

***OUTBREAKS BY THE NUMBERS: FRUITS
AND VEGETABLES
1990-2005***

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ABSTRACT

The year 2006 was a banner year for produce-related foodborne illness outbreaks, marked by outbreaks linked to spinach, tomatoes and lettuce. In a comprehensive survey of outbreaks with an identified food source, produce outbreaks accounted for 13% (713/5,416) of outbreaks and 21% (34,049/161,089) of associated illnesses from 1990 through 2005, according to data from the Center for Science in the Public Interest (CSPI). CSPI conducted a hazard analysis on produce by identifying the most common food/pathogen combinations and ranked their risk based on their history of causing outbreaks and associated illnesses.

Greens-based salads contaminated with Norovirus was the most common cause of outbreaks, followed by lettuce with Norovirus, sprouts with *Salmonella*, unspecified fruit with Norovirus, greens-based salads with *Salmonella*, melon with *Salmonella*, mushrooms with chemicals or toxins, greens-based salads with *E. coli*, lettuce with *E. coli*, and potatoes with *Salmonella*.

In all produce outbreaks, Norovirus is the top cause of outbreaks (40%), followed by *Salmonella* (18%), *E. coli* (8%) and *Clostridium* (6%). The main hazards associated with fruits are Norovirus (39%), *Salmonella* (28%), and *Cyclospora* (8%). In vegetable outbreaks, the major pathogens are Norovirus (26%), *Salmonella* (21%), and *Clostridium* (12%). The major pathogens in produce dish outbreaks are Norovirus (51%), *Salmonella* (13%), *E. coli* (6%) and *Shigella* (6%).

In light of the recent produce related outbreaks, identifying ways to control hazards will reduce the risk of foodborne illness from produce. By identifying food/pathogen combinations responsible for produce outbreaks, we can generate a hazard analysis, which is the first step in identifying appropriate solutions.

BACKGROUND

- Each year, 76 million people become ill and 5,000 die after eating poisoned food, according to the Centers for Disease Control and Prevention (CDC).
- Only a small proportion of foodborne illnesses are associated with outbreaks reported to CDC, and of the reported outbreaks between 1990 and 2005, less than 37% have both an identified etiology and food source.
- The CDC publishes foodborne illness outbreak line listings organized by pathogen, including outbreaks with unknown etiologies and outbreaks with unknown food vehicles.
- CSPI maintains a database of only those foodborne illness outbreaks with an identified etiology and food vehicle. The outbreaks are categorized by specific food type, which is critical information for making science-based risk management decisions.
- Outbreak data has helped improve the hazard analysis for various food commodities, such as meat, seafood, and juice. It can also be used for produce, a commodity that causes high numbers of outbreaks and illnesses. In the past year alone, numerous multistate produce outbreaks have highlighted the urgency of gaining a better understanding of that pathogens that cause produce outbreaks in order to better ensure produce safety.

METHODS

- CSPI's data is compiled from various sources, including the CDC, state and local health departments, and scientific and medical journals.
- The database is updated regularly, and only includes those incidents of foodborne illness which meet the CDC's definition of an outbreak, occurred in the United States between 1990 and 2004, and for which there is a known or suspected etiology and an identified food vehicle.
- Outbreaks in the CSPI database are grouped according to regulatory agency, and placed within one of thirteen food categories. Each category is then subdivided into food types. The database is updated as new reports of foodborne illness are identified, and is published periodically in CSPI's *Outbreak Alert!*
- Using the *Outbreak Alert!* database, we identified the most common produce-pathogen combinations causing outbreaks from 1990 to 2004.

RESULTS

- Between 1990 and 2005, there were 713 outbreaks and 34,049 individual cases linked to produce in the CSPI database. Produce outbreaks account for 13% of foodborne illness outbreaks and 21% of illnesses in the database. (Figure 1)
- Fifty percent of the produce outbreaks are caused by food from restaurants and other food establishments. Private homes account for 13% of produce outbreaks. Other locations for produce outbreaks include the workplace, catered events, and schools. (Figure 2)
- Between 1990 and 2005, produce outbreaks have an average of 48 illnesses per outbreak. Produce outbreaks cause more illnesses on average than beef, poultry and seafood outbreaks. (Figure 3)
- Norovirus is the major cause of these outbreaks, accounting for 40% of all outbreaks. *Salmonella* is responsible for 18% of produce outbreaks, while *E. coli* causes 8%. (Figure 4)
- The most common produce items associated with outbreaks are greens-based salads, lettuce, potatoes, unspecified fruits and sprouts. Produce items causing the most illnesses linked to outbreaks are greens-based salads, berries, tomatoes, lettuce, and sprouts.

RESULTS

- The main hazards associated with greens-based salad outbreaks are Norovirus (64%), *Salmonella* (9%), and *E. coli* (7%). In lettuce outbreaks the major hazards are Norovirus (47%), *E. coli* (22%), and *Salmonella* (11%). Major hazards in potato outbreaks are *Salmonella* (33%) and *Staphylococcus* (24%). In unspecified fruit outbreaks, prominent hazards are Norovirus (67%) and *Salmonella* (9%). In sprouts, the most common hazards are *Salmonella* (80%) and *E. coli* (20%). (Figure 5)
- Norovirus and *Salmonella* are the two major pathogens in produce and show up frequently on a variety of produce items. Norovirus shows up most frequently on: greens-based salad, lettuce, and unspecified fruits. *Salmonella* shows up most frequently on: sprouts, greens-based salad, melon, potatoes. Mushrooms with chemical/toxins were also a frequent contributor to produce outbreaks. Finally, *E. coli* in green-based salad and lettuce appeared regularly. (Table 1)
- Between 1998 and 2005, Norovirus is responsible for four of the top five produce-pathogen combinations. The domination of Norovirus as a major pathogen in recent years may be explained by improved lab detection of Norovirus or by the increasing prevalence of the virus worldwide. (Table 2)

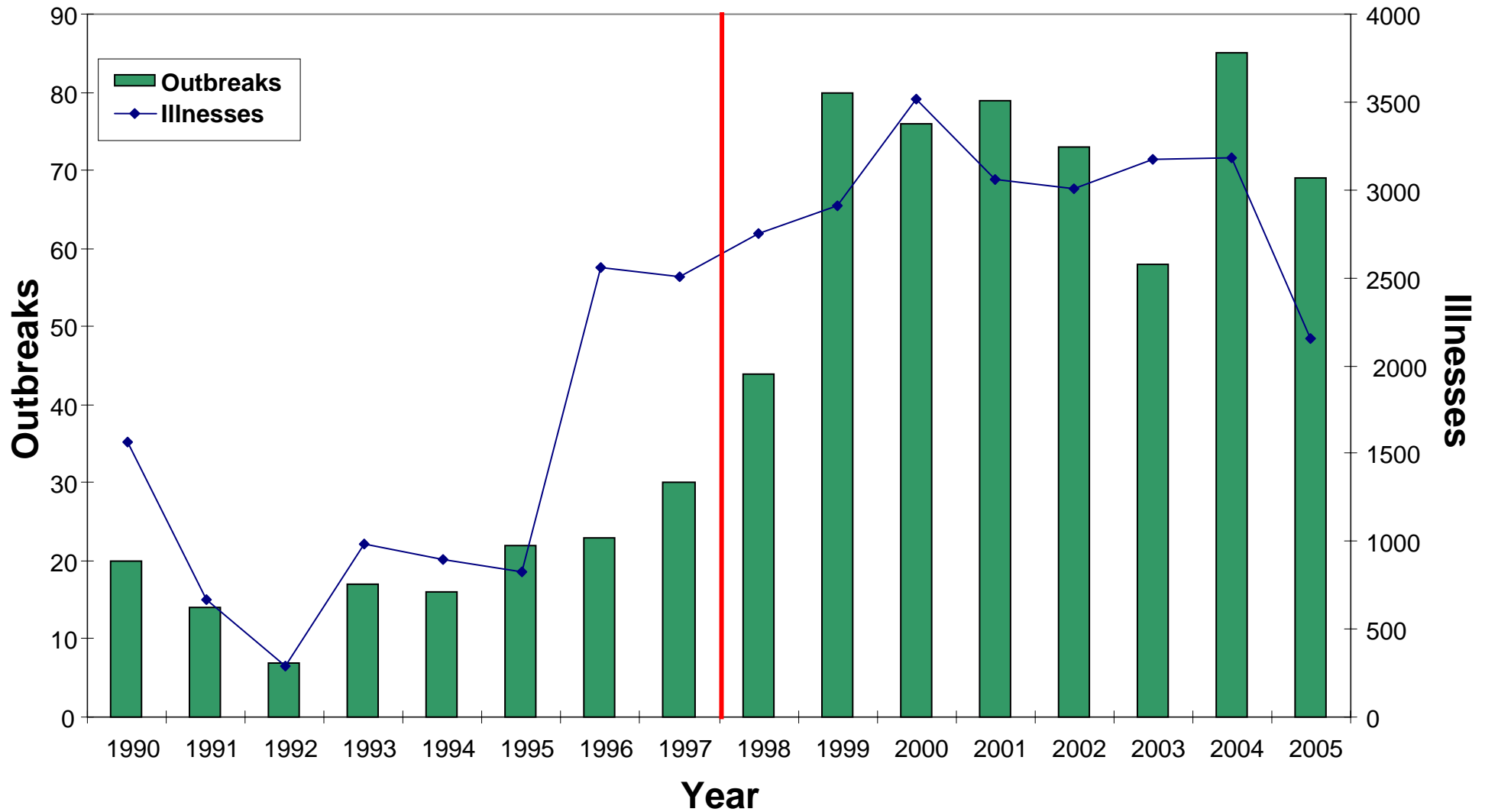
CONCLUSIONS

In light of the frequency and size of produce-related outbreaks, solutions are urgently needed to reduce the risk of foodborne illness from produce. By identifying food/pathogen combinations responsible for produce outbreaks, we can generate a hazard analysis, which is the first step to identifying appropriate solutions.

The produce industry needs to implement a Hazards and Critical Control Points (HACCP) based program to reduce the risk of microbial contamination, using the Seafood HACCP program as a model. Mandatory seafood HACCP utilized a preventative control program for seafood processors in an industry with many small companies. The Food and Drug Administration (FDA) should establish a regulatory requirement that all produce growers and processors develop a food safety plan and FDA should set requirements for what should be in the plan. Finally, the agency should publish a “Hazards and Controls Guide” outlining hazards in different produce items using the outbreak data, and the best known controls to prevent or reduce the risk. This Guide can be updated as needed to reflect new science.

In order to build a solid risk-based approach to produce safety, we must develop a hazard analysis for produce items, using outbreak data on the most common produce items and pathogens, and data from other sources.

FIGURE 1. YEARLY TRENDS IN PRODUCE OUTBREAKS



NB: In 1998, the Centers for Disease Control enhanced outbreak surveillance efforts. The sharp increase in outbreak numbers between 1997 and 1998 is likely due to the enhanced surveillance.

FIGURE 2. PRODUCE OUTBREAK LOCATIONS

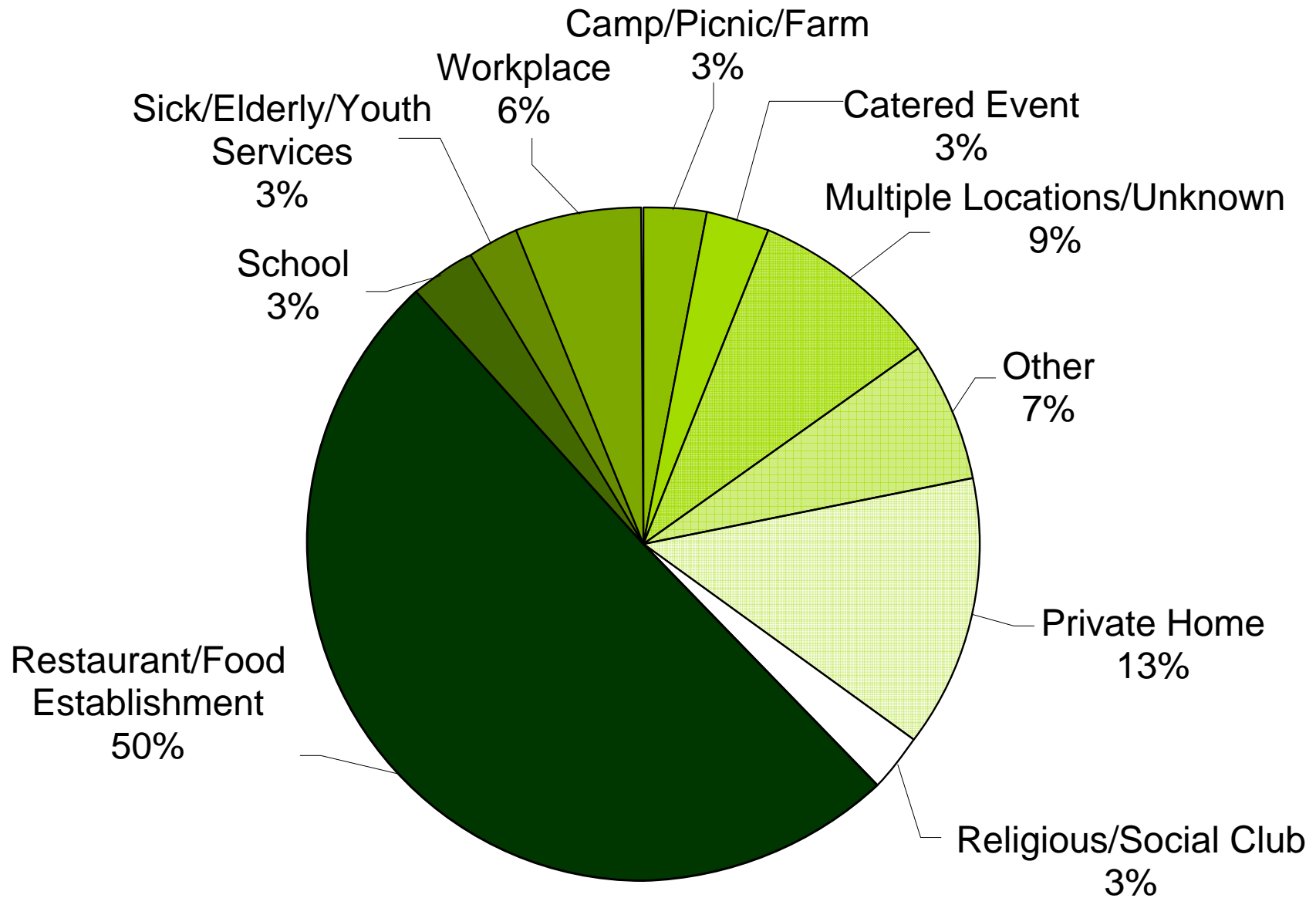


FIGURE 3. AVERAGE CASES PER OUTBREAK BY FOOD CATEGORY 1990-2005

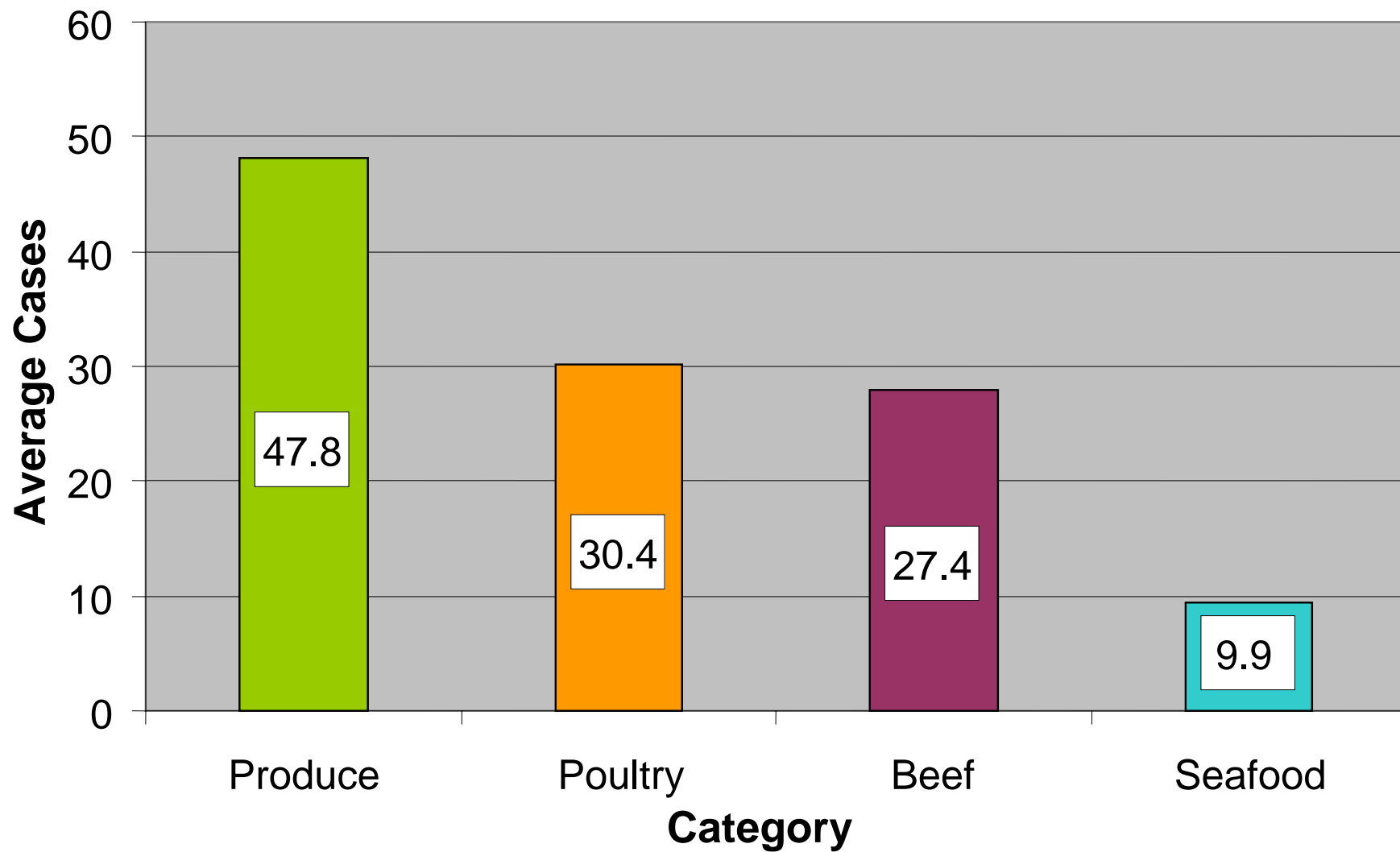


FIGURE 4. PATHOGENS IN PRODUCE

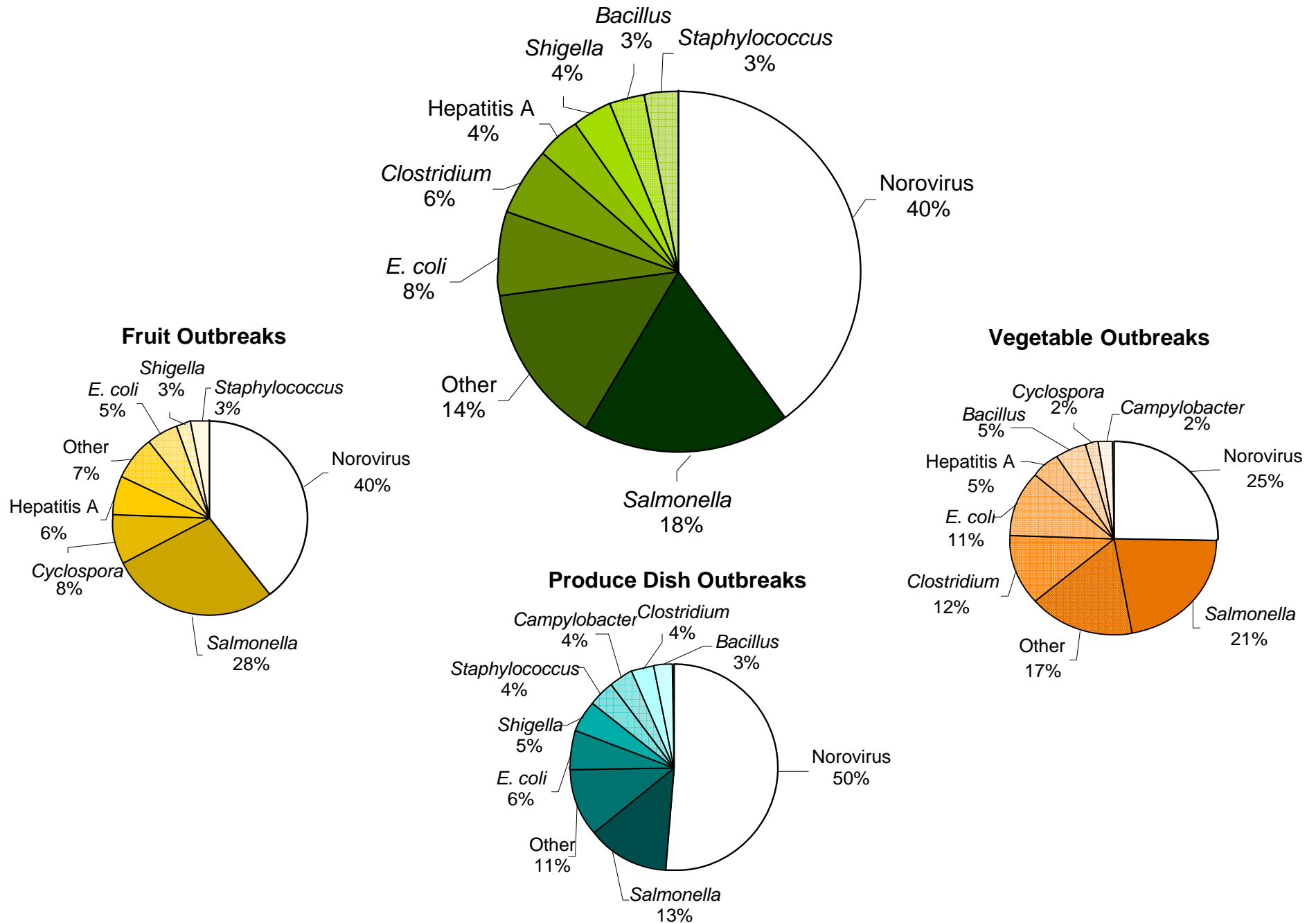


TABLE 1. MAJOR FOOD-PATHOGEN COMBINATIONS CAUSING OUTBREAKS, 1990-2005

Rank	Food	Pathogen	Outbreaks	Illnesses	% Produce Outbreaks
1	Greens Salad	Norovirus	144	5,353	20.2%
2	Lettuce	Norovirus	30	1,025	4.2%
3	Sprouts	<i>Salmonella</i>	24	1,875	3.4%
4	“Fruit”	Norovirus	22	1,636	3.1%
5	Greens Salad	<i>Salmonella</i>	20	1,033	2.8%
6	Melon	<i>Salmonella</i>	16	1,137	2.2%
7	Mushrooms	Chemicals/Toxins	16	82	2.2%
8	Greens Salad	<i>E. coli</i>	15	791	2.1%
9	Lettuce	<i>E. coli</i>	14	382	2.0%
10	Potato	<i>Salmonella</i>	14	206	2.0%

TABLE 2. MAJOR FOOD-PATHOGEN COMBINATIONS CAUSING OUTBREAKS, 1998-2005

Rank	Food	Pathogen	Outbreaks	Illnesses	% Produce Outbreaks
1	Greens Salad	Norovirus	139	5,139	24.6%
2	Lettuce	Norovirus	29	949	5.1%
3	“Fruit”	Norovirus	18	1,147	3.2%
4	Sprouts	<i>Salmonella</i>	16	681	2.8%
5	“Vegetables”	Norovirus	13	521	2.3%
6	Greens Salad	<i>Salmonella</i>	12	519	2.1%
7	Fruit Salad	Norovirus	12	355	2.1%
8	Tomato	<i>Salmonella</i>	11	1,512	2.0%
9	Greens Salad	<i>E. coli</i>	11	560	2.0%
10	Melon	<i>Salmonella</i>	11	401	2.0%

Source: *Outbreak Alert!* Center for Science in the Public Interest, 2007

FIGURE 5. PATHOGENS IN TOP PRODUCE VEHICLES 1990-2005

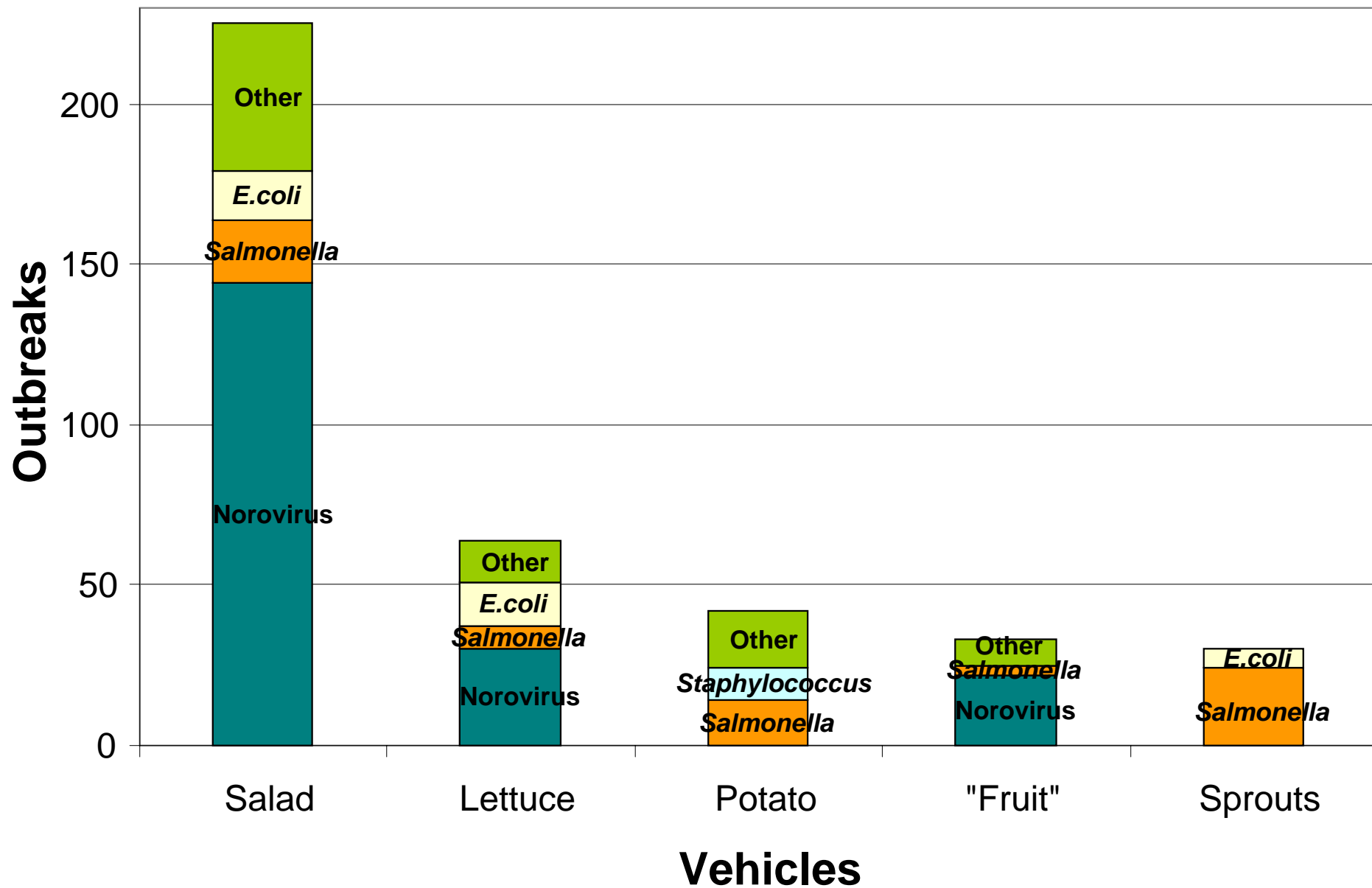


FIGURE 6. PATHOGENS IN TOP PRODUCE VEHICLES 1998-2005

