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FSIS Perspective on Pre-harvest Interventions

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Conclusions

- We are not losing the battle with E. coli O157:H7
- Unfortunately, we probably can't win it either

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It is “time to close the book” on the problem of infectious diseases. (1969)

Jesse Steinfeld, MD, U.S. Surgeon General, 1969-73

“The future of infectious diseases will be very dull. (1972)”

Macfarlane Burnet, 1960 Nobel Prize Winner In Medicine

Told students that there were “no new diseases to be discovered. (1976)”

Lewis Thomas, Dean Yale Medical School

Examples of Pathogenic Microbes Identified Since 1973

- 1973 Rotavirus
- 1977 Ebola virus
- 1977 Legionella pneumophila
- 1980 Human T-lymphotrophic
- 1981 Toxin-producing Staph aureus
- 1982 Escherichia coli O157:H7
- 1982 Borrelia burgdorferi
- 1983 HIV
- 1983 Helicobacter pylori
- 1989 Hepatitis C Virus
- 1992 Vibrio cholerae O139
- 1993 Hantavirus Virus
- 1994 Cryptosporidium
- 1995 Ehrlichiosis
- 1996 nvCJD Prion
- 1997 HVN1 Virus Influenza
- 1999 Nipah Virus

Source: US Institute of Medicine, 1997; WHO, 1999.



Environment factors

Changes in food production

- CAFOs & Manure glut
- Globalization of food supply
- Centralized production

E. coli O157

Scotland (JE Coia et al, J. Infect 36:317, 1998)

- ✓ Handling / preparing raw food (40%)
- ✓ Gardening / garden play (36%)
- ✓ Lived on / visited farm (20%)
- ✓ Direct / indirect contact with manure (17%)
- ✓ Private H₂O supply (12%)
- ✓ Recent high coliform counts in H₂O supplies (12%)

FoodNet Case-control

- ✓ farm animals

E. coli O157 case-control study, 1996-1997

Previously Identified Risk Factors for Sporadic Infection

- ✓ Eating at a table service restaurant
-

E. coli O157 Study, 1999-2000

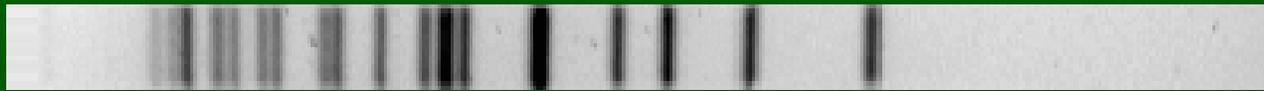
- ✓ Restaurant consumption of pink hamburger was **NOT** associated with infection

- * FoodNet case-control studies

Host factors

- **Increased numbers of susceptible persons**
Aging , HIV infection, immunosuppressive drugs
- **Changing eating habits**
Dietary, "fast food", eating out,...
- **Improved surveillance & detection**

Improved surveillance & detection



Molecular subtyping "DNA Fingerprinting"

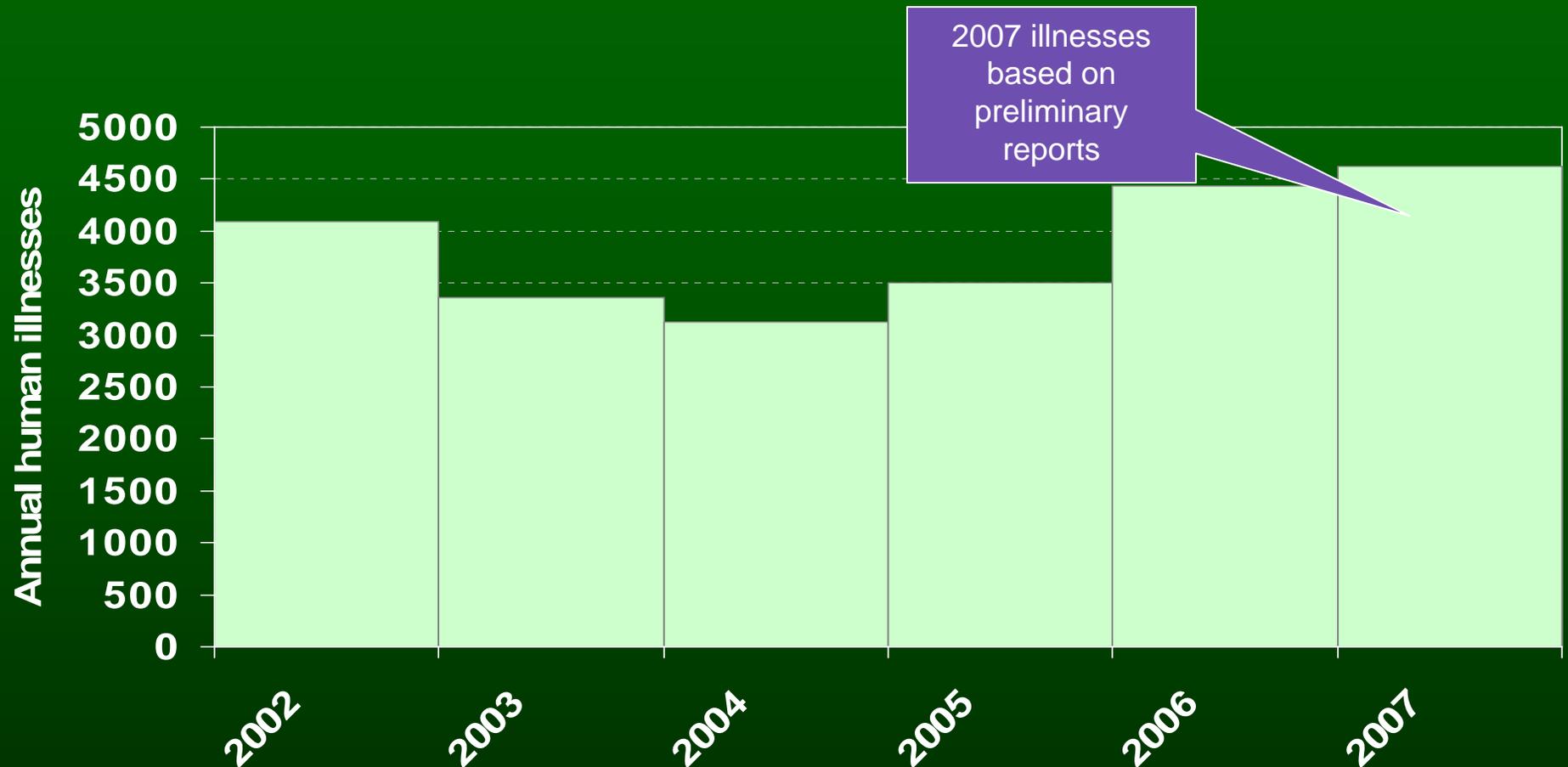
- Converts genetic material into a "bar code"
- Can be scanned & transmitted electronically
- New lab methodology

Where do the microbes come from?

Agent	# of cases	reservoir	% food
Norwalk-like viruses	9,200,000	man	40
<i>Campylobacter</i> spp	1,963,141	poultry	80
<i>Salmonella</i> , nontyphoidal	1,341,873	animal	95
<i>Clostridium perfringens</i>	248,520	soil, man, animal	100
<i>Giardia lamblia</i>	200,000	Man, animal	10
Staphylococcal	185,060	man	100
<i>Toxoplasma gondii</i>	112,500	cat	50
<i>Shigella</i> spp.	89,648	man	20
<i>Yersinia enterocolitica</i>	86,731	pig	90
<i>Escherichia coli</i> O157:H7	62,458	cow	85



Illnesses due to Shiga-toxin Producing *E. coli*



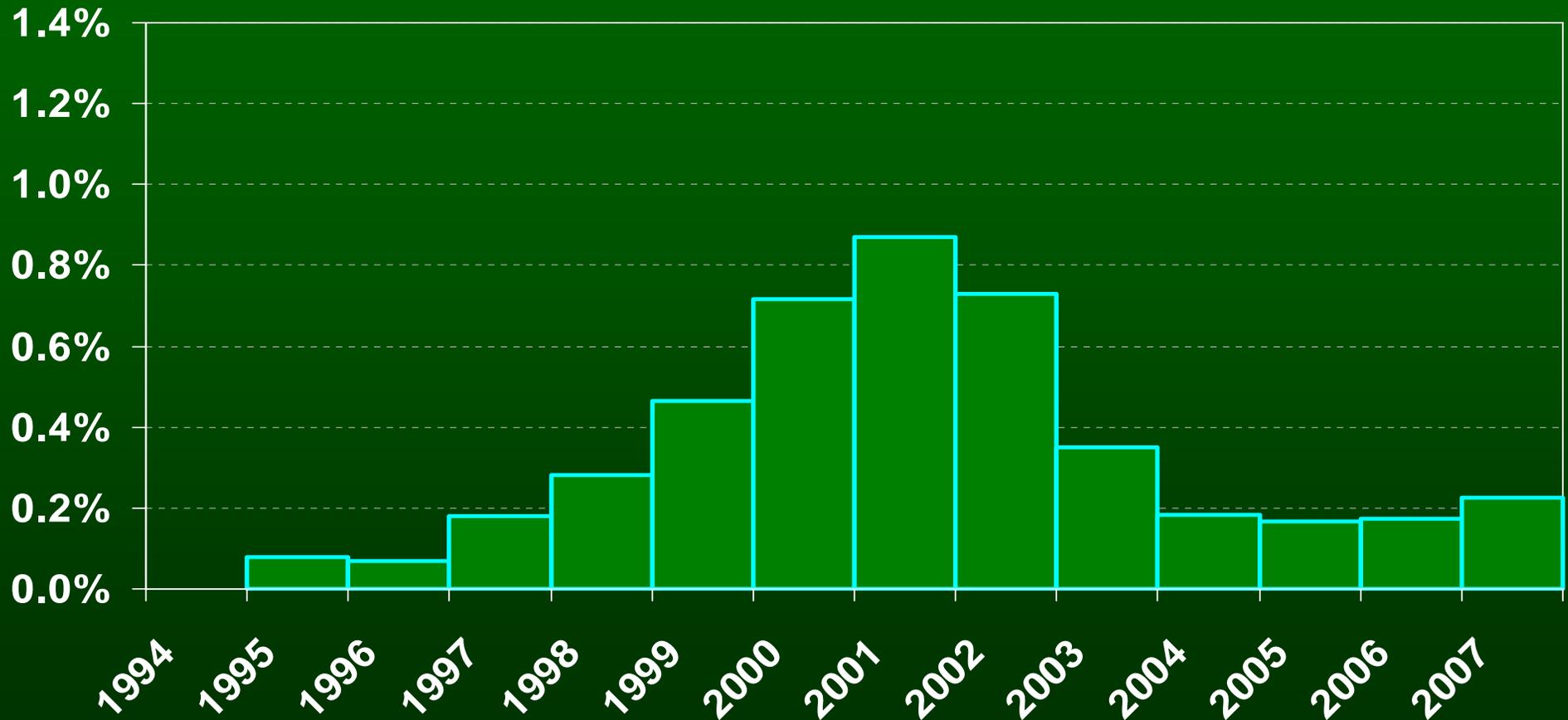
Illnesses reported from CDC Morbidity and Mortality Weekly Report

<http://www.cdc.gov/mmwr>



What does the FSIS sampling program say?

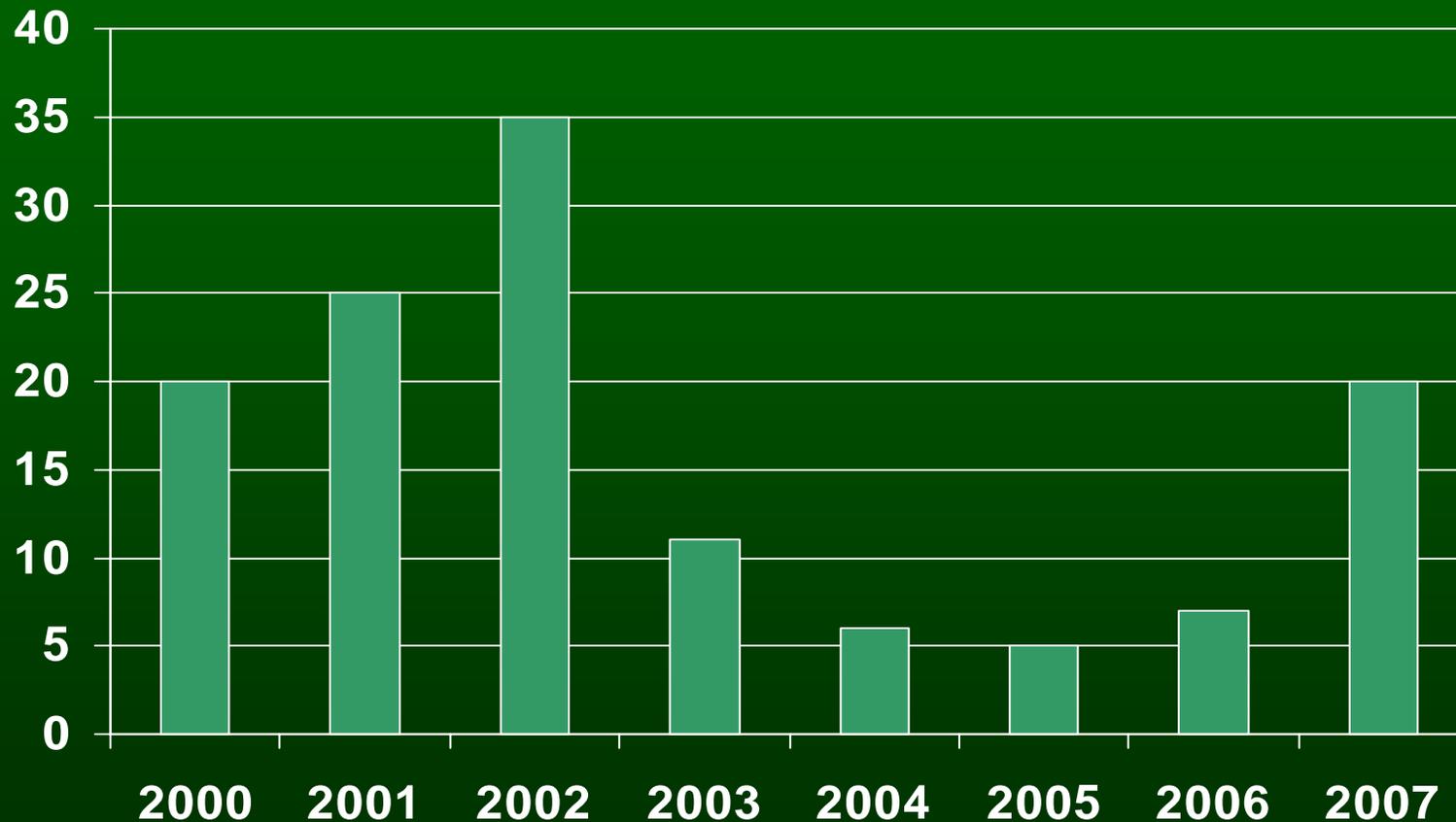
FSIS Testing Results for Raw Ground Beef: Percentage of Samples that Tested Positive for *E. coli* O157:H7



Source: http://www.fsis.usda.gov/Science/Ground_Beef_E.coli_Testing_Results/index.asp



Number of Beef Recalls Associated with *E. coli* O157:H7



Source: http://www.fsis.usda.gov/FSIS_Recalls/index.asp

2007 Recalls Associated with Raw Beef Products Contaminated with *E. coli* O157:H7

Month	States	Number of Recalls	Pounds Recalled
January	Arkansas	1	4,240
March	Washington	1	16,743
April	California	1	107,943
May	Minnesota, Michigan	2	107,943
June	California, Texas	2	5,740,440
July	Michigan, Nebraska	2	32,589
September	New York, New Jersey, Maryland	3	21,700,949
October	Wisconsin, Georgia, Illinois, Florida, New York	5	1,028,704
November	Pennsylvania, Wisconsin	2	1,180,311
December	Tennessee	1	102

Source: http://www.fsis.usda.gov/FSIS_Recalls/index.asp



What We Are Doing to Combat

E. coli O157:H7

- Expanding our microbiological testing
- Using specially trained investigators to verify that plants are helping to control *E. coli* O157:H7
- Having inspection personnel complete checklists to evaluate control measures



What We Are Doing to Combat *E. coli* O157:H7

- Testing all materials that are used as components in raw ground beef
- Testing imported trim
- Using a more sensitive enrichment broth for *E. Coli* O157:H7 sampling



Pre-harvest activities as FSIS

- ▲ Responsibility transferred from APHIS to FSIS in 1994
 - Voluntary - no legal authority over animals on farm
 - Information, Education, Collaboration
 - Government, Industry, Academia Partnerships
 - Food animal production industry changes will be market-driven
- ▲ Outreach and liaison activities to develop and sustain risk reduction strategies in animal and egg production
- ▲ HACCP rule goes into effect, 1996
 - Identify and promote programs that encourage food animal producers to adopt production practices that support HACCP and reduce food safety hazards in animals presented for slaughter.

Conclusions

- We are not losing the battle with E. coli O157:H7
 - Better at identifying the agent
 - Risk-based sampling
 - New detection methods
- Unfortunately, we probably can't win it either... maybe
 - HACCP for 10 years
 - Pre-harvest interventions such as vaccines
 - Current risk-assessment will provide options for risk managers to consider
 - Non-O157:H7 Shigatoxin producing E. coli
- Minimization of contamination at slaughter/dressing and diversion via testing cannot be completely successful without a fully integrated approach that adds pre-harvest to the mix

The Red Queen Principle

- Leigh van Valen (evolutionary biologist, 1973)

“...in this place it takes all the running you can do, to keep in the same place.”

- Red Queen to Alice in *Through the Looking Glass*

