



**Stop the mop...when it might transmit  
pathogens in your restaurants**



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Hal King, Ph.D. Managing Partner

**Active**  
*Food Safety*

by phi

# My experience outside of the food industry: Infectious Disease Research and Prevention

## US PUBLIC HEALTH SERVICE COMMISSIONED CORPS

### Outbreak Investigations



### International Disease Prevention



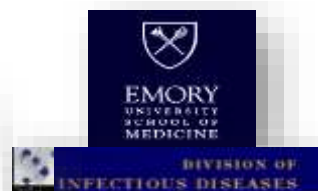
### Emerging Diseases Investigations

### Interventions for Prevention



### Biological Threats - Force Health

## Infectious Disease Research



### Food Safety- Leadership

## Intervention/Product Innovations



## Active Food Safety

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### Advisory Services

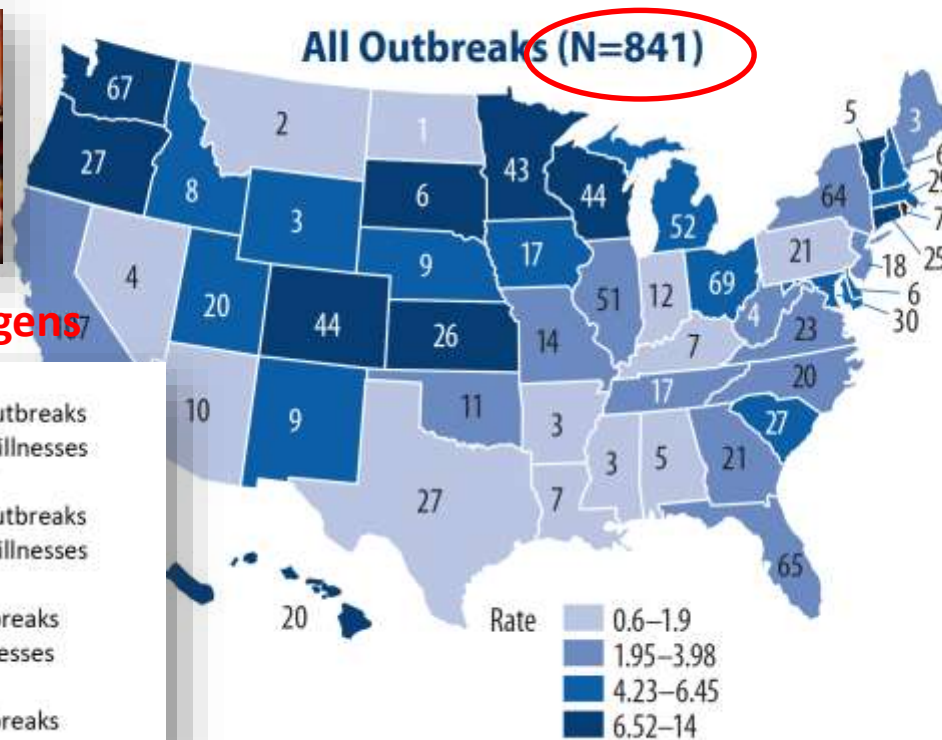
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# Before this pandemic: foodborne disease outbreaks/illnesses needed to be a national priority

## ALL FOODBORNE DISEASE OUTBREAKS IN THE UNITED STATES- 2017

**Figure:** Rate of reported foodborne disease outbreaks per one million population\* and number of outbreaks,<sup>†</sup> by state<sup>‡</sup> and confirmed and suspected etiology<sup>§</sup> — Foodborne Disease Outbreak Surveillance System, United States, 2017.



### Top 4 Pathogens

- **Norovirus:**
  - 140 (35%) outbreaks
  - 4,092 (46%) illnesses
- **Salmonella:**
  - 113 (29%) outbreaks
  - 3,007 (34%) illnesses
- **STEC (E. coli):**
  - 19 (5%) outbreaks
  - 513 (6%) illnesses
- **C. perfringens:**
  - 19 (5%) outbreaks
  - 478 (5%) illnesses

**MORE THAN 60% OF ALL FOODBORNE DISEASE OUTBREAKS IN THE UNITED STATES ARE CAUSED BY RESTAURANTS- 2017**

**Table 3:** Foodborne disease outbreaks and outbreak-associated illnesses, by location of food preparation—Foodborne Disease Outbreak Surveillance System, United States, 2017.

Location	Outbreaks		Illnesses	
	No.	%	No.	%
Restaurant	481	57	12,538	44
Shelter/dining	366	43	1,773	30
Food truck	60	7	1,034	4
Bar	22	3	220	2
Other or unknown/loc	28	4	671	3
Multiple types	11	2	388	2

**About the same year to year since reporting began**

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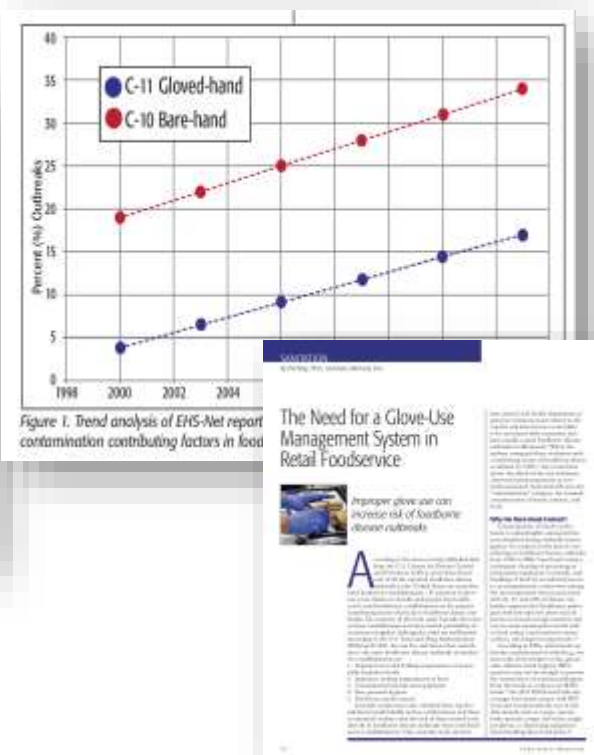
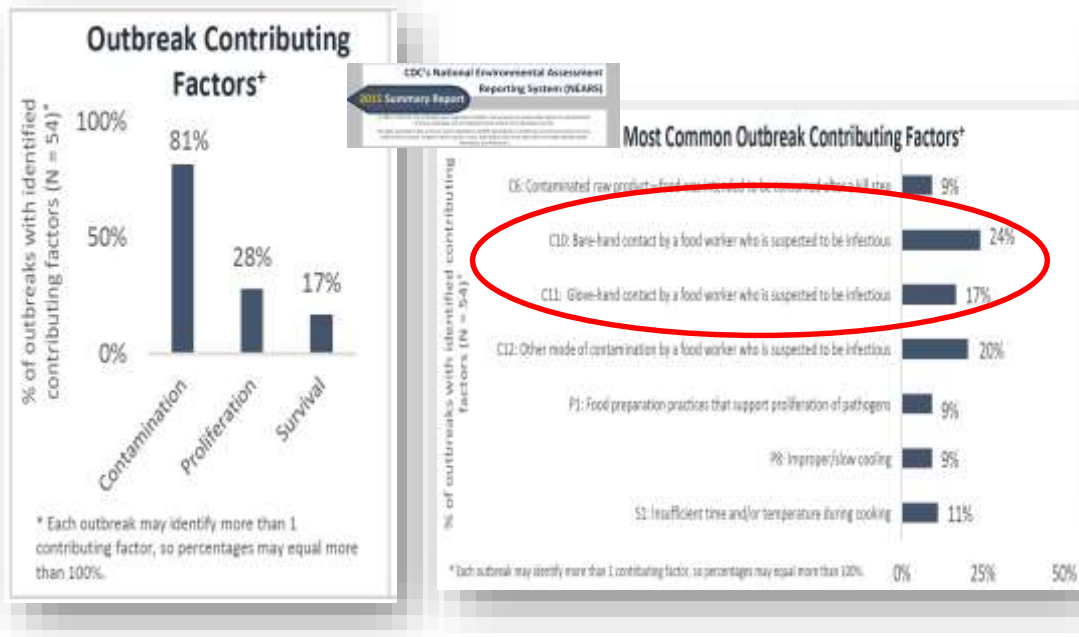
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# How do the majority of foodborne disease outbreaks/illnesses happen in restaurants?

3 categories (Contamination, Proliferation, and Survival)  
covering 32 contributing factors

From surfaces and hands/gloves



# Some of the cleaning and sanitation tools we use in restaurants actually contribute to the **cross contamination** of foods when used improperly

*Dirty, reusable cloth towels can be a source of cross-contamination (BoH)...  
and are poor guest experience (FoH)*





# Some of the cleaning and sanitation tools we use in restaurants actually contribute to the **cross contamination** of foods when used improperly

## 9 out of 10 Public Health Officials observed improper use of cleaners and sanitizer

Chain Food Safety Professionals

Public Health Officials & Inspectors

Believe using pail/buckets and reusable towels could cause cross-contamination between surfaces even when the sanitizer is maintained at the appropriate concentration

65%

61%

Believe it may be difficult to keep the sanitizing solution at the required concentration due to food soils on towels or in solution

73%

65%

During 3rd party audits or health inspections we see improper storage of reusable towels – outside of the sanitizing solution or incorrect sanitizer concentration

58%

93%

Observed restaurant employee not using a cleaner and sanitizer appropriately

65%

91%

During 3rd party audits or health inspections, observed improper use of reusable towels or sanitizer concentration levels.

65%

76%

REPEAT VIOLATORS



Operators Footnote: Results based on online survey among 45 large chain foodservice operators and members, distributed by NRA-QA in June 2018 (MR# 010-030) Public Health Footnote: Results based on online survey among 35 Public Health Officials, distributed by NACCHO in June 2018 (MR# 010-030)

# Some of the cleaning and sanitation tools we use in restaurants actually contribute to the **cross contamination** of foods when used improperly

## PEER-REVIEWED ARTICLE

Food Protection Trends, Vol. 40, No. 6, p. 360-401  
Copyright ©2017, International Association for Food Protection  
20011 130th Street, Suite 100, Blue Bell, PA 19008-0995

Rebecca M. Goulton,<sup>1\*</sup> James S. Clayton,<sup>2</sup>  
Robin Grant Moore,<sup>1</sup> Justin M. Bradshaw,<sup>1,4</sup>  
Jason W. Frye,<sup>1</sup> Essi J. Purcuch<sup>3</sup> and LeeAnn Jaykus<sup>1</sup>

<sup>1</sup>Dept. of Food, Bioprocessing and Nutrition Sciences, North Carolina State University, Raleigh, NC 27605, USA  
<sup>2</sup>IQO Inc., 400 Chestnut Ridge Road, Westport Lakes, NJ 07672, USA  
<sup>3</sup>Current Affiliation: Johnston Community College, Smithfield, NC 27577, USA



## Characterizing Microbial Cross-Contamination on Large Surfaces Using a Traditional "Cloth and Bucket" Disinfection Method

**TABLE 2. Numbers of microorganisms detected in bucket solution after wiping experiments**

Organism	Treatment	Positive input control (mean CFU/PFU ± standard deviation)	Bucket solution (mean CFU/PFU ± standard deviation)	% transferred to and remaining in bucket solution <sup>a</sup>
<i>L. innocua</i>	PBS	9.58 ± 0.74	9.49 ± 0.99	99.1
	QAC	9.60 ± 0.28	N/A-LOE <sup>b</sup>	N/A-LOE <sup>b</sup>
	QAC + soil	8.83 ± 0.37	N/A-LOE <sup>b</sup>	N/A-LOE <sup>b</sup>
<i>E. coli</i>	PBS	8.13 ± 0.18	8.54 ± 0.78	105.0
	QAC	6.33 ± 0.43	N/A-LOE <sup>b</sup>	N/A-LOE <sup>b</sup>
	QAC + soil	5.81 ± 0.20	N/A-LOE <sup>b</sup>	N/A-LOE <sup>b</sup>
<i>B. cereus</i>	PBS	10.01 ± 0.07	10.54 ± 0.22	105.3
	QAC	10.06 ± 0.03	9.48 ± 0.19	94.2
	QAC + soil	9.98 ± 0.03	9.96 ± 0.03	99.8
MS2	PBS	8.52 ± 1.09	8.39 ± 0.99	98.5
	QAC	7.80 ± 0.18	N/A-LOE <sup>b</sup>	N/A-LOE <sup>b</sup>
	QAC + soil	7.46 ± 0.35	6.56 ± 0.38	87.9

<sup>a</sup>Transferred to, and remaining in, the bucket solution was calculated by dividing the number of organisms detected in the bucket solution by the number of organisms detected in the positive input control and multiplying by 100 [(bucket solution mean/positive input control mean) × 100].

<sup>b</sup>Not applicable (N/A), when the organism was completely inactivated by the disinfectant (limit of enumeration [LOE] reached) and ratios could not be determined.

# Some of the cleaning and sanitation tools we use in restaurants actually contribute to the cross contamination of foods when used improperly

## MOPs?



- Large, cotton-string mop heads are bulky and can be difficult to clean, disinfect, and dry after each use
- Single-bucket use can lead to cross-contamination issues and the spread of germs if the buckets are not scrubbed out after each cleaning cycle, per area
- Additionally, hot water use can increase the rate of growth and spread of germs and bacteria within the bucket
- Additionally, cleaning or switching out the single bucket after the restroom floor is sanitized to avoid cross-contamination with a dining or food preparation floor is entirely impractical

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### Hospital Sanitation: the Massive Bacterial Contamination of the Wet Mop

JOHN C. N. WESTWOOD, MARY A. MITCHELL, and SUZANNE LEGACÉ

Ottawa General Hospital and Department of Microbiology and Immunology, Faculty of Medicine,  
University of Ottawa, Ottawa 2, Ontario, Canada

Received for publication 15 August 1970

Following the demonstration of massive spread of bacterial contamination throughout the hospital by the wet-mopping techniques in use, quantitative studies were undertaken to determine the source of contamination and to institute measures of control. It was found that mops, stored wet, supported bacterial growth to very high levels and could not be adequately decontaminated by chemical disinfection. Laundering and adequate drying provided effective decontamination, but build-up of bacterial counts occurred if mops were not changed daily or if disinfectant was omitted from the wash-water. Recommendations were based upon the experimental findings.

It is generally agreed that a modern hospital should be clean and that its standard of cleanliness reflects its standard of hygiene. There is also an uneasy feeling that dirt may in some way be linked to infection rates, though this is by no means proven. For these reasons, housekeeping procedures are always of major concern to Infection Control Committees, but, apart from the excellent study of Lilly (4, 5), whose results and conclusions we confirm and extend in this publication, there is in the literature an almost total lack of hard data relating bacteriological findings to particular housekeeping techniques and relating either of these to incidence of hospital-acquired infection. In the absence of such data, it is very difficult to convince the financial administration of the need for instituting any changes which require additional funds, even when the inadequacy of current procedures is freely admitted.

The investigation here reported was undertaken to obtain factual data at a time when the Infection Control Committee and the Hospital Administration were greatly concerned about the inadequacy of cleaning services provided by the firm under contract. It was hoped that the study would provide a rational basis for action, and this proved to be the case. The Infection Control Committee was able to make recommendations, backed by factual bacteriological evidence, regarding cleaning procedures, disinfectant-detergent, and laundering of mops, and these were immediately accepted by the Administration and Medical Advisory Committee. The findings are here published in the hope that they may be of

service to other hospitals faced with similar problems.

Most hospitals depend upon wet-mopping with the two-bucket system for floor-cleaning, even



Extraction of mops. Clean metal pails were thoroughly washed with a 1:80 dilution of disinfectant-detergent, followed by thorough rinsing under running tap water.

One gallon (3.5 liters) of tap water was then run into each bucket for extraction of the mops to be

693

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# How do floors play a role in cross contamination of foods when this leads to foodborne disease outbreaks

## SURVEILLANCE AND OUTBREAK REPORT

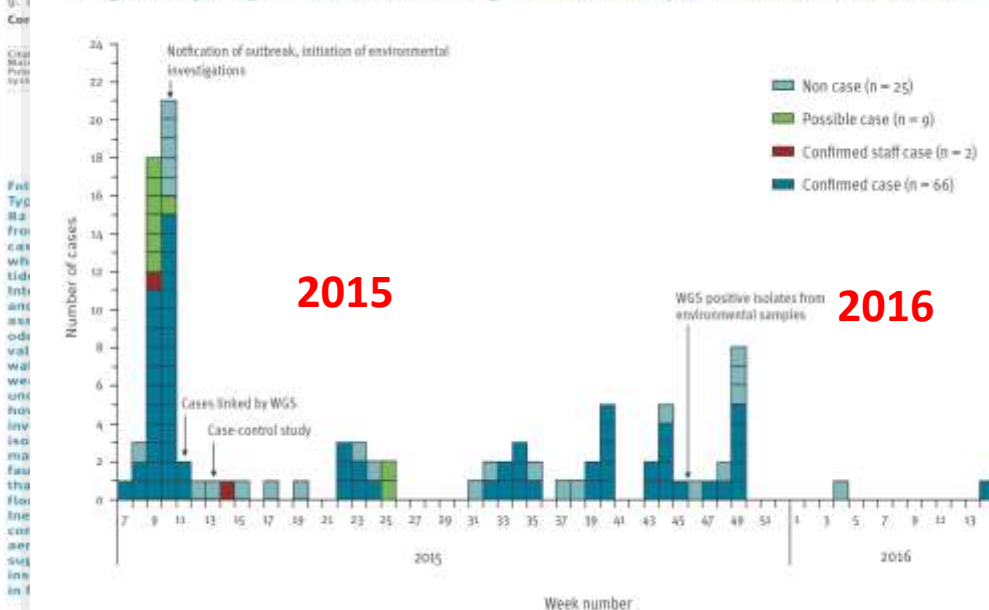
### Investigation using whole genome sequencing of a prolonged restaurant outbreak of *Salmonella* Typhimurium linked to the building drainage system, England, February 2015 to March 2016

John Mair-Jenkins<sup>1,2,3</sup>, Roberta Borges-Stewart<sup>4</sup>, Caroline Harcourt<sup>5</sup>, Judith Cox-Rogers<sup>6</sup>, Tim Dallman<sup>7</sup>, Philip Ashton<sup>8</sup>, Robert Johnson<sup>9</sup>, Deborah Modha<sup>9</sup>, Philip Monk<sup>9</sup>, Richard Puleston<sup>10</sup>

<sup>1</sup> Field Epidemiology Training Programme, Public Health England, United Kingdom

FIGURE 1

Reported date of symptom onset of cases of a *Salmonella* outbreak and people not meeting case definitions with matching whole genome sequencing of clinical isolates, United Kingdom, Week 7 (February) 2015–Week 14 (March) 2016 (n = 102)



WGS: whole genome sequencing.

## Reported in 2017 in the United Kingdom

- An outbreak from the same strain of *Salmonella* from only one restaurant over the course of 2 years
- Different employees also had illness from the same strain
- The same strain was isolated from several environmental surfaces in this restaurant

# How do floors play a role in cross contamination of foods when this leads to foodborne disease outbreaks

## SURVEILLANCE AND OUTBREAK REPORT

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1. Field Epidemiology Training Programme, Public Health England, United Kingdom
2. European Programme for Intervention Epidemiology Training (EPIET), European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden
3. Field Epidemiology Service, National Infection Service, Public Health England, United Kingdom
4. East Midlands Health Protection Team, Public Health England, United Kingdom
5. Environmental Health, Blagoev District Council, Blagoev, United Kingdom
6. Gastrointestinal Bacteria Reference Unit, National Infection Service, Public Health England
7. Food Water and Environment Laboratory, National Infection Service, Public Health England
8. Clinical Microbiology, Leicester Royal Infirmary, University Hospitals of Leicester NHS
9. University of Nottingham, School of Medicine, Division of Epidemiology and Public Health

Correspondence: John Mair-Jenkins (john.mairjenkins@phe.gov.uk)

#### Conflict of interest

John Mair-Jenkins, Roberta Egege-Stewart, Caroline Harber, Judith Cox-Rogers, Tim Gellman, Philip Ashton, Robert Johnson, Deborah Mudd, Philip Munk, Richard Puleston: No conflict of interest declared.

Article published on 21 June 2016

Following notification of a *Salmonella enterica* serovar Typhimurium gastroenteritis outbreak, we identified 12 cases linked to a restaurant with symptom onset from 12 February 2015 to 8 March 2016. Seventy-two cases had an isolate matching the nationally unique whole genome sequencing profile (single nucleotide polymorphism (SNP) address: 1.1.1.124.395.395). Interviews established exposure to the restaurant and subsequent case-control analysis identified an association with eating carvery buffet food (adjusted odds ratios (AOR): 20.9; 95% confidence interval (CI): 2.2 – ∞). Environmental inspections, food/water testing, and a food trace-back investigation were inconclusive. Repeated cycles of cleaning were undertaken, including hydrogen peroxide fogging; however, transmission continued. After 7 months of investigation, environmental swabbing identified 106 isolates from kitchen surfaces and restaurant drains matching the outbreak profile. We found structural faults with the drainage system and hypothesised that a reservoir of bacteria in drain biofilm and under-floor flooded areas may have sustained this outbreak. Ineffective drain water traps (U-bends) may have also contributed by allowing transmission of contaminated aerosols into the kitchen environment. These findings suggest that routine swabbing of sink drain points and inspection of drainage systems should be considered in future outbreak scenarios.

#### Introduction

It is estimated that salmonellosis in the United Kingdom (UK) is a leading cause of foodborne illness, with an estimated 100 000 cases annually [1]. Salmonellosis is a zoonotic disease and a where conditions have also been found in an outbreak where the transmission.

#### The event

On 7 March 2016, notification of a *Salmonella* outbreak was received from a laboratory of a *Salmonella* outbreak in February 2016. The outbreak was linked to a restaurant with symptom onset from 12 February 2015 to 8 March 2016.

Hypothesis-generating investigation is at the same time for their illness including subtypes being the likely

The same strain was isolated from several environmental (drains, floors, equipment, etc.) surfaces in this restaurant

TABLE 1

Summary of environmental samples (n = 375) with isolates implicated in a *Salmonella* outbreak (n = 106) by whole genome sequencing, United Kingdom, March 2015–May 2016

Sample date	Water samples (n)	Food samples (n)	Environmental samples (n)	WGS positive isolates within five SNP clade(n)	Positive sample source
Mar 2015	1	0	26	0	NA
Jun 2015	0	1	16	0	NA
Sep 2015	1	2	27	0	NA
Nov 2015	0	0	99	3	Sinks/wash hand basins
				7	Cleaning materials
				3*	Sewer swabs
Dec 2015	0	0	62	5	Kitchen cloths
				2*	Sinks/wash hand basins
				2*	Cleaning materials
Jan 2016	6	9	47	15	Surface and deep drain swabs
				4	Kitchen cloths
				12*	Sinks/wash hand basins
				4	Meat sink waste trap
				7	Floor swabs
Feb 2016	1	0	42	10	Kitchen surface swabs
				19	Surface and deep drain swabs
				1	Sinks/wash hand basins
Mar 2016	0	0	41	12	Surface and deep drain swabs
Apr 2016	0	0	59	0	NA
May 2016	0	0	50	0	NA
Total	9	12	354	106	NA

NA: not applicable; SNP: single nucleotide polymorphism; WGS: whole genome sequencing.

\* Three isolates matched outbreak sequence (0 SNP difference).

\* One isolate matched outbreak sequence (0 SNP difference).

# How do floors play a role in cross contamination of foods when this leads to foodborne disease outbreaks

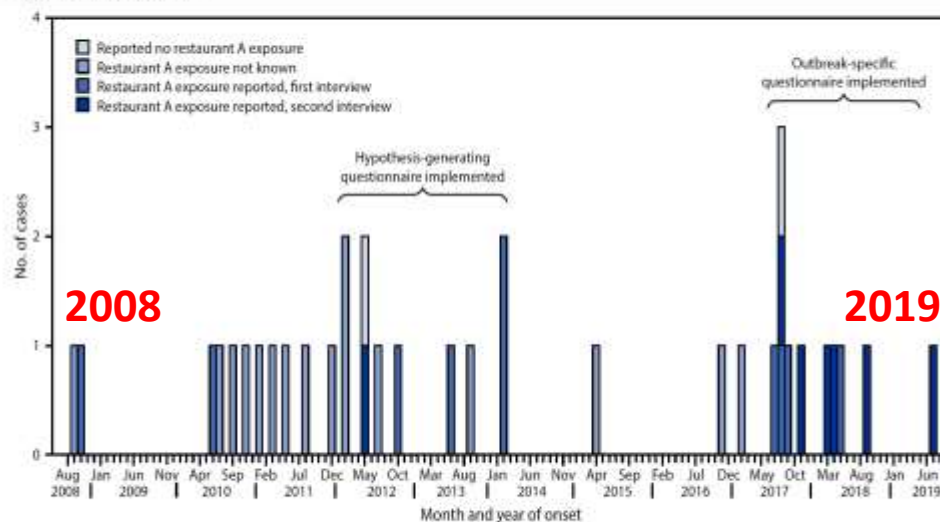
## Reported in 2021 in the United States

- 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

### Protracted, Intermittent Outbreak of *Salmonella* Mbandaka Linked to a Restaurant — Michigan, 2008–2019

William E. Nordstrom, MD<sup>1,2</sup>; Bethany Belmick, MPH<sup>3</sup>; Katherine D. Arnold, MPH<sup>3</sup>; Douglas Potter, MBA<sup>1</sup>; Justin J. Henderson, MPH<sup>3</sup>; Stephen Dietrich, MS<sup>3</sup>; Mary Francis, MPH<sup>3</sup>

FIGURE. Cases of *Salmonella* Mbandaka outbreak subtype (N = 35), by month and year of illness onset\* and restaurant A exposure — Michigan, September 2008–July 2019†



# How do floors play a role in cross contamination of foods when this leads to foodborne disease outbreaks

## Protracted, Intermittent Outbreak of *Salmonella* Mbandaka Linked to a Restaurant — Michigan, 2008–2019

William D. Nolenon, MD<sup>1,2</sup>; Bethany Reimink, MPHE<sup>3</sup>; Katherine D. Arends, MPH<sup>3</sup>; Douglas Porter, MBA<sup>1</sup>; Justin J. Henderson, MPH<sup>3</sup>; Stephen Dietrich, MS<sup>3</sup>; Mary Franko, MPHE<sup>3</sup>

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

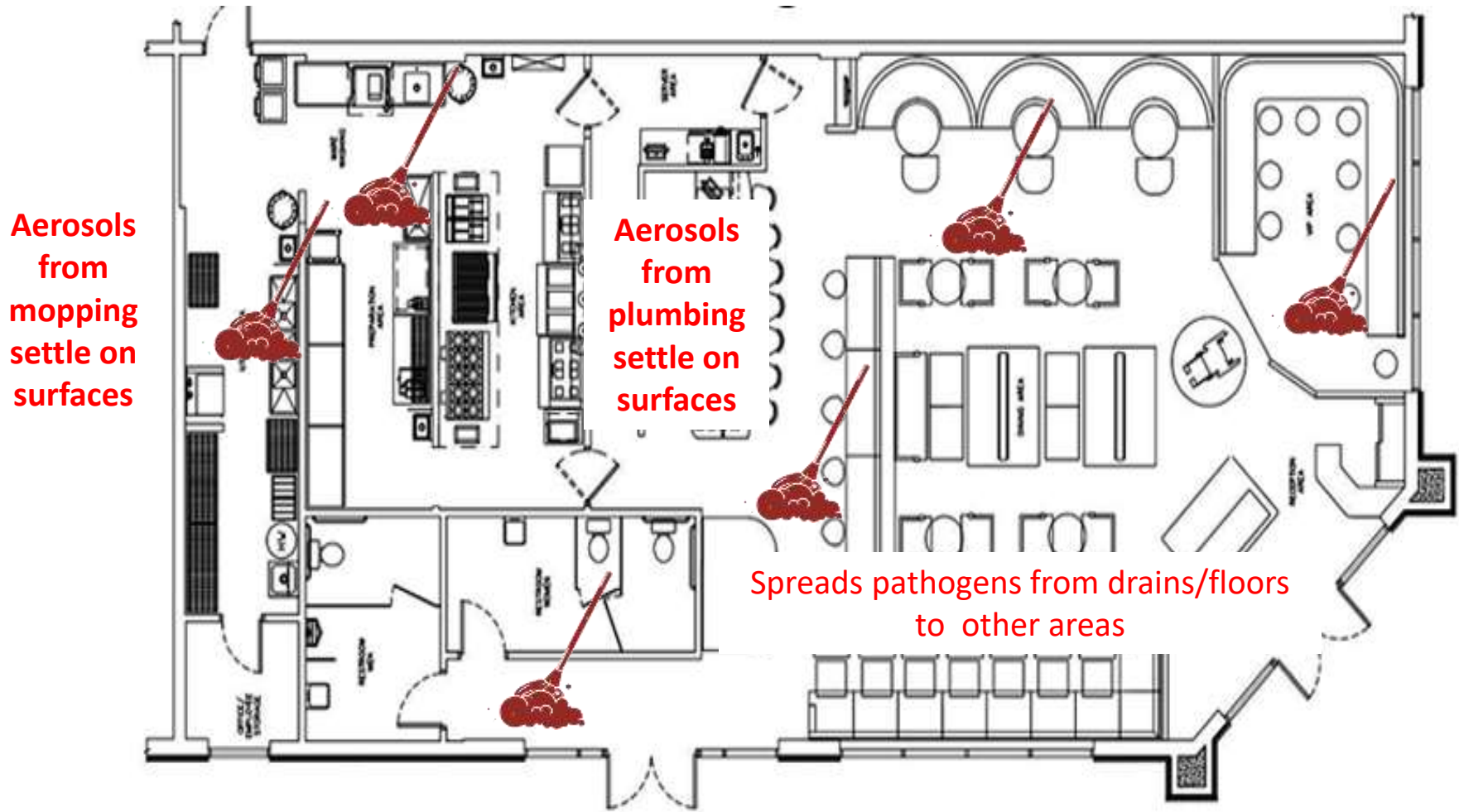
Source of isolate	No. of samples collected	No. (%) of isolates identified by PFGE	No. (%) of isolates identified by WGS	Isolation date or date range	Clade by cgMLST
Symptomatic patient	36	36 (100)	30 (83)	2008–2012	B
				2012–2014	C
				2015–2018	A
Asymptomatic employee*	100	5 (5)	5 (5)	Jun 2018	A
Environment (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.



# How could mops play a role in cross contamination of foods when this leads to foodborne disease outbreaks



# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks

Select sanitizers that kill foodborne pathogens quickly



- Does the sanitizer kill all foodborne pathogens (look at the label)
- Does the sanitizer kill pathogens quickly (too much time reduces compliance)
- Does the sanitizer have a means to ensure it remains effective during storage
- Are employees cleaning a surface with a cleaning agent before sanitizing it

# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks

Designate where mops can be used by color coding to reduce spread of pathogens from one area to another

**Kitchen areas**

**Restrooms**

**Work Areas**

**Dining Room**

**Kitchen**

**Separate and exclude**



•Use color coded cleaning tools

•Use Dirty water buckets separate from clean water

•Store tools properly to prevent cross contamination

# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks

Be prepared to clean up body fluid spills properly – **never use a mop**



Must have an  
Emergency  
Operating  
Procedure (EOP)



## The risk

- Employee or customer vomits in establishment
- Employee and/or cleaning tools contaminated by *Norovirus*
- *Norovirus* contaminates food
- Most food contact surface sanitizers do not kill *Norovirus*
- Large foodborne disease outbreak



No mop allowed for vomiting event clean up

**NO MOPS**



# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks

Use single-use mop heads -preferable microfiber- in areas where highest risk of pathogens on floors exist (e.g., kitchen and restrooms)



**NO MOPS**



*Laundry-Free™ Premira® II*  
Microfiber Floor Pads  
Disposable pads for maximum cleaning and uniform chemical application

**And use  
for all  
body fluid  
spills**

# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks

Use single-use mop heads -preferable microfiber- in areas where highest risk of pathogens on floors exist (e.g., kitchen and restrooms)

To ensure chemical disinfectants retain their efficacy

NO MOPS



Contec® Healthcare

Critical Care

## Clinical Advantages of Disposable Microfiber Mops

David J. Flynn  
Peter K. Kang, Ph.D.  
K. Mark Whitlock, Ph.D.

A study of hygiene and microfiber products for

### Overview

#### The need

Environmental sanitation contributes to the risk of healthcare-associated infections. To improve outcomes, many facilities now use microfiber cloths as part of their cleaning programs. Can the type of microfiber product (disposable vs. reusable) make a difference?

#### The solution

Disposable microfiber mops and wipes offer improved cleaning, compatibility with disinfectants, and consistent quality compared to reusable products.

#### The benefit

Improved compliance, reliability and efficacy of cleaning procedures can reduce the risk of cross-contamination in healthcare environments.

### Introduction

For decades, cleaning procedures using cotton string mops and products to cleaning with la and cloths. While several studies have improved cleaning and of further research suggested disposable (single-use) mops.

The performance concerns products include:

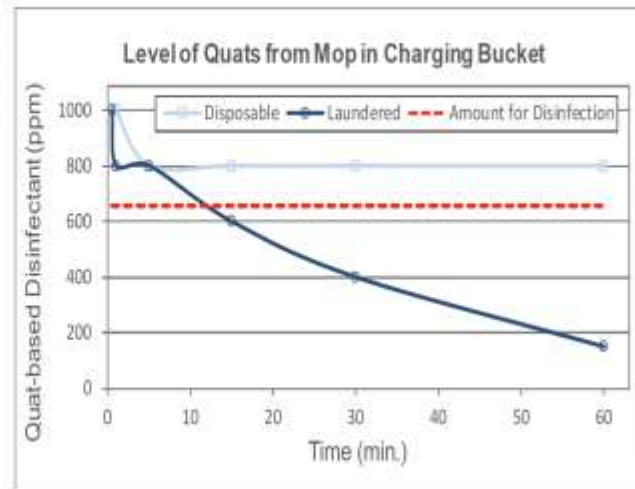
- 1) Loss of cleaning capacity
- 2) Retention and accumulation of material through reuse
- 3) Increased risk of cross-contamination from reuse

This report summarizes the concerns with laundered mops and how these concerns can be

### Study Parameters

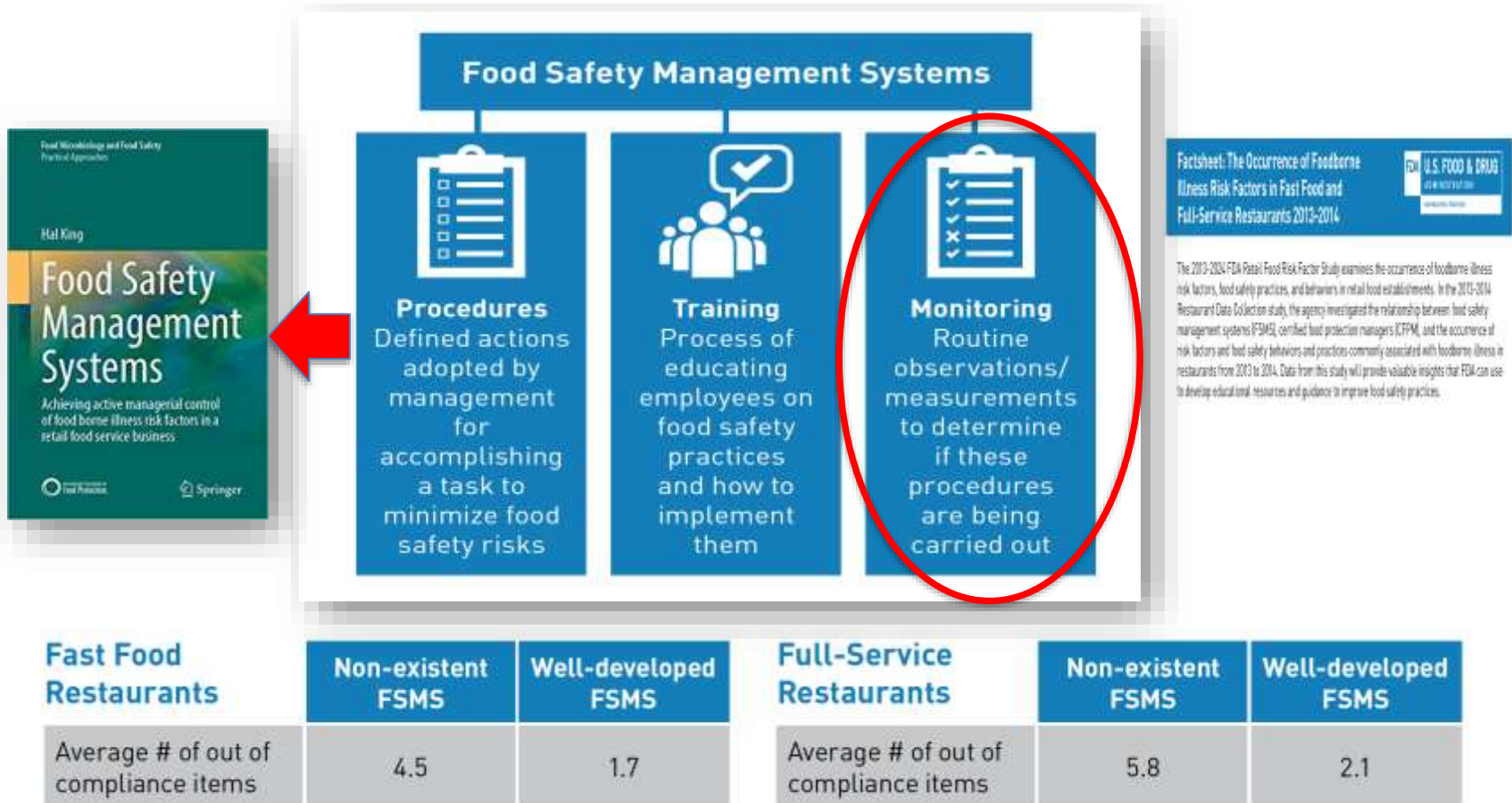
- 1) Microfiber mopping pad microscopy to visualize high temperatures and essential for effectiveness
- 2) Levels of organic and inorganic material after laundering were measured using standard microbiological techniques
- 3) The impact of residual quat-based disinfectant on mop efficacy was determined using ATP analysis
- 4) Bioassays (bacteria and fungi) to measure microfiber mops and mops after laundering was determined using standard microbiological techniques
- 5) The cleaning efficacy of disposable vs. laundered microfiber products in hospital patient rooms was quantified using ATP analysis

Figure 8 Levels of quat disinfectant in residual solution sampled from the mop when applied using a laundered versus disposable microfiber mop.



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# How could restaurant operators reduce the risk of cross contamination of foods that can lead to foodborne disease outbreaks



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

# What do restaurants need to continue post pandemic to reduce all foodborne illnesses risk



The most effective controls for the prevention of both of these viral diseases in foodservice are similar



1. Ensure **employee wellness (symptoms screening)** checks at each shift (under your Health Policy -all employees know)



2. Ensure **personal hygiene** controls are in place at all times

- Hand washing and proper hand sanitizer use
- Proper use of PPE (face coverings and mask use)
- Proper use of gloves



3. Ensure **environmental contamination controls** to reduce the risk of virus transmission to both employees and food (cleaning and sanitation/disinfection)



A focus on High-Touch Surfaces and floors

4. Ensure use of a **Food Safety Management System (FSMS)**

- Defined SOP's
- Defined training
- Defined monitoring of controls



5. Ensure a **Certified Food Protection Manager (CFPM)** as the PIC at all shifts to manage the FSMS

6. Location (social) distancing of customer seating

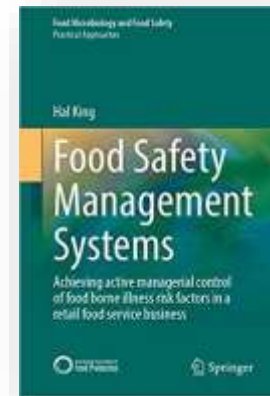
## All of this!





# Your Questions?

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**Additional resources**



# Thank you