

Good Agricultural Practices

Fruit and Vegetable Microbial Safety Issues



Fruits and Vegetables

Promotional campaigns to increase produce consumption to at least 5 servings a day.

U.S. Dietary Guidelines

Healthy People 2010

National Cancer Institute

Produce for Better Health Foundation



Fruit and Vegetable Consumption

Between 1970 - 1997, the U.S. per capita consumption of fruits and vegetables increased 24 % !



577 lbs to 718 lbs per year

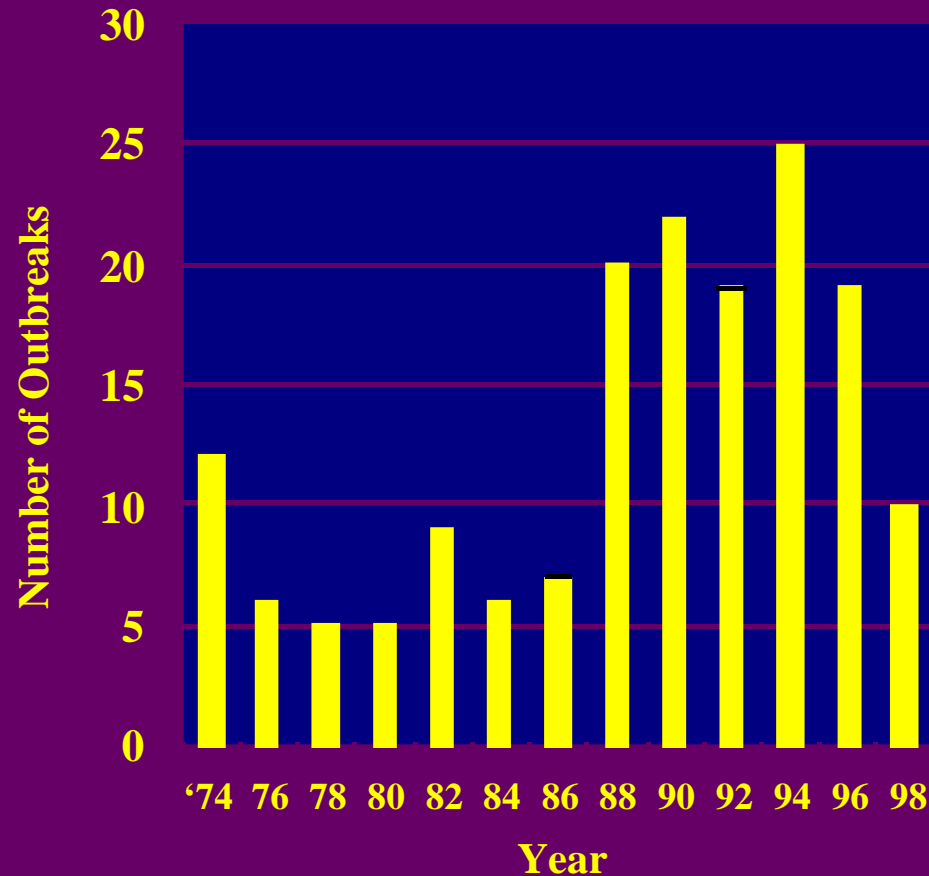


Fruits and Vegetables

- **Significant increases in the number of produce associated foodborne disease outbreaks in the U.S.**
- **Produce associated outbreaks per year more than doubled from 1973-1987 and 1988-1998.**



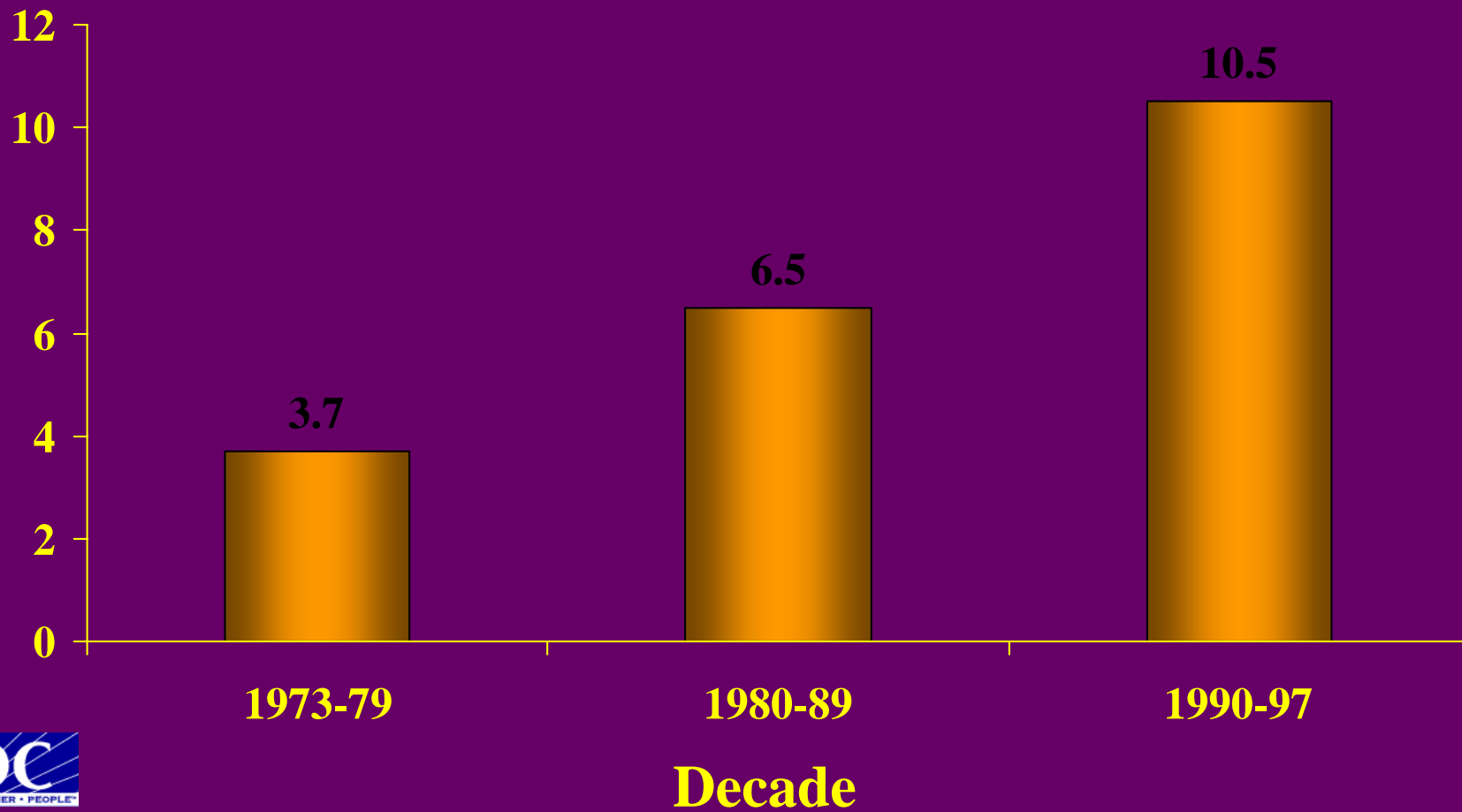
U.S. Fruit and Vegetable Outbreaks: 1973 - 1998



Source: CDC Foodborne outbreak surveillance system

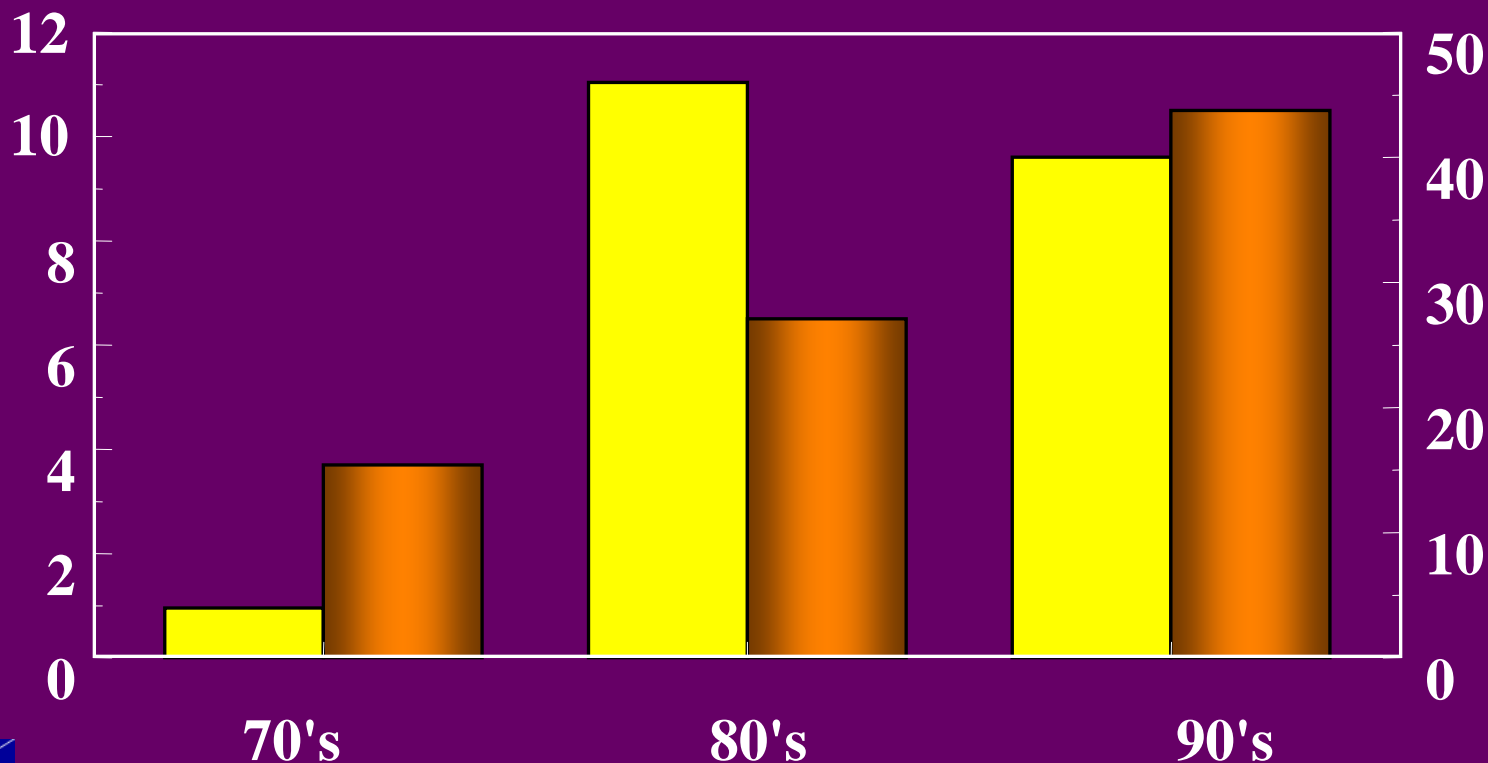
Number of Produce Associated Outbreaks by Decade, 1973 - 1997

Outbreaks / year



Produce Related Outbreaks & Cases per Outbreak, 1973 - 1997

■ Outbreaks / yr ■ Mean # ill / outbreak



Selected Produce-Associated Outbreaks, 1990 - 1997

<u>Year</u>	<u>Pathogen</u>	<u>Vehicle</u>	<u>Cases</u>	<u># of States</u>	<u>Source</u>
1990	<i>S. chester</i>	Cantaloupe	245	30	Central America (CA)
1990	<i>S. javiana</i>	Tomatoes	174	4	US
1990	Hep. A	Strawberries	18	2	US
1991	<i>S. poona</i>	Cantaloupe	>400	23	US/CA
1993	O157:H7	Apple cider	23	1	US
1993	<i>S. montevideo</i>	Tomatoes	84	3	US

Selected Produce-Associated Outbreaks, 1990-1997

<u>Year</u>	<u>Pathogen</u>	<u>Vehicle</u>	<u>Cases</u>	<u># of States</u>	<u>Source</u>
1994	<i>Shigella flexneri</i>	Scallions	72	2	CA
1995	<i>S. stanley</i>	Alfalfa sprouts	242	17	?
1995	<i>S. hartford</i>	Orange juice	63	21	US
1995	O157:H7	Leaf lettuce	70	1	US
1995/6	<i>S. newport</i>	Alfalfa sprouts	>100	7	?
1996	O157:H7	Leaf lettuce	49	2	US

Selected Produce-Associated Outbreaks, 1990-1997

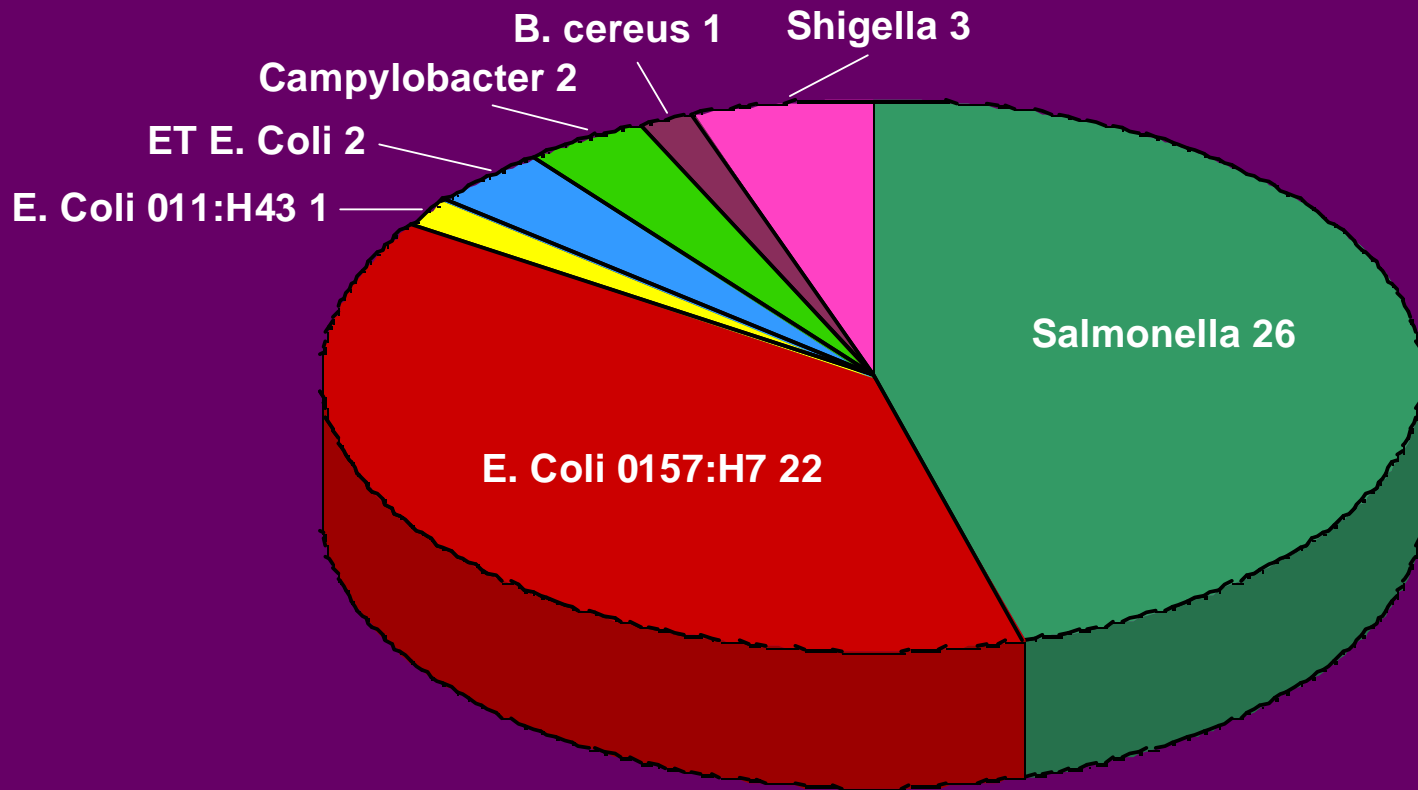
<u>Year</u>	<u>Pathogen</u>	<u>Vehicle</u>	<u>Cases</u>	<u># of States</u>	<u>Source</u>
1996	<i>S. montevideo</i>	Alfalfa sprouts	>600	1	US
1996	<i>Cyclospora</i>	Raspberries	978	20	CA
1996	O157:H7	Apple Juice	71	3	US
1997	Hepatitis A	Strawberries	151	1	CA
1997	<i>Cyclospora</i>	Raspberries	>200	15	CA
1997	<i>S. infantis/</i> <i>anatum</i>	Sprouts	81	4	US

Fruit & Vegetable Outbreaks by Specific Agent, 1973 - 1998

	<u>1973-87</u>	<u>1988-98</u>
Bacterial	24	57
Parasitic	1	8
Viral	4	7
Unknown	35 (55%)	41 (37%)
Total Outbreaks	64	112
Outbreaks/year	4.3	10.2

Source: CDC Foodborne outbreak surveillance system

Fruit and Vegetable Bacterial Outbreaks: 1988 - 1998



Source: CDC Foodborne outbreak surveillance system



Sources of Produce Outbreak Agents

Animal

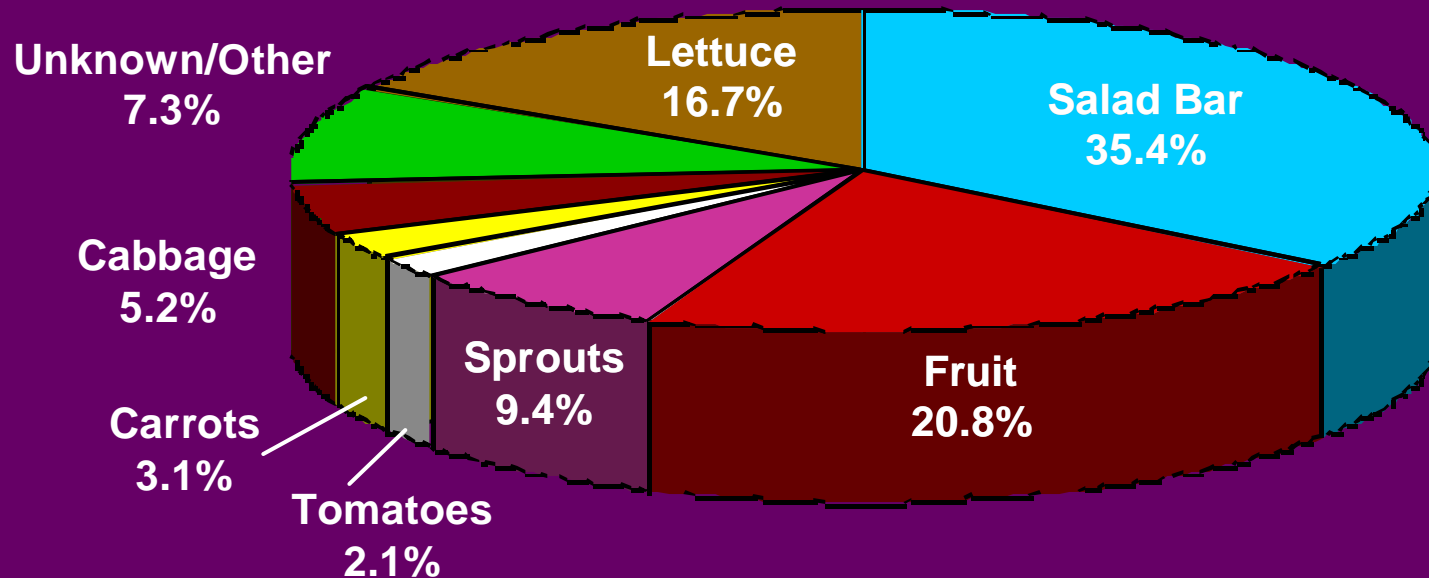
- *Cryptosporidium* (cider and onions)
- non-typhoidal *Salmonella* (sprouts)
- *E. coli* 0157:H7 (lettuce and sprouts)

Human

- *Shigella* (parsley)
- Hepatitis A (green onions/strawberries)
- *S. typhi* (mamey)
- *C. cayetanensis* (raspberries)
- ETEC (carrots)



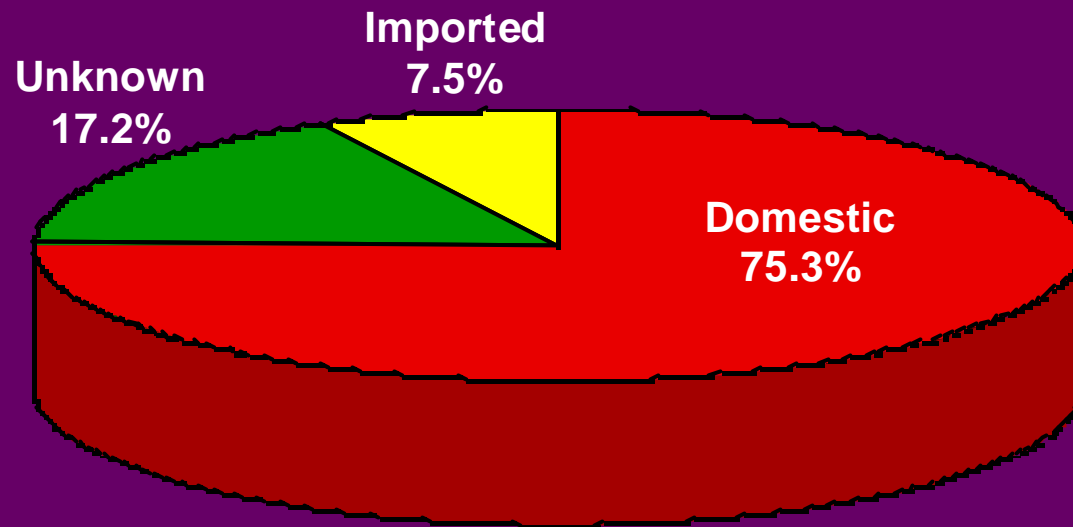
US Produce Outbreaks: 1990 - 1998



Source: CDC Foodborne outbreak surveillance system



Fruit and Vegetable Outbreaks by Origin of Produce: 1990 - 1998



Source: CDC Foodborne outbreak surveillance system

Frequency of Pathogens on Produce

- **Vegetables (from literature):**
 - *Salmonella* 1- 8%
 - *L. monocytogenes* 2- 30%
 - *Shigella* 1%
- **FDA Produce Surveillance Program**
 - Imports - 4% positive rate (*Salmonella* & *Shigella*)
 - Domestic - currently being conducted



E. coli O157:H7 Lettuce Outbreak

- **A multistate Outbreak of *Escherichia coli* O157:H7 Infections Associated with Consumption of Mesclun Lettuce**
- **By Elizabeth D. Hilborn, et.al.**
- **Archives of Internal Medicine, Vol. 159, August 9/23, 1999.**



E. coli O157:H7 Lettuce Outbreak

- **Occurred during May & June, 1996**
- **49 Cases**
- **Two separate outbreaks reported in:**
 - **Connecticut - mesclun mix**
 - **Illinois - red leaf lettuce**
- **Patients had similar demographics**



E. coli O157:H7 Lettuce Outbreak

- **Were these two outbreaks related?**
- **Case-control studies conducted.**
- **Molecular subtyping by pulsed field gel electrophoresis (PFGE) showed they were indistinguishable.**



E. coli O157:H7 Lettuce Outbreak

- **49 Cases of Infection**
 - **Connecticut 21**
 - **Illinois 28**
- **21 Patients (49%) were hospitalized**
- **3 Patients (7%) developed HUS**
- **Patients age from 2 - 87 years**



E. coli O157:H7 Lettuce Outbreak

Results of the Investigation

- Lettuce traced back to one California grower.**
- Lettuce grown near beef cattle ranch.**
- A dirt track separated the two operations.**
- Free range chickens had access to cattle and lettuce fields.**

E. coli O157:H7 Lettuce Outbreak

- **Unchlorinated well water used for cattle husbandry, lettuce culture and processing.**
- **The processing shed was open to the environment; there was no mechanism to exclude dust, insects, birds or rodents.**
- **No handwashing facilities were available.**



E. coli O157:H7 Lettuce Outbreak

- **Gloves were not worn during processing.**
- **Recirculated wash water was used.**
- **The recirculating and filtration systems failed in May and the water was changed 3X a day.**
- **Lettuce was crisped in reused plastic baskets.**

E. coli O157:H7 Lettuce Outbreak

- **E coli O157:H7 was not isolated from the lettuce during the investigation.**
- **But, E. coli bacteria were present on the finished lettuce and in the wash water.**
- **This indicated the presence of fecal contamination from humans or animals.**





7 18 '96



Produce Associated Outbreaks

Conclusions:

- **Outbreaks have increased by nearly a factor of 3.**
- **Number of cases per outbreak have increased x10.**
- **A variety of produce involved.**



Produce Associated Outbreaks

Conclusions:

- **Most due to bacteria, esp. *Salmonella*.**
- **New agents detected, *E. coli* O157:H7 & *Cyclospora*.**
- **Unknown agents may be due to *Norwalk*-like virus.**
- **Domestic versus international.**



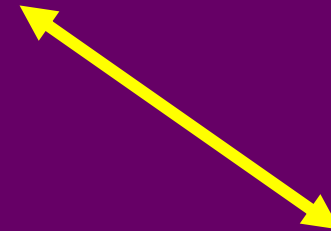
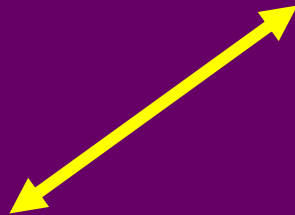
Why are Foodborne Illnesses Increasing?

- **Complexities of the Food System**
- **Aging of the Population**
- **Chronic Illnesses / Compromised Immunity**
- **Awareness of Hygiene & Risks Changing**
- **Changing Microorganisms:**
 - * **More Virulent Strains**
 - * **Adapting to Stresses**

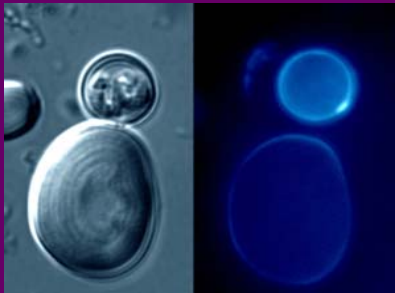


The Cycle of Infection

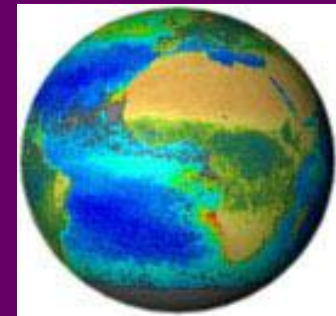
HOSTS



MICROBES



ENVIRONMENT



Why Should We Care?

Foodborne illness outbreaks are a major cause of:

- **Personal distress**
- **Preventable death**
- **Avoidable economic burden**



Why Should We Care?

Every year foodborne illnesses result in an estimated:

- **76 million cases of foodborne illness.**
- **325,000 people hospitalized for foodborne illness.**
- **5,200 needless deaths each year.**
- **Economic losses between 10-83 billion dollars.**



Produce Associated Outbreaks Affect Business

- **Strawberry industry lost an estimated \$50 million in 1996 after mistakenly being indicated as the source of pathogens in an outbreak.**
- **Odwalla shareholder value dropped approximately 41% (\$12.4 million) in six months after outbreak.**
- **Work against produce promotions campaigns.**
- **May result in unwanted legislation or regulation.**

Produce Associated Outbreaks Affect Business

- **Food retailers interested in food safety & addressing the issue because of consumers.**
- **Food retailers are requiring third party inspection of farms that supply produce and certification of Good Agricultural Practices.**
- **Growers are having to absorb the costs of these inspections.**

The Cost of Foodborne Illness

- **Loss of business and reputation**
- **Lawsuits, attorney and court fees**
- **Increased insurance premiums**
- **Loss of employee morale**
- **Embarrassment**
- **Financial disaster!**



Contamination With Microbial Pathogens: Where Can It Occur?

- In fields or orchards
- During harvesting and transport
- During packing or processing
- In distribution and marketing
- In restaurants and food service facilities
- In the home



FARM to FORK

Sources of Pathogens on Fresh Produce*

- Contaminated irrigation water
- Fresh or uncomposted manure/fecal material
- Wild and domestic animals
- Handling by infected workers

Beuchat, 1996



Sources of Pathogens on Fresh Produce*

- Equipment
- Transport vehicles
- Contaminated flume, wash water, or ice
- Contamination during processing



Beuchat, 1996

Sources of Pathogens on Fresh Produce*

- Improper storage and packaging
- Cross contamination
- Improper handling after wholesale or retail purchase

Beuchat, 1996



PREVENTION is the Key to Reducing Microbial Contamination of Fresh Fruits and Vegetables



What Can Growers and Packers Do?

- **Learn About the Risks**
- **Develop a Food Safety Plan**
- **Strengthen GAPs**
- **Document Activities**



**Goal:
Reduce Microbial Risks
to Assure Food Safety.**



The End



Acknowledgements

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