chain food safety management program.

Ingredient sourcing

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Ghost Kitchens

Best Practices

- Gather the ingredient and product food safety specifications for each menu item to be produced in the ghost kitchen from the brand owner, and source the supplier(s) based on GFSI certification or at a minimum compliant to the FDA FSMS rules that require evidence of preventative controls of all potential hazards

- Ensure the suppliers are executing the specifications via regular monitoring of the production facilities (third party audits, testing products, and corporate facility visits)

- Ensure the ghost kitchens are only receiving and using approved source of foods established by the ghost kitchen business

- Ensure the ghost kitchen locations are supported by a recall program to ensure removal of unsafe ingredients due to CDC investigations and/or FDA recalls

Ingredient sourcing

The digital transformation of foodservice and delivery
Ghost Kitchens

What are the Ghost Kitchen food safety risks?

- There can be multiple different hazards (e.g., *Salmonella* Typhi in raw chicken and *E. coli* 0157 on produce) associated with one or more food preparation step (e.g., cooking chicken and sourcing and washing produce) just to prepare one menu item made in a foodservice establishment
  - Because of this, many enterprise foodservice businesses (often called chain restaurants) that have multiple locations across the US develop very specific food safety specifications based on the hazards associated with the preparation of their menu items.

- However, if the ghost kitchen makes the same menu item but omits the required specification and training (e.g., may not segregate raw chicken handling areas from RTE food prep), the product is not being produced in the same manner as the brand and as its customers may expect

Menu preparation for food safety

The digital transformation of foodservice and delivery
Ghost Kitchens

Best Practices

- Develop a Process HACCP plan for all menu items prepared in the ghost kitchen (and/or use a restaurant brands plan). Use the plan to develop a Food Safety Management System and use the system to monitor the controls of all hazards

- Ensure specific ingredients required by a brands recipe are only used for that menu item and not substituted

- Train employees on the proper food preparation of each menu item including what the hazard controls are for each
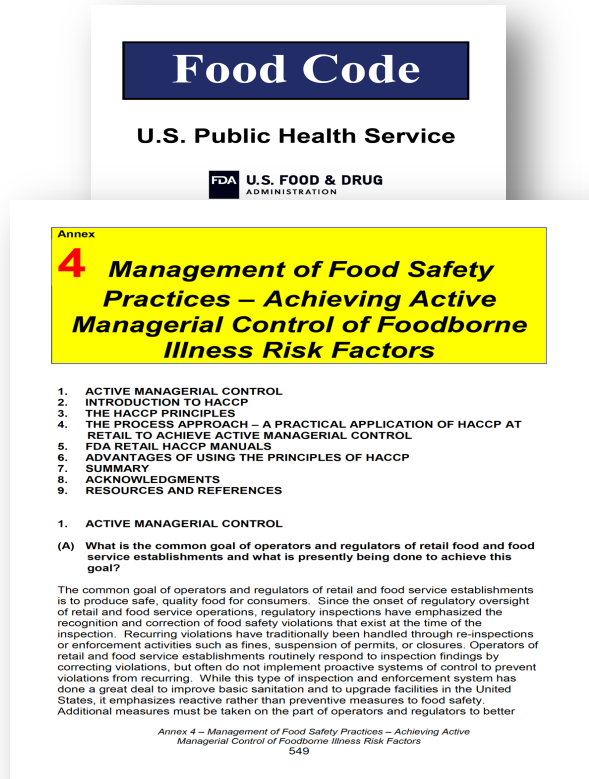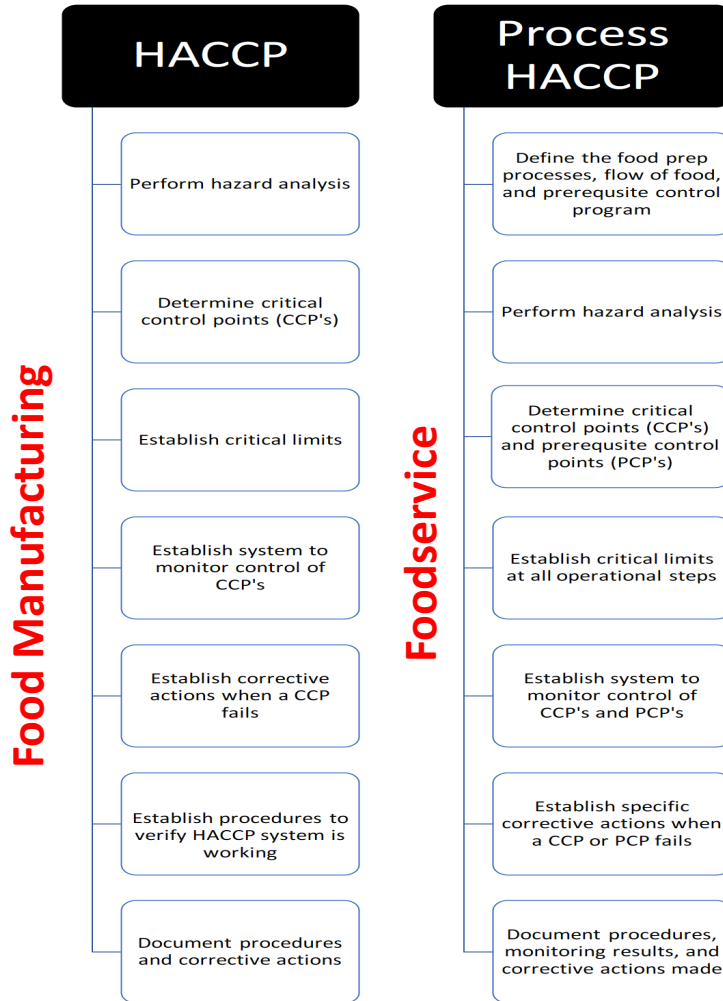
Menu preparation for food safety

So how can restaurants manage these risk to prevent foodborne illnesses/outbreaks

HACCP-based Food Safety Management Systems

Menu preparation for food safety

One example of an important FSMS:
Development of a Process HACCP plan for the entire menu

Food Manufacturing

HACCP

- Perform hazard analysis
- Determine critical control points (CCP's)
- Establish critical limits
- Establish system to monitor control of CCP's
- Establish corrective actions when a CCP fails
- Establish procedures to verify HACCP system is working
- Document procedures and corrective actions

Foodservice

Process HACCP

- Define the food prep processes, flow of food, and prerequisite control program
- Perform hazard analysis
- Determine critical control points (CCP's) and prerequisite control points (PCP's)
- Establish critical limits at all operational steps
- Establish system to monitor control of CCP's and PCP's
- Establish specific corrective actions when a CCP or PCP fails
- Document procedures, monitoring results, and corrective actions made

All menu items prepared and served in the restaurant
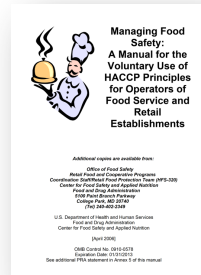

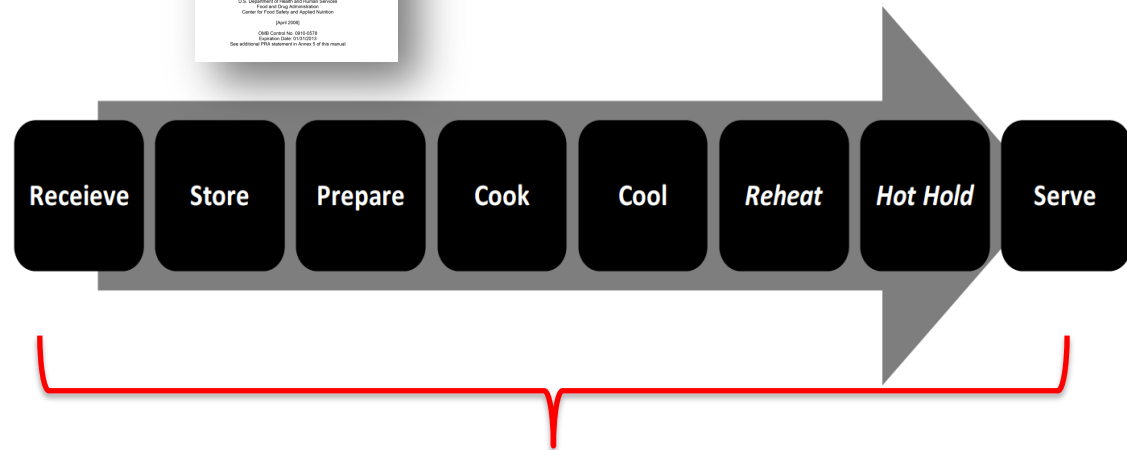
Menu preparation for food safety

One example of an important FSMS: Development of a Process HACCP plan for the entire menu

Monitor additional "Prerequisite Control Points" (PCPs) to ensure executed:

- Physical barriers (e.g., gloves/utensils),
- Personal hygiene standards (hand washing, health policy, excluding sick employees),
- Cleaning and sanitation management system focused on cross contamination prevention

Managing Food Safety:
A Manual for the Voluntary Use of HACCP Principles for Operators of Food Service and Retail Establishments

Additional copies are available from:
Office of Food Safety
Retail Food and Cooperative Programs
Coordination Staff/Retail Food Protection Team (HFS-320)
Center for Food Safety and Applied Nutrition
Food and Drug Administration
5100 Paint Branch Parkway
College Park, MD 20740
(Tel) 240-402-2349

U.S. Department of Health and Human Services
Food and Drug Administration
Center for Food Safety and Applied Nutrition

[April 2006]

OMB Control No. 0910-0578
Expiration Date: 01/31/2013
See additional PRA statement in Annex 5 of this manual

Flow of food prep for each menu item

| Receieve | Store | Prepare | Cook | Cool | *Reheat* | *Hot Hold* | Serve |

Define hazards and their control at each process for each menu item and monitor to ensure controls are executed
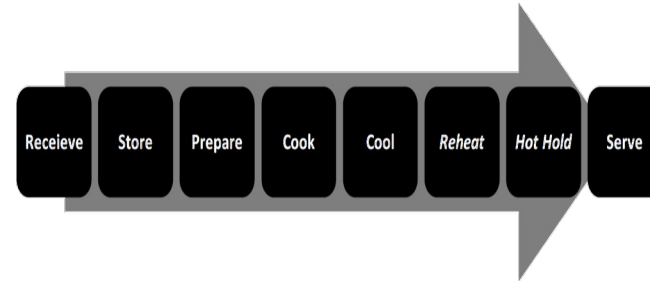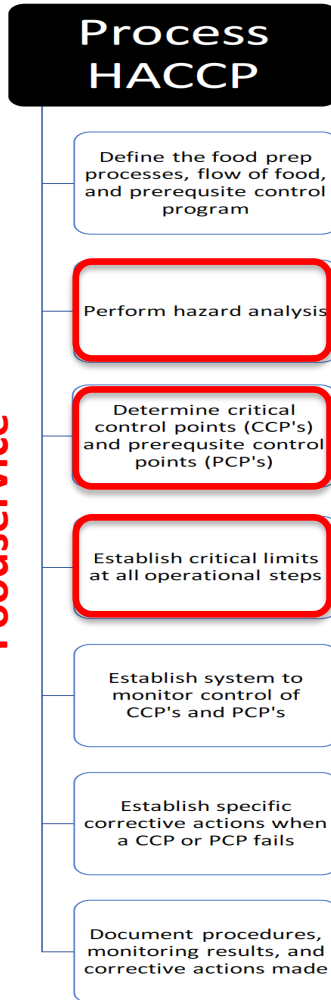
Menu preparation for food safety

One example of an important FSMS:
Development of a Process HACCP plan for the entire menu

Cooked black beans

Identify the hazards in the preparation and holding of black beans and define the controls necessary to prevent these hazards

Foodservice

Process HACCP

- Define the food prep processes, flow of food, and prerequisite control program
- Perform hazard analysis
- Determine critical control points (CCP's) and prerequisite control points (PCP's)
- Establish critical limits at all operational steps
- Establish system to monitor control of CCP's and PCP's
- Establish specific corrective actions when a CCP or PCP fails
- Document procedures, monitoring results, and corrective actions made

Receieve → Store → Prepare → Cook → Cool → Reheat → Hot Hold → Serve

- *C. perfringens* toxin production in cooked beans

- Cook beans to 145°F, hold beans at 135°F

- Confirm cook temperature, hot hold temperature, do not add new batch of cooked beans to beans being held in hotel pans
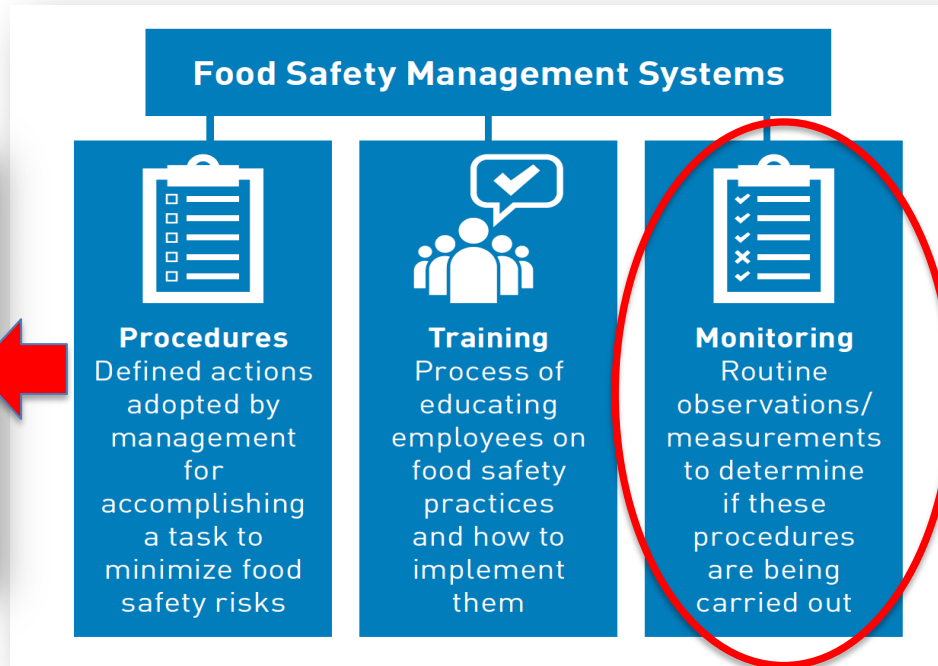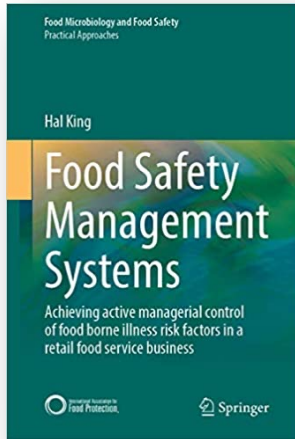
One example of an important FSMS:
Development of a Process HACCP plan for the entire menu

Use technology to help you train, monitor, and ensure execution of the controls necessary to prevent all hazards in food prep
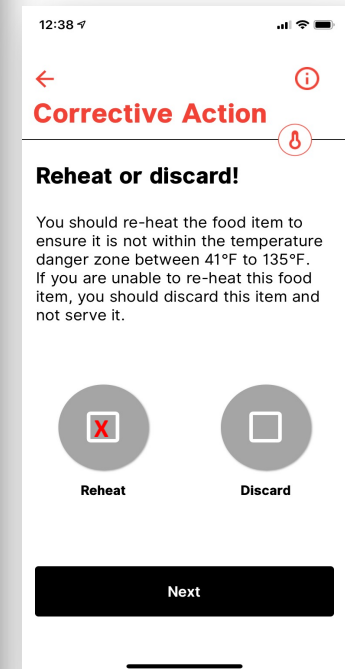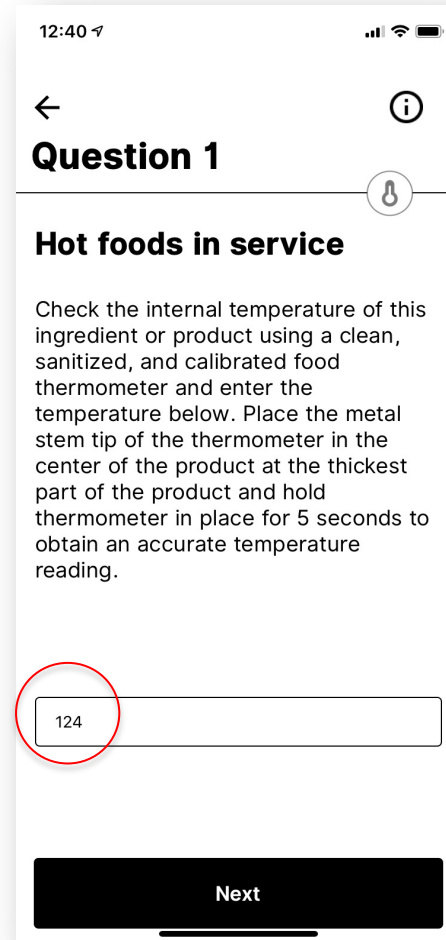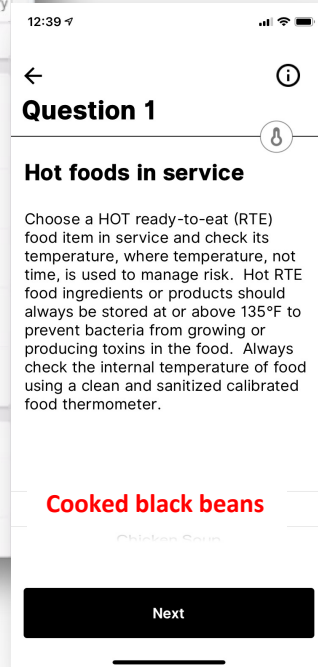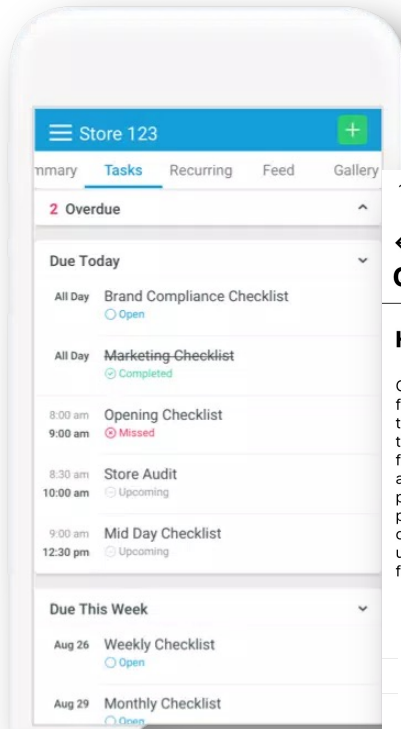
Food Safety Management Systems reduce the risk of foodborne illnesses and outbreaks in restaurants

The FDA has shown that Food Safety Management Systems (FSMS) reduce foodborne illness risk in restaurants

Food Safety Management Systems

Procedures
Defined actions adopted by management for accomplishing a task to minimize food safety risks

Training
Process of educating employees on food safety practices and how to implement them

Monitoring
Routine observations/ measurements to determine if these procedures are being carried out

Food Microbiology and Food Safety
Practical Approaches

Hal King

Food Safety Management Systems

Achieving active managerial control of food borne illness risk factors in a retail food service business

Springer

Factsheet: The Occurrence of Foodborne Illness Risk Factors in Fast Food and Full-Service Restaurants 2013-2014

FDA U.S. FOOD & DRUG ADMINISTRATION
NATIONAL RETAIL FOOD TEAM

The 2013-2024 FDA Retail Food Risk Factor Study examines the occurrence of foodborne illness risk factors, food safety practices, and behaviors in retail food establishments. In the 2013-2014 Restaurant Data Collection study, the agency investigated the relationship between food safety management systems (FSMS), certified food protection managers (CFPM), and the occurrence of risk factors and food safety behaviors and practices commonly associated with foodborne illness in restaurants from 2013 to 2014. Data from this study will provide valuable insights that FDA can use to develop educational resources and guidance to improve food safety practices.

Fast Food Restaurants	Non-existent FSMS	Well-developed FSMS
Average # of out of compliance items	4.5	1.7

Full-Service Restaurants	Non-existent FSMS	Well-developed FSMS
Average # of out of compliance items	5.8	2.1

The digital transformation of foodservice and delivery

Mail Order Restaurant Foods

What are the Mail Order Restaurant food safety risks?

- All foodservice foods are prepared and served for immediate consumption
    - Most are not packaged for service to enable holding cold/frozen but only for handling to eat

- Many menu items are not designed for cooling down and shipping
    - Some ingredients used in recipes are more hazardous if shipped held and incorrectly (Reduced Oxygen Packaging)

- The current express mail businesses are not designed for the sanitary transportation of foods
    - Not equipped to keep packaged foods cold or frozen (even when packed with cool or frozen packs)

- Packages of food are regularly dropped at customers door (not signed for nor placed into cold/frozen storage immediately)
    - Customers are sometimes not home when foods are delivered allowing the foods to sit outside

The digital transformation of foodservice and delivery

Mail Order Restaurant Foods

Best Practices

- Ensure restaurant is designed and equipped to prepare menu items for cooling down foods properly prior to packaging and shipping
    - Do not use ROP for preparation

- Ensure the menu items selected to ship do not contain hazards that will be more probable during shipping
    - Growth of pathogens due to cold chain issues

- Ensure packaging is designed to keep packaged foods cold or frozen up to the time of delivery (and in all seasons)
    - Provide guidance to the customer on how to hold the foods if they do not consume them immediately (USDA guidelines as example)

- Ensure a "sign for receipt" process to document when foods delivered and accepted by customers
    - Ensure carrier has directions if customer not at home
    - Or provide guidance on consumption of foods if not proper temperature upon arrival

The digital transformation of foodservice and delivery

More resources for the industry

The prevention of foodborne disease outbreaks/illnesses in restaurants must be a national priority

T**HESE ARE THE FACES BEHIND THE STATISTICS**

Stop Foodborne Illness
The Voice for Safe Food

1000's of illnesses and many deaths every year- Many suffer years of chronic secondary medical complications

We need a paradigm shift in how we manage hazards in restaurants

Thank you!

Hal King, Ph.D., Managing Partner