



Food Service Sanitation and Infection Prevention

What you NEED to know

Are we “Out of Compliance”?

- US FDA report published in 2004 after observing facilities to determine foodborne illness risk factors
- Cleaning and sanitization process for food contact surfaces were reviewed
- Food contact surfaces were improperly cleaned
 - Elementary Schools: 25%
 - Supermarket Delis: 58%



CDC Vitalsigns (June 2011)

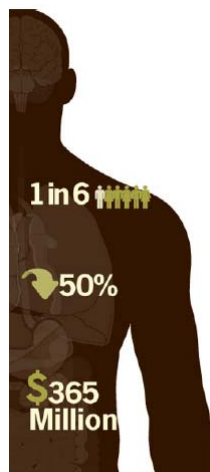
Each Year.....

- 1 in 6 people gets sick from eating contaminated food
- 1000 reported disease outbreaks
- 48 millions illnesses
 - Highest incidence in children <5yrs
- 128,000 hospitalizations
- 3000 deaths annually
 - >60yrs highest incidence for hospitalization and death

**MOST FOODBORNE
ILLNESSES OCCUR IN
PERSONS WHO ARE NOT
PART OF A RECOGNIZED
OUTBREAKS**



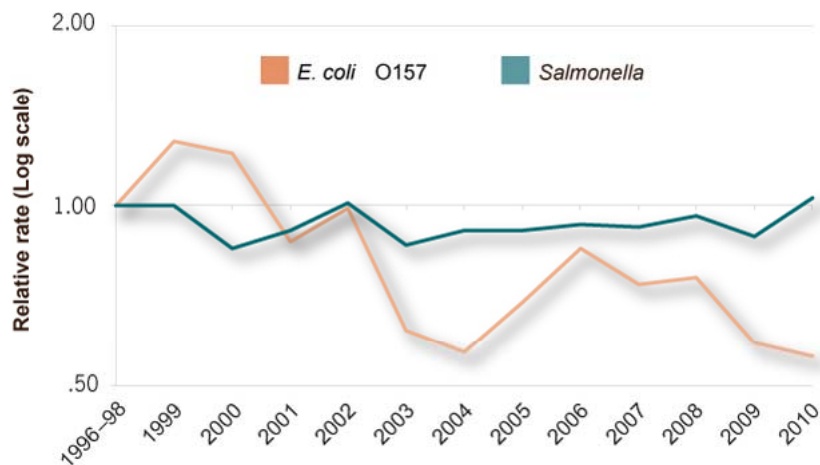
CDC Vitalsigns (June 2011)



- Of the ~1000 reported outbreaks *Salmonella* and other common germs continue to be the culprits
- In the last 15 years, the number of recalls of ground beef due to *E. coli* contamination has been cut by 50%
- *Salmonella* infections have **not** declined
 - Each year, 1 million people get sick
 - \$365 million in direct medical costs



E. coli O157 & *Salmonella* infection



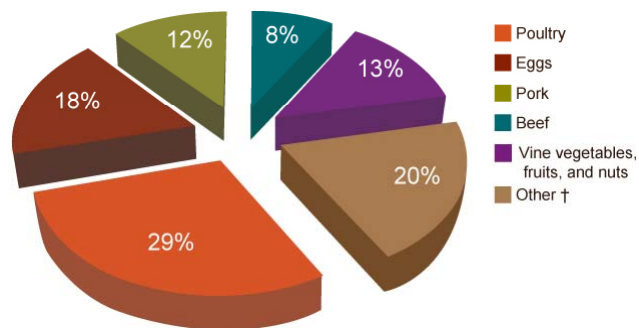
Source: Foodborne Diseases Active Surveillance Network, 2010.



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Foods associated with *Salmonella* outbreaks*



*These contaminated ingredients or single foods (belonging to one food category) were associated with 1/3 of the *Salmonella* outbreaks.

†Other includes: Sprouts, leafy greens, roots, fish, grains-beans, shellfish, oil-sugar, and dairy.

Source: CDC National Outbreak Reporting System, 2004-2008.



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The Culprits!

Bacteria, Viruses, Moulds, Parasites



What's the Cause?

- o Foodborne illness is MOST often caused by food that looks good, smells fine & tastes GREAT!



Affects of Foodborne Illness

- Common symptoms include stomach ache, vomiting, fever
- Diarrheal illness ranging from mild to severe
- Can develop severe complications
- Can cause emotional and economic hardship

**SOCIETAL COST OF
A SINGLE FATAL
CASE OF *E. COLI*
ESTIMATED AT
\$7MILLION**



Acquisition and Transmission

- Contamination can occur anywhere:
 - Fields where the food is grown
 - 2006, Fresh Spinach caused 200 illnesses in 26 states due to irrigation water
 - Farms where animals are raised
 - 2010, Chicken and feed contamination results from 500 million eggs recalled due
 - Food Processing plants
 - 2009, Processing plant contamination of peanut butter crackers to pet treats results in sickness 46 states
 - Food Manufacturing plants
 - 2011, 50,000lbs of ground turkey recalled following illness in 10 states



Acquisition and Transmission

- Contamination can occur anywhere:
 - Distribution and Delivery of Food
 - 1994, trucks hauling raw eggs followed by ice cream resulted in 200,000 people becoming ill nationwide
 - Supermarkets, Restaurants, Cafeterias
 - 2003, Egg Salad sold at a Supermarket in 2 states linked with 18 ill people
 - At home
 - 2007, undercooked frozen pot pies sicken people in 35 states, Puerto Rico and the Caribbean



The Bugs

- Viruses
 - Rotavirus, Norovirus
- Bacteria
 - Salmonella, E.coli, Listeria
- Parasites
 - Toxoplasma, Trichinella
- Mould
 - Aspergillus

Viruses and
Bacteria are the
most common
cause



The Common Enemies

Microorganism	Source	Symptoms	Onset Time	Duration
<i>E.coli</i> O157:H7	Humans & animals Found in intestinal tract and shed in FECES Raw and undercooked foods	Water / Bloody DIARRHEA , nausea, cramps, Haemolytic Uremic Syndrome (HUS)	2 – 5 days	up to 8 days
<i>Salmonella</i> spp.	Humans & domestic or wild animals Found in intestinal tract and shed in FECES Undercooked food, Contaminated tableware	Headache, DIARRHEA , nausea, cramps, dehydration, fever, loss of appetite	6 – 72 hrs	2 – 3 days
<i>Listeria monocytogenes</i>	In FECES of domestic & wild mammals, fowl Found in soil, water and plant matter Unpasteurized milk products, improper sanitation of refrigerators	Nausea, vomiting, headache, delirium, coma, collapse septicaemia, miscarriage and can result in stillbirth	2 days – 3 weeks	5 – 10 days

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The Common Enemies

Microorganism	Source	Symptoms	Onset Time	Duration
<i>Shigella</i>	Humans and flies shed in FECES Asymptomatic carries can transmit for months Water, milk and food	DIARRHEA , cramps, chills, fever	2 – 5 days	4 – 7 days
<i>Campylobacter jejuni</i>	Chicken, Cattle, Flies in INTESTINAL TRACT Non-chlorinated water Raw milk, improperly cooked poultry	Fever, headache, muscle pain, DIARRHEA , nausea and abdominal pain	2 – 5 days	7 – 10 days
<i>Staphylococcus aureus</i>	Humans, cows, dogs, fowl SECRETIONS of nose, throat, wounds, pimples Hands and skin as normal flora Ready to eat, meat, poultry and dairy	Nausea, vomiting, DIARRHEA , dehydration, cramps, lowered blood pressure	30 mins – 7 hrs	24 – 48 hrs

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The Common Enemies

Microorganism	Source	Symptoms	Onset Time	Duration
<i>Vibrio vulnificus</i>	Warm coastal waters Naturally occurring world wide 5 – 10% all shellfish are contaminated	Fever, chills, nausea, vomiting, DIARRHEA , shock, abdominal pain, severe fatigue	Within 3 days of ingestion	Up to 3 days
<i>Clostridium perfringens</i>	Soil, dust, sewage and INTESTINAL TRACTS of humans and animals Associated with temperature abuse	DIARRHEA and gas pains	8 – 24 hrs	1 day (1 – 2 weeks for elderly or young)
<i>Clostridium botulinum</i>	Spores widely distributed in soils, sediment, water INTESTINAL TRACT of fish & mammals Associated with improperly canned foods	Double vision, droopy eyelids, trouble speaking and swallowing, paralysis	2 – 36 hrs	Death can occur within 24 hrs, recovery weeks to months

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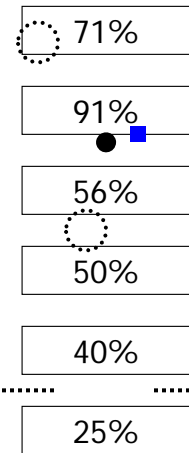
The Common Enemies

Microorganism	Source	Symptoms	Onset Time	Duration
<i>Bacillus cereus</i>	Soil, dust, cereal crops, water, FECAL-ORAL route via humans Meats, milk, vegetables, fish, rice and starchy foods (pasta, potatoes)	Watery DIARRHEA , cramps, gas pains	6 – 15 hrs	24 hrs
Hepatitis A	Humans via FECAL-ORAL route, occasionally nonhuman primates Contaminated water, food, raw & undercooked shellfish	Fever, fatigue, loss of appetite, nausea, jaundice, dark urine, joint aches	15 – 50 days	Less than 2 months
Norovirus (Norwalk)	Human, contaminated water Shed in FECES Raw shellfish, ready-to-eat foods, eggs, ice	Nausea, vomiting, DIARRHEA , cramps, headache, fever	24 – 48 hrs	1 – 2 days

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Evidence for airborne transmission of Norwalk-like virus (NLV) in a hotel restaurant



- Hotel restaurant with 126 patrons
- Patron (■) vomited at table
- 52 of 83 survey responders ill
 - 63% overall attack rate
- Attack rates higher at closer tables
- Consistent with airborne transmission of NLV

PJ Marks; Epidemiol. Infect. 2000, 124: 481-487

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Norovirus Transmission

- Food (39%)
- Hands (12% “person to person”)
- Water (3%)
- Environmental surfaces (fomites)
- Air (aerosolization with vomitus)
- 46% unknown or no data available

MMWR 2001; 50: RR-9

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To Clean or Not to Clean.....

There really is no option!



Surfaces & Food-borne Infection

	<i>Salmonella enteritidis</i>	<i>Salmonella chester</i>	<i>Escherichia coli</i>	<i>Salmonella typhi</i>	<i>Shigella sonnei</i>
Equipment*	X				
Cutting Board		X			
Hand-Mouth			X		
Surface-Mouth				X	X
Surface-Hand-Mouth				X	
Ward Dust				X	

Reported incidents of environmental surfaces implicated in transmission of foodborne infection (Bloomfield et al 1997)



“C” stands for.....

- We have to CRAWL before we walk
- We have to CLEAN before we sanitize

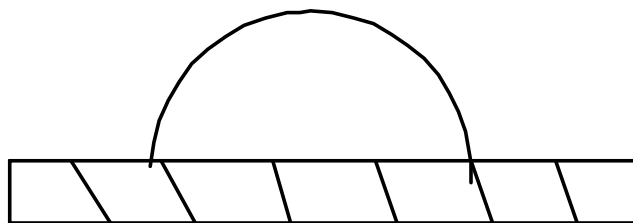


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Why is cleaning important?

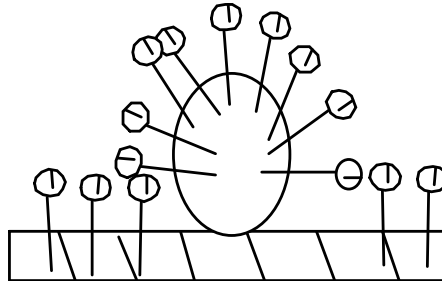


- Attached soil strongly adsorbed onto a substrate is difficult to remove by mechanical action alone

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Mechanism of Soil Removal

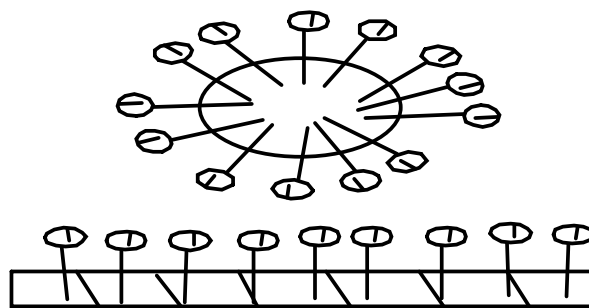


- Surfactant adsorption at various interfaces weakens the soil attachment and facilitates its removal.

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Mechanism of Soil Removal



- Soil is surrounded, lifted, suspended and dispersed. Adsorbed surfactant molecules retard the process of re-deposition.

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Cleaning vs Sanitization

Cleaning:

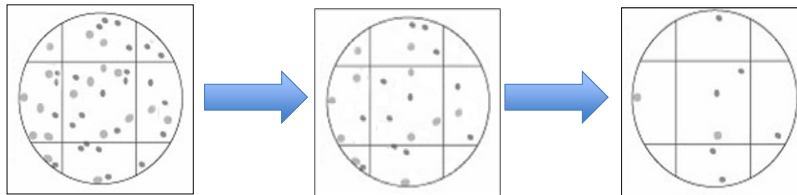
- Removal of organic matter, using appropriate chemicals
 - Detergents (surface acting agents)
 - Solvent Cleaners (grease dissolvers)
 - Acid Cleaners (mineral deposits)
 - Abrasive Cleaners (steel wool, copper, nylon)
- Organic material harbors bacteria and can prevent sanitizing from occurring

Sanitizing:

- Application of heat or chemicals to a pre-cleaned surface to achieve a 99.999% reduction in pathogenic microorganisms
 - Chlorine
 - Chlorine Dioxide
 - Iodine
 - Quaternary ammonium (Quats)
 - PAA
 - Ozone
- Sanitizing is not equal to Sterilization



(Scrape/Soak), Clean, Rinse and Sanitize



○ SCRAPE / SOAK

- Remove large food particles

○ CLEAN

- In hot (110°F) soapy water or as per mechanical dishwasher instructions

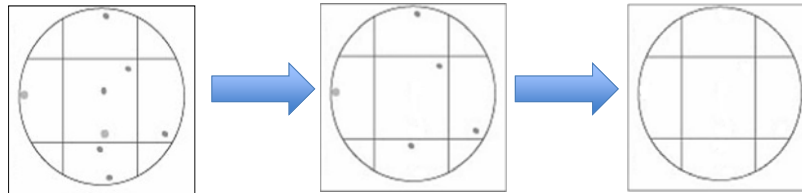
○ RINSE

○ SANITIZE

- Heat or Chemical
- AIR DRY



Sanitize < Disinfect < Sterilize



Reduction in
vegetative bacteria

Reduction of
vegetative bacteria,
viruses, fungi

Removal of all
pathogens

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What's in Your Bottle?



Oxidizers, Surfactant Based, Miscellaneous

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Chlorine and Chlorine Compounds

- Calcium Hypochlorite, Sodium Hypochlorite, Sodium Chlorite
- Hypochlorous acid is the biocidal species in this formula but it is too reactive to ship so it is almost always sold as hypochlorite
- Hypochlorous acid is very biocidal with a broad spectrum of activity (50 – 200ppm required for food sanitation, 5000ppm for sporicidal activity)
- Very unstable. It reacts with metal, organic matter, and virtually anything else you can name
- Can be corrosive, particularly at lower pH.
- It is also VERY cheap



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Chlorine Dioxide (ClO₂)

- Very biocidal against a broad range of microorganisms
- Less reactive with soil and metals than hypochlorous acid
- Particularly effective against biofilms
- A dissolved gas that does not want to stay in solution
- Unstable enough that it must be generated at point of use
- Toxic to humans
- Explosive at high concentrations



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Iodine & Bromine

- Effective broad spectrum biocides
- Relatively free of toxicity & irritancy
- Effective at pH ranging from 2 to 5.5
- Good wetting & detergency properties
- Can discolor surfaces
- Tribromoacetic acid used in brewing (not as much as it used to be)
- Iodine used a bit in dairy



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Hydrogen Peroxide (H₂O₂)

- Moderately effective biocide
- Takes a high level to be effective (in the 100s-1000s of parts per million range)
- Stable in presence of organic matter
- Non-staining
- Can be corrosive to soft metals aluminum, copper, brass, zinc, mild & galvanized steel
- Very low toxicity so can be used in many food applications



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Peroxyacetic acid (PAA)

- Referred to as PAA, peracetic acid, and peroxyacetic acid
- Effective at lower concentrations than hydrogen peroxide
- Not inactivated by catalase or other enzymes
- Very low toxicity
- Strong odor
- Somewhat corrosive to surfaces
- Less reactive to soil than other oxidizers
- Can be inactivated by high mineral load in water
- Has become the sanitizer of choice for most CIP applications



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Quaternary ammonium chloride (quat)

- Cationic surfactant
- Substantive to surfaces
- Foams so not particularly useful for CIP but foam makes it more useful for OPC
- Can be inactivated by hard water
- Not particularly sensitive to soil
- Broad spectrum but cannot kill spores or some viruses unless at VERY high levels
- Incompatible with anionic surfactants
- Good safety and toxicity profile
- Very NON corrosive (despite the ammonium in its name)



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Acid anionic

- Anionic surfactant at low pH
- Broad spectrum efficacy
- Not effective against spores and some viruses
- Not inactivated by soil
- Pretty good cleaner
- Not inactivated by hard water
- Foams a LOT



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Alcohol

- Broad spectrum
- Not particular effective against spores
- Not inactivated by soil or hard water
- Must be used at VERY high levels (60%)
- VERY expensive
- Flammable



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Hand Hygiene

Just CLEAN Them!



Why should we wash our hands?

- Recognized as the best way of stopping the spread of organisms
- Soap and water
 - No indication for antimicrobial soap
 - 10-15 seconds of lathering
- Alcohol
 - more research into concentration required to kill all viruses

LET'S SING!!



When to Wash Hands

- Before eating, preparing or handling food
- Between handling raw meat, poultry & seafood
- Between handling cooked food & food that will be eaten raw
- After coughing, sneezing and blowing your nose
- After going to the toilet
- After handling rubbish
- After handling chemicals (cleaning products)



Transmission to Hands

Bacteria on a hand after using the toilet and before washing hands



Copyright Public Health Laboratory Service and Food and Drink Federation
Tel: 020 7336 2460 Fax: 020 7377 0481 Email: foodlink@fdi.org.uk Web: www.foodlink.org.uk

Transmission from surfaces

100% with *E. coli*
100% with *Salmonella spp.*
100% with *S. aureus*
22% – 33% with HAV
16% with Rotavirus



Take Home Message

The SO What!



Strategies to PREVENT Foodborne Illness

- Ensure food does not become contaminated
 - Keep Hands and nails clean
 - Keep the food preparation area clean
 - Handle food safely

- Kill or Minimize growth of microorganisms
 - Cook high-risk foods thoroughly
 - Keep hot food hot
 - Keep cold food cold



Maximizing Sanitizer Effectiveness

- Surface **MUST** be cleaned first
- Surface **MUST** be rinsed after cleaning
- Intimate contact on all surfaces to be sanitized **MUST** be achieved
- Temperature **MUST** be verified
 - Does it need to reach a specified temp?
 - Can the product be used effectively in cold conditions?
- Concentration of sanitizer **MUST** meet label instructions
- Automated dilution systems **SHOULD** be maintained to ensure correct dilution is occurring
 - Validation of diluted product using test strips
 - Ensure product is not used beyond expiry



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Maximizing Sanitizer Effectiveness

- Contact time **MUST** be followed as per label instructions
- pH of sanitizer **MUST** meet recommended label instructions
- Composition of makeup water **MUST** be considered
 - Use of potable water
 - Is Deionized water required?
- Verification that the sanitizer is effective against the type of microorganism of concern
 - Bacteria?
 - Fungi?
 - Virus?
- Number of organisms
 - Is the level of contamination beyond the ability of the sanitizer?



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Please don't make me eat poop!



Just Wash Your Hands!



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Questions?

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