…And Is the Water Safe?

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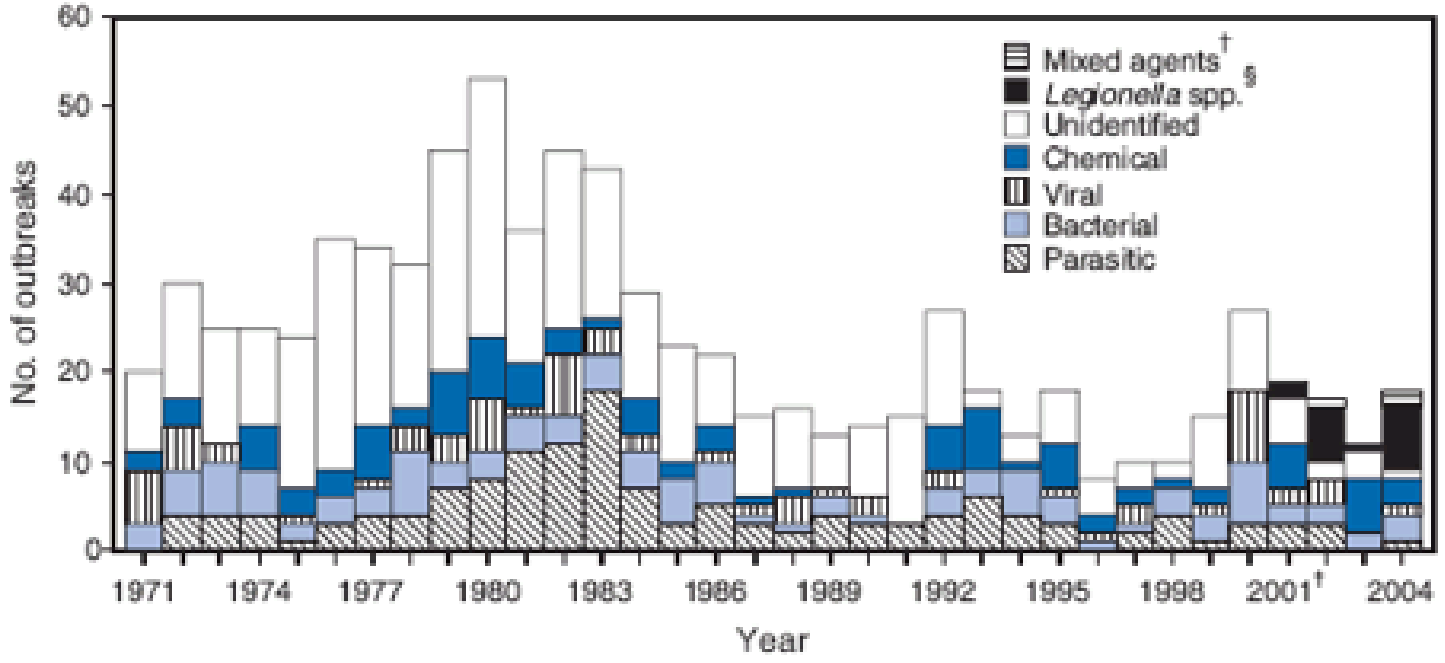
Water Safety – Infectious Agents

- Drinking water systems
- Contamination of food by water
  - washing, irrigation, growing waters
- Recreational water

- Sources of microorganisms
  - exogenous contamination
  - “autochthonous” pathogens naturally present in water

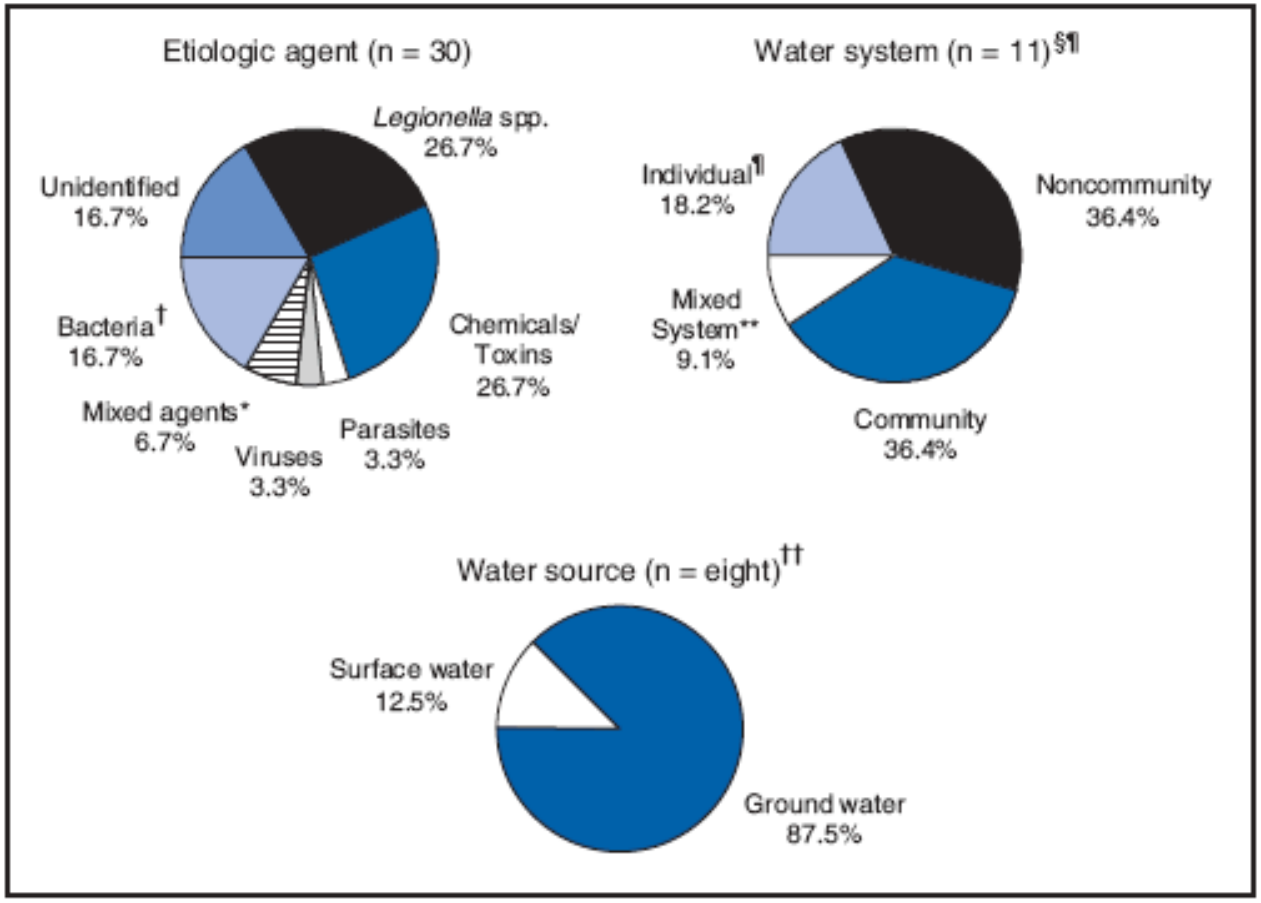
Waterborne Disease: Drinking Water-Associated

FIGURE 3. Number* of waterborne-disease outbreaks associated with drinking water, by year and etiologic agent — United States, 1971–2004



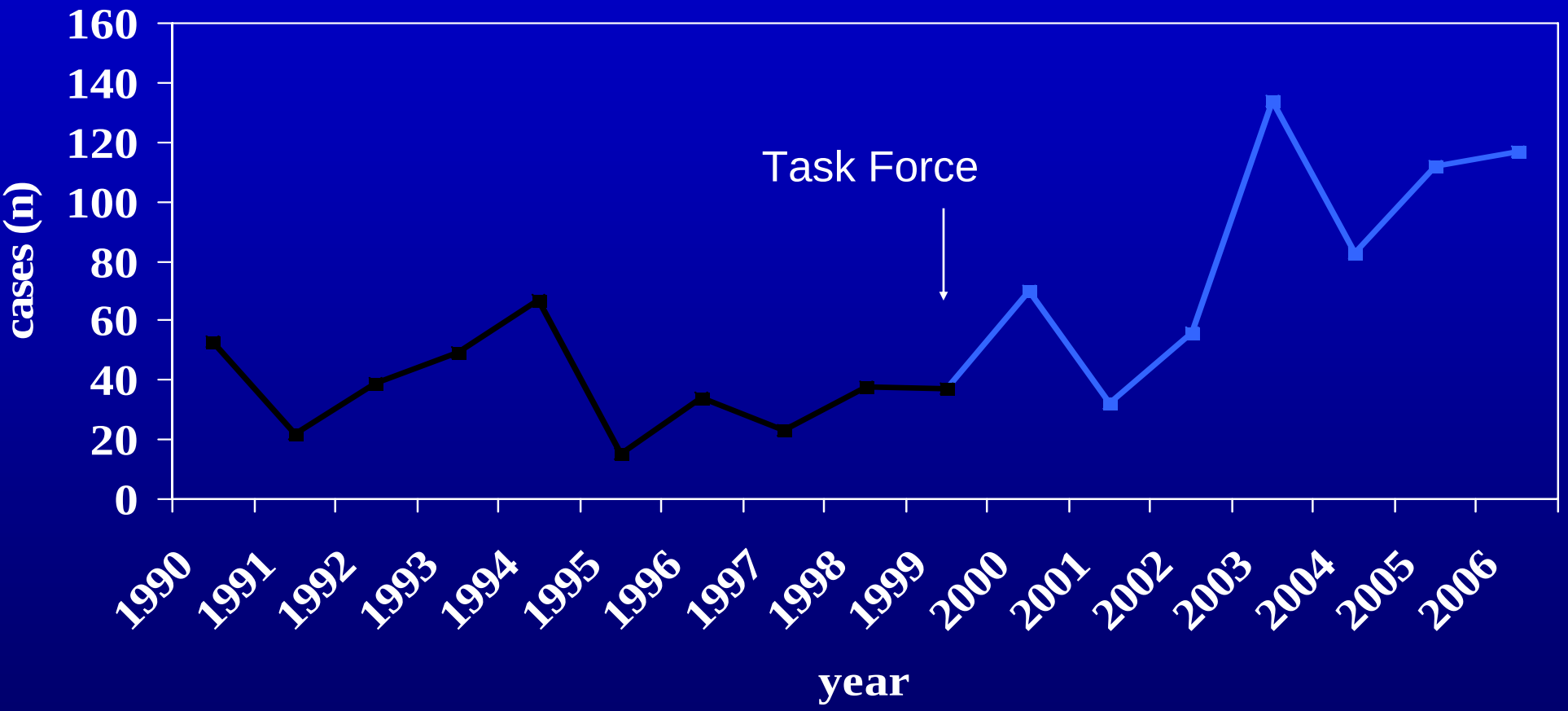
*n = 803.
†Beginning in 2003, mixed agents of more than one etiologic agent type were included in the surveillance system. However, the first observation is a previously unreported outbreak in 2002.
§Beginning in 2001, Legionnaires' disease was added to the surveillance system, and *Legionella* spp. were classified separately in this figure.

FIGURE 6. Percentage of waterborne-disease outbreaks (WBDOs) associated with drinking water, by etiologic agent, water system, and water source — United States, 2003–2004



* Each WBDO involves more than one etiologic agent.
† Other than *Legionella* spp.
§ Deficiencies 1–4. See Table 10.
¶ Does not include commercially bottled water, therefore, not comparable to previous summaries.
** Noncommunity and individual systems.
†† Deficiencies 1–3. See Table 11.

Confirmed LD Cases Maryland, 1990-2006*



* 2006 data provisional

Legionella

- Present in public water systems
  - chlorine tolerant
- Has a propensity to colonize institutional hot water systems, residing in biofilms
- Is a recognized cause of nosocomial pneumonia, particularly in “high risk” units (bone marrow, organ transplant); 40% mortality nationally

Global Spread of Seventh Pandemic

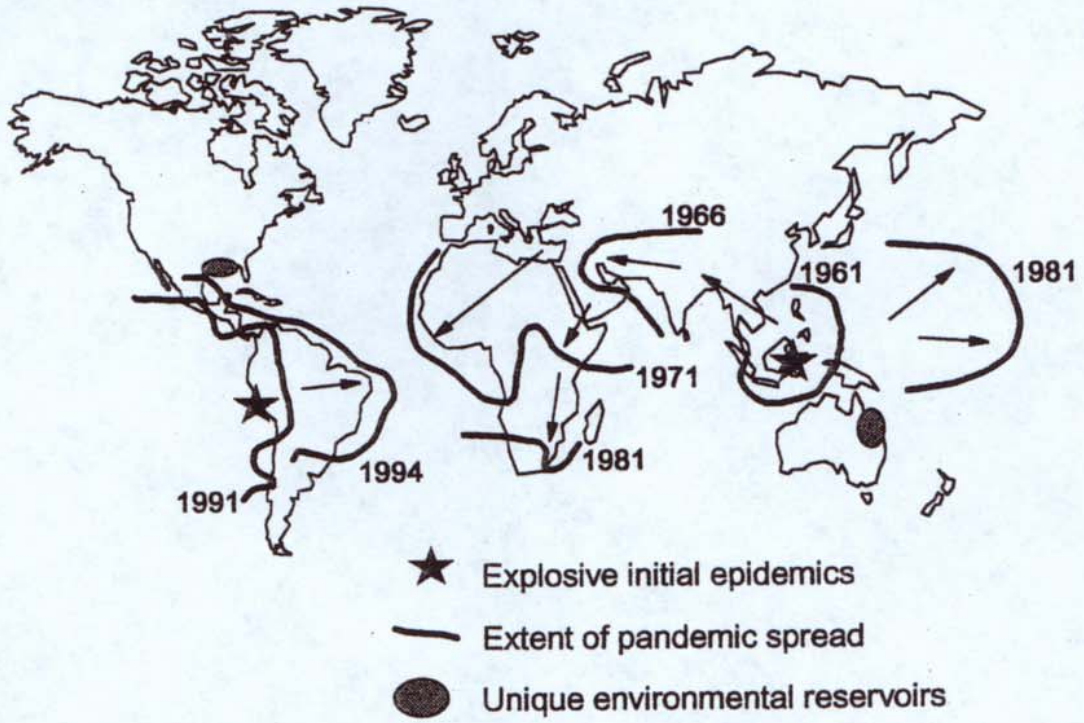
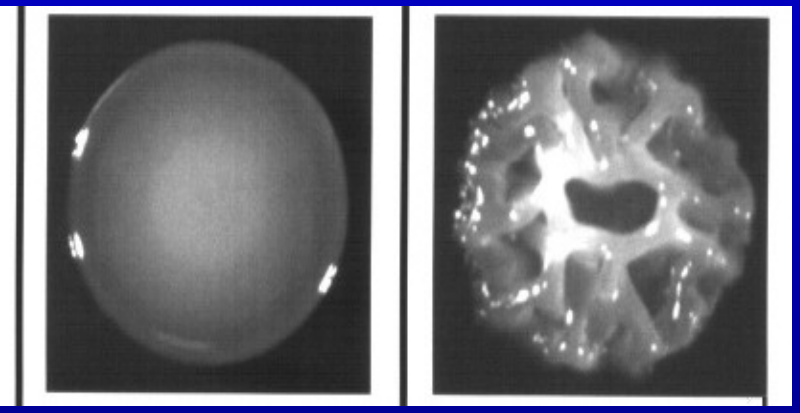


Figure 2. Global spread of the seventh cholera pandemic, 1961–1994, and recently defined areas with environmental reservoirs of toxigenic El Tor *V. cholerae* O1.

Rugose variants of *V. cholerae*

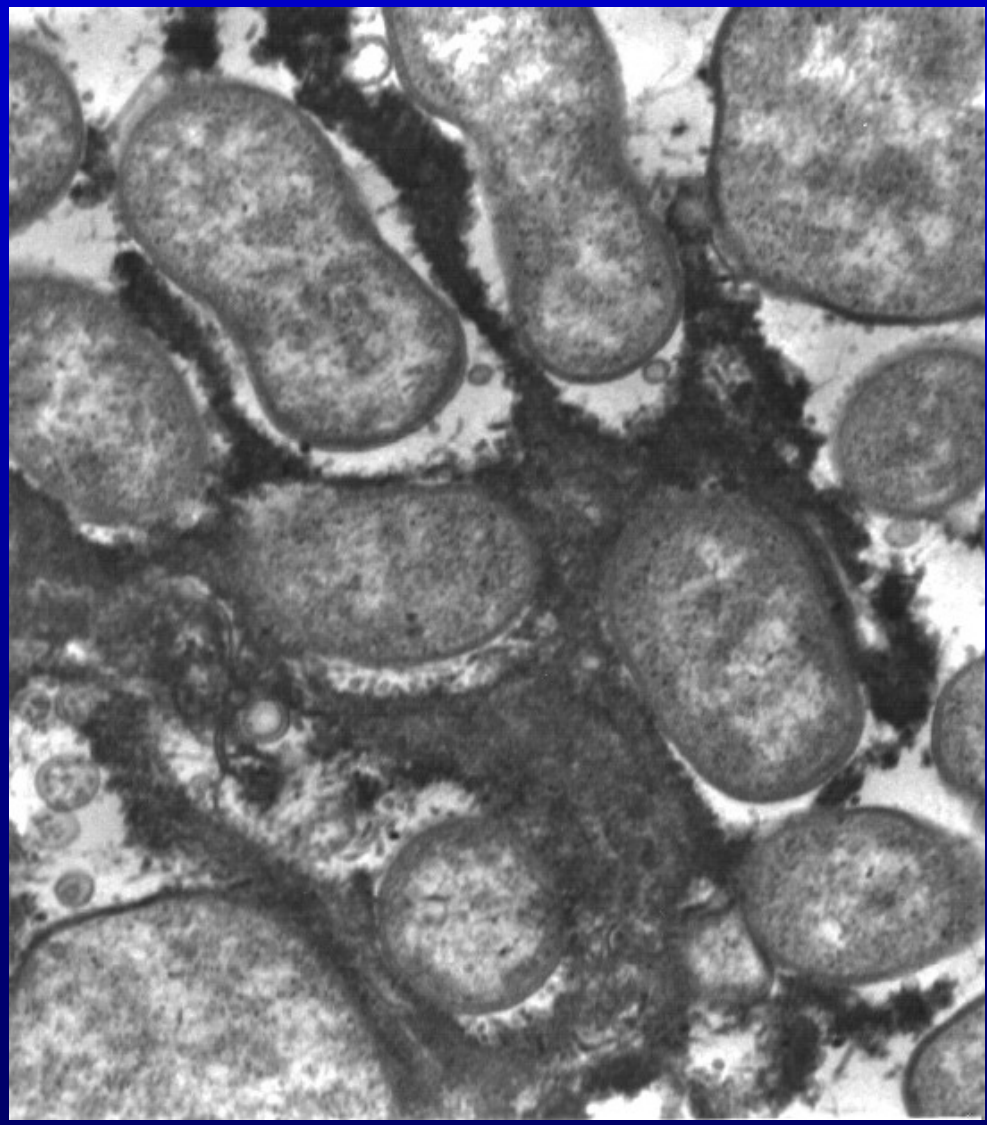


Smooth **Rugose**

- Rugose colonies are wrinkled
- Rugose variants produce EPS
- EPS promotes increased biofilm formation
- EPS promotes elevated resistance to chlorine, UV light, H_2O_2, and complement
- Rugose variants are as virulent as a smooth form

NCTC 6585 smooth

NCTC 6585 rugose



Current Drinking Water "Issues"

- Chlorine
  - Possible long-term health effects
  - Chlorine-tolerance of some pathogens
- Pathogen growth within water systems/biofilm formation
- Increases in "at-risk" populations

Foodborne Illness linked with Water

- Washing of produce/fruit with contaminated water
- Contamination of fields with pathogens in irrigation water or run-off
  - *E. coli* O157:H7 in spinach

Deaths from *Vibrio vulnificus* in Florida, 1990-2006

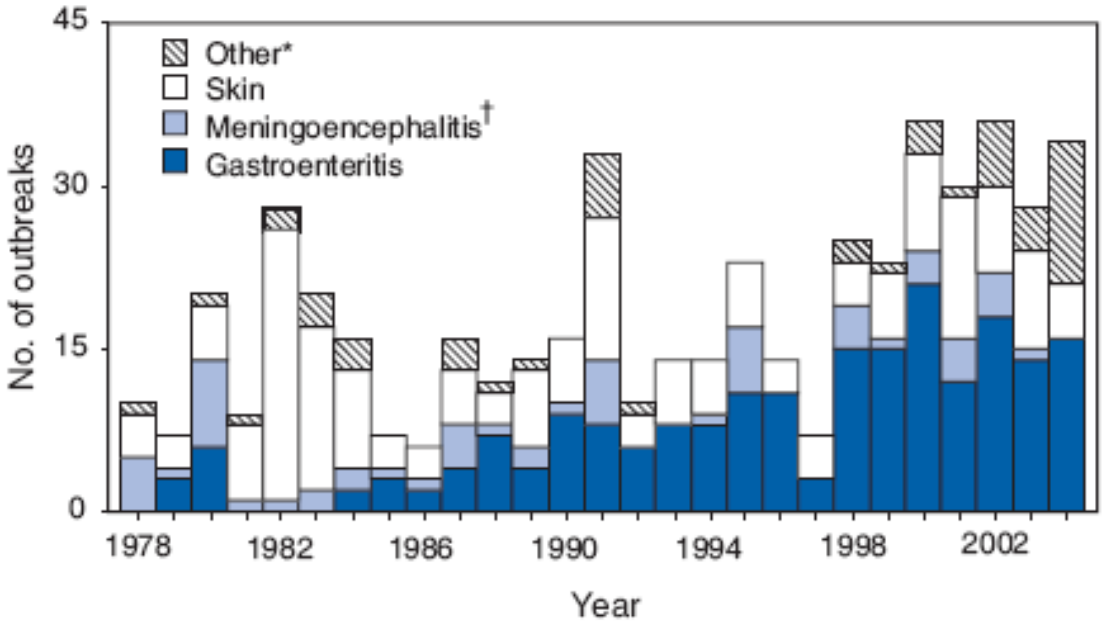
Exposure	# Deaths	% Total Cases
Oysters	66	15.2
Wound	24	5.5
Unknown	20	5.2
Crab	2	0.5
Shrimp	1	0.3
Clams	1	0.3
Total	114	

Florida Department of Health
Food and Waterborne Disease Program
Presenter: Roberta M. Hammond, Ph.D., R.S.

What do you do when you find poop in the pool?

Illness Associated with Recreational Water

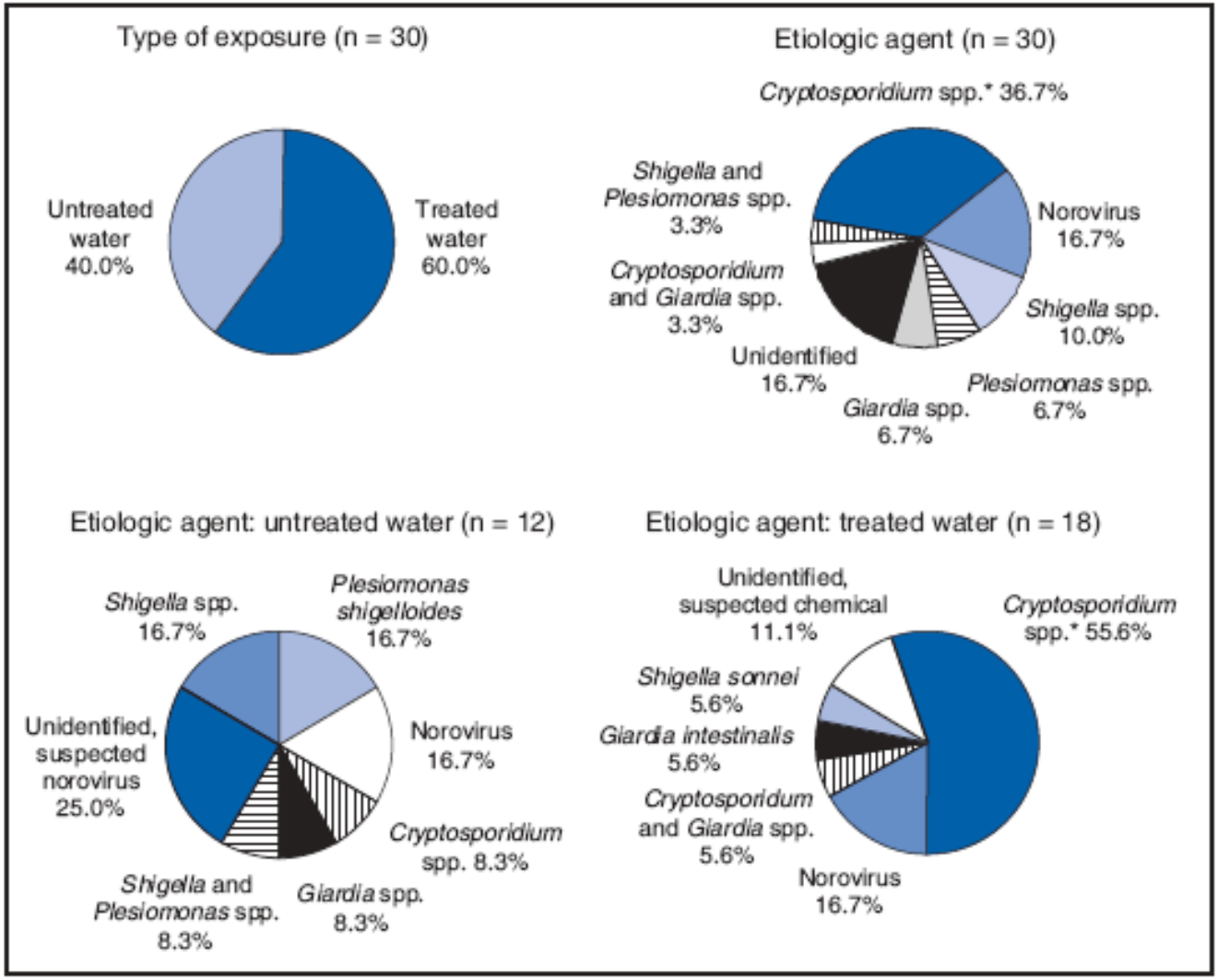
FIGURE 9. Number of recreational water-associated outbreaks (n = 508), by year and illness — United States, 1978–2004



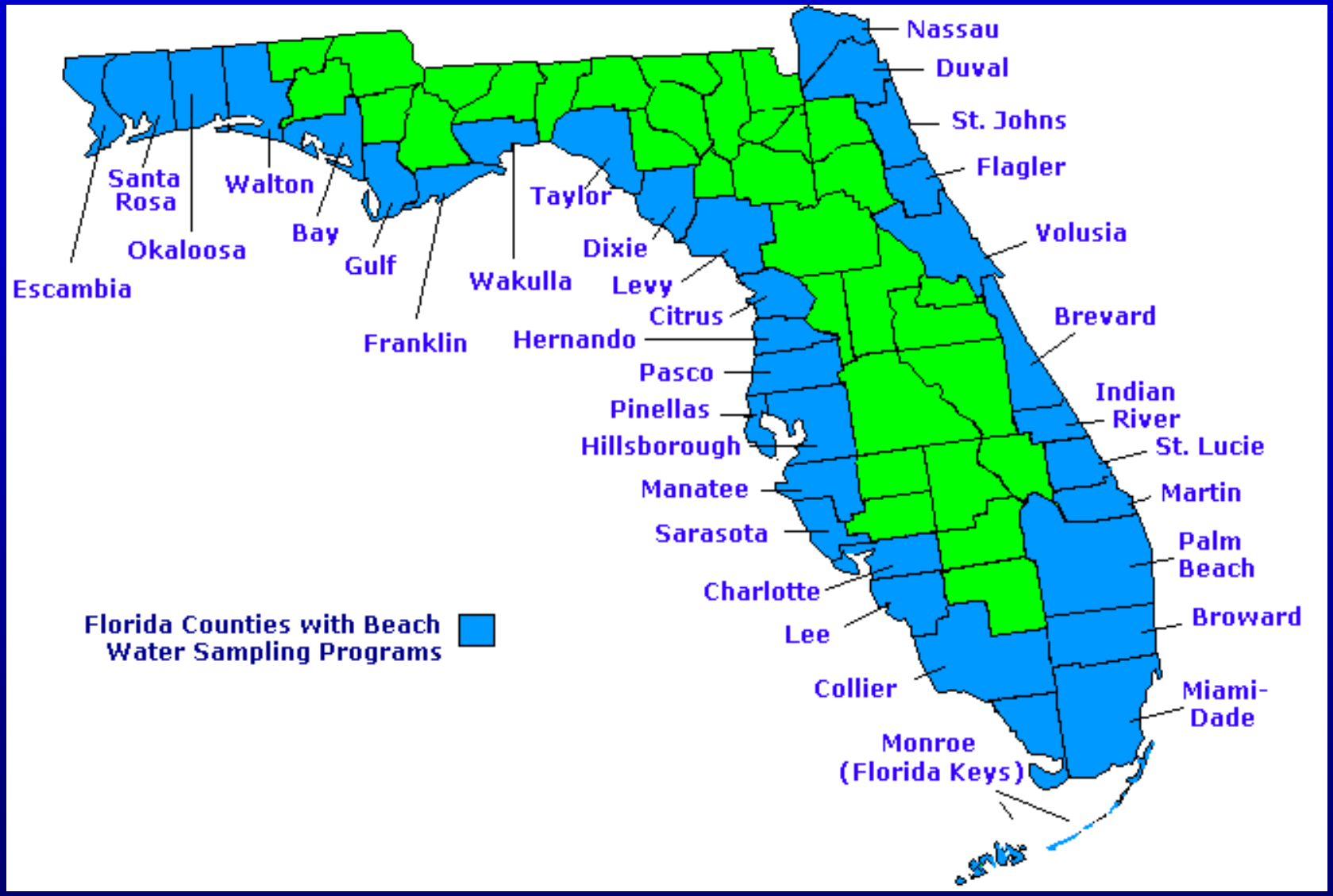
* Includes keratitis, conjunctivitis, otitis, bronchitis, meningitis, hepatitis, leptospirosis, Pontiac fever, acute respiratory illness, and combined illnesses.

† Also includes data from report of ameba infections (**Source:** Visvesvara GS, Stehr-Green JK. Epidemiology of free-living ameba infections. J Protozool 1990;37:25S–33S).

FIGURE 5. Recreational water-associated outbreaks of gastroenteritis, by type of exposure and etiologic agent — United States, 2003–2004



* For one of these outbreaks, cysts of *Giardia* species and oocysts of *Cryptosporidium* species were identified in pool water, but only *Cryptosporidium* was identified in the tested clinical samples.



http://esetappsdoh.doh.state.fl.us/irm00beachwater/default.aspx

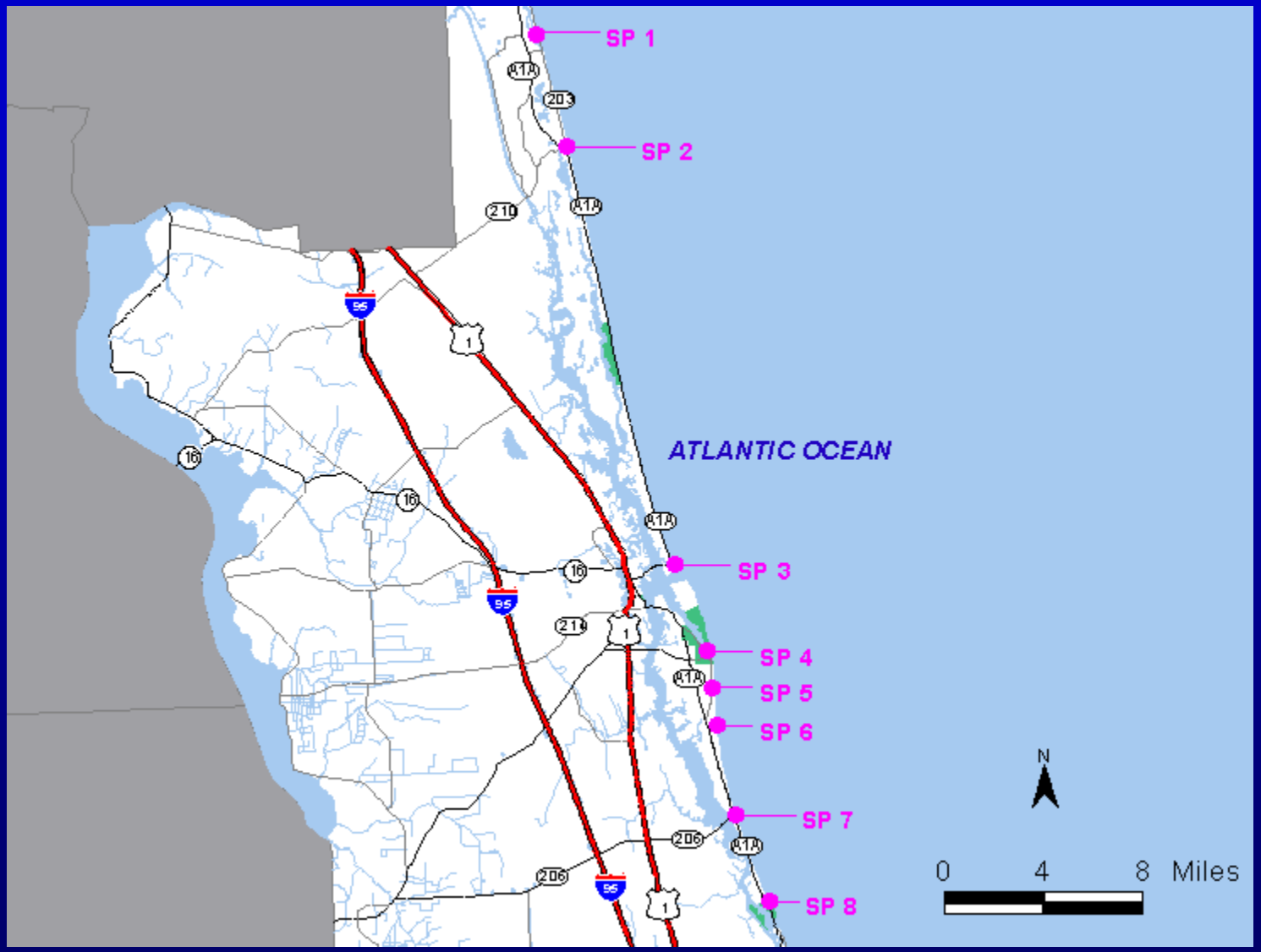
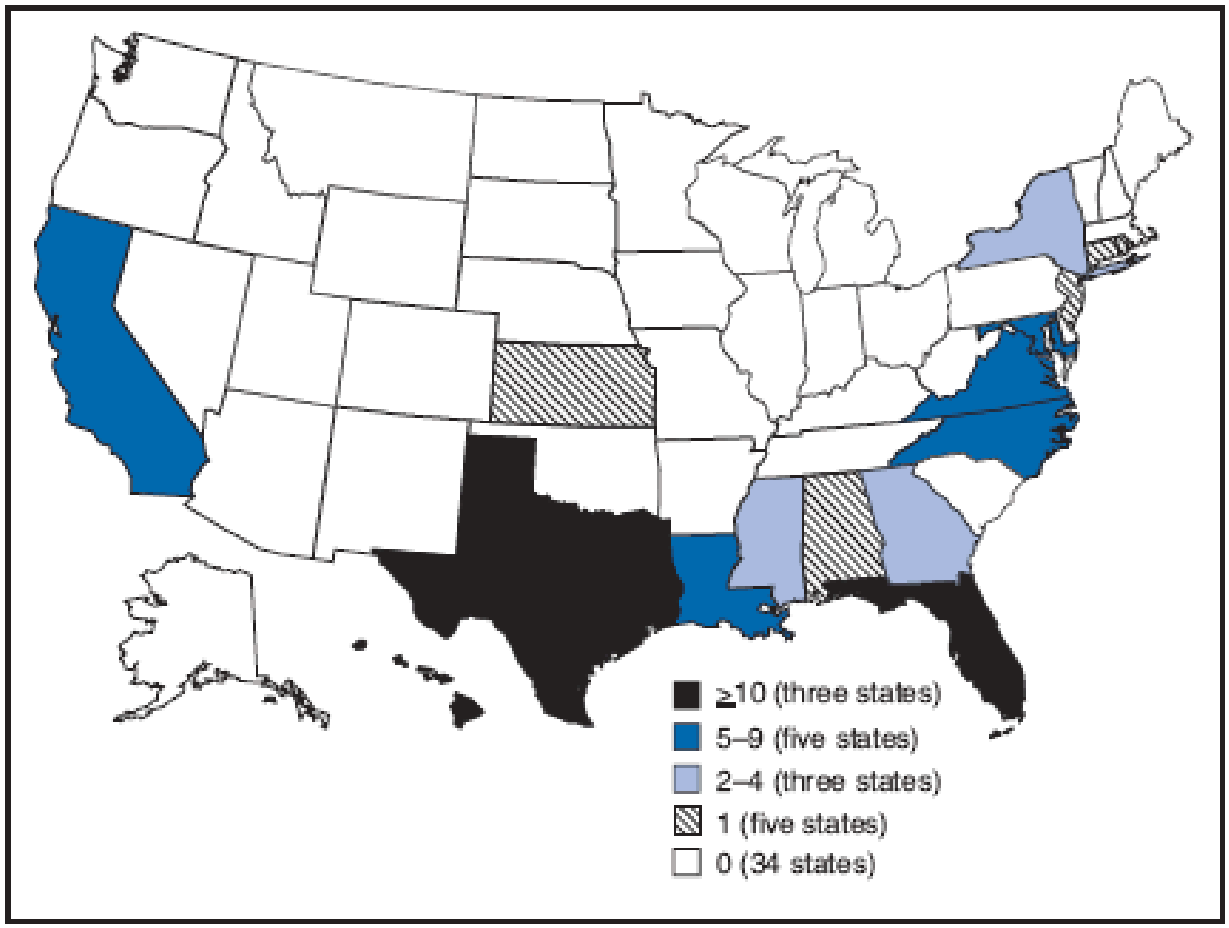

SP 1
SP 2
SP 3
SP 4
SP 5
SP 6
SP 7
SP 8
ATLANTIC OCEAN
A1A
203
210
95
1
16
214
206
N
0
4
8 Miles

FIGURE 6. Number of illnesses associated with *Vibrio* isolation and recreational water exposure (n = 142) — United States, 2003–2004*



* **Note:** These numbers are largely dependent on reporting and surveillance activities in individual states and do not necessarily indicate the true incidence in a given state.

Vibrio vulnificus

- Clinical
  - Gastroenteritis/primary septicemia
    - may be mild to severe and potentially life threatening
  - wound infections
    - Range from mild, self-limited infections to severe myositis and cellulitis
    - May produce vesicles/bullae
    - Reported mortality of 15-25%; mortality occurs almost exclusively in patients who have hemochromatosis, cirrhosis, or who are immunocompromised

Waterborne Pathogens

- Need for ongoing research/ interventions:
  - Movement of pathogens through surface and ground water
  - Management of pathogens that are chlorine tolerant and/or form biofilms
  - Minimizing risk of waterborne pathogens in food
  - Reduction of contamination risk in recreational water
- Need for risk communication/interventions, high-risk patients
  - Legionella
  - *Vibrio* species